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 THE SUPERINTENDENT OF GOVERNMENT PRINTING.
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GENERAL REPORT

ON THE OPERATIONS OF THE

Topographical Surveys of India,

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FOR SEASON

1874-75.

Dated Calcutta, 20th January 1876.

General remarks.

THE Topographical Surveys of India for the professional year of 1874-75 and the Cartographic and other work performed in the several branches of the Head Quarters Office during the year ending 31st December 1875, may be described as follows, in continuation of the printed report for the season of 1873-74, dated 15th January 1875.

Parties employed.

2. No change has taken place in the number of Topographical parties, at work. Nos. 1, 5 and 7 continue to operate in the Native States within the Rajputana and Central India Agencies, and are making very steady progress amongst the chief or larger Native States embracing such an extensive area, so long almost unknown to us: No. 2 in the district of Khandesh (Bombay Presidency) and in the Native States through the Sathpura Range and along the Nerbudda River, chiefly very intricate ground: No. 3 in the Bustar dependency, in the vicinity of Chanda and Raipoor, south-west portion of the Central Provinces, perhaps one of the very worst tracts in India for survey operations: No. 4 in the districts of Mandla, Balaghat and Belaspur, north-eastern portion of the Central Provinces, also notoriously bad country: and No. 6 in the Naga and Daphla Hills on the Assam Frontier.

Nature of country operated upon.

3. Considerable portions of the area now annually mapped by the Topographical parties have hitherto been blanks in all our best maps, and nearly all the rest is of very wild and inhospitable country, which has, if visited, been so roughly, barely, and inaccurately represented by detached routes at distant intervals, as to convey very erroneous impressions of the ground. Wilder, more unhealthy and still less known ground yet remains to be dealt with, but the limits of such areas are, year after year, narrowing rapidly under the combined efforts of the three branches of this Department.

4. Much, however, still remains to be done before the first Topographical Survey of all parts of India (British and Native possessions) can be accom-

plished, and the energy of our Surveyors will be severely taxed, in dealing with the greater portion of these several detached tracts of country which remain for survey.

5. The total results for the season are, of final Topography, 21,731* square miles, on the two distinct scales as per margin, and triangulation in advance of detail survey, 22,644 square miles. The expenditure of the seven parties for the season, *viz.*, from 1st October 1874 to 30th September 1875, amounts to Rs. 4,14,344, and the average rate of the season's survey, inclusive of the cost of the triangulation in advance, is Rs. 19-1 per square mile.

Results and cost of the season's operations.

	Square miles.
* On 1 inch scale	13,583
„ ½ „ in the Naga and Daphla Hills and Bustar ...	8,148
TOTAL ...	21,731

6. In addition to the above, surveys on scales varying from 12 to 6 inches to the mile were made of the city and cantonment of Jhalra Patun and Gagron and Sehore, of the cantonment, city and environs of Ajmere, cantonment of Nasirabad, and the city of Kishengarh, all falling within the regular course of the operations of the respective establishments. On the scale of 4 inches to the mile, five forest reserves† in the districts of Mandla and Balaghat were surveyed. The boundaries of the estates in Simla were completed, and the triangulation and details for the extension survey of the hills of Mashobra, Mahasu and Phagu, east of Simla, were likewise nearly brought to a conclusion.

Military cantonments and city plans.

† Area 128,877 acres.

7. To test the detail survey 1,063 linear miles of check routes were run in addition to examination of plane tables *in situ*, by which much confidence is placed on the work. By the season's triangulation 2,466 points and 1,494 elevations were trigonometrically determined by observations at 459 stations. Further and complete details, showing the relative outturn and cost of each party and the results of the season's triangulation, are given in Statements A and B in the Appendix, and in Statement C a comparison is made of the general results, total expenditure, and average mileage rates for the seasons of 1873-74 and 1874-75.

8. The results of the season under review are as full and satisfactory as could be desired, compared as to area with those of 1873-74; they show a decrease of 2,372 square miles of topography, an increase of 3,021 square miles of triangulation, and a decrease of Rs. 10,697 in expenditure.

Results of the season under review compared with those of the previous season.

9. The decrease in the area finally surveyed is chiefly due to the sad disaster‡ which early in the season befell No. 6 Party in the Naga Hills, and the consequent entire stoppage of work of the detachment under the Officer in charge, Captain Badgley, who was very severely wounded and unable to take any active share in the further operations of the field season, which therefore produced little or no area topographically delineated. The Daphla Military Expeditionary Survey was also greatly restricted in its operations owing to the withdrawal of the Field Force and the Survey Party with it from the hills early in the season, thereby preventing the attainment of a considerable area of new trans-frontier country which was almost within our grasp.

‡ *Vide* review of the operations of No. 6 Party further on.

10. The decrease in expenditure is caused by savings of the salaries of Officers on leave, and by the recent measures which, under the special orders of Government cited in the margin, have been necessarily adopted for the gradual reduction of the estimates of this Department from 24 to 20 lakhs of rupees, *viz.*, the stoppage of promotion, and vacancies which are not filled.

No. 712, dated the 30th September 1875.

11. Standard sheets, 45 in number, each of 15 minutes of latitude by 30 minutes of longitude, have been rendered by executives; 31 of these are on the scale of 1 mile = 1 inch; and 14 on 2 miles = 1 inch in the usual excellent style, and forming valuable materials of those parts of the Native States

Season's fair mapping.

and other distant and intricate parts of the country of which the geography was most unknown.

12. In addition to these, 10 standard sheets have likewise been well redrawn for photozincography by No. 3 Party, during their recess, from the old highly-colored field sections of the Ganjam and Orissa Survey, which never having before seen the light are now published for the first time, for the use of local Officers. The area represented on these sheets covers 25,672 square miles of country. In addition, fair copies of all the large-scale plans of cities, forts, cantonments and forest reserves have been rendered. All these maps and plans having been drawn for photozincographic reproduction to scale have been transferred to zinc, and the greater number have been already printed, so that the survey results are immediately utilised. Silver print photographed reductions on the $\frac{1}{4}$ inch scale have also been obtained of all the standard sheets for incorporation of these materials on the sheets of the Indian Atlas, and the greater portion has either been compiled or is now under compilation on the atlas sheets marginally noted.

33 S. W., 34 N. E. and N. W., 35 N. E. and S. E., 37 N. E. and S. E., 54 N. W. and S. W., 93 N. W. and S. W., 71 S. E.; 90 S. W., 52 N. E. and N. W., 53 S. E. and S. W., 129 S. W. and S. E., 130 N. E. and N. W.

13. The combined results of the Imperial Topographical and Revenue Surveys under my control are as follows:—

Combined results of Topographical and Revenue Surveys for the season.

	Area.	Cost.	Average rate.	Remarks.
	Square miles.	Rs.	Rs. A.	
Topographical Surveys	21,731	4,14,344	19 1 per square mile.	Scale 1 inch = 1, 2 and 4 miles.
Revenue Surveys ...	13,320	5,11,530	38 7 ,,	,, 1 mile = 4 and 2 inches.
Total ...	35,051	9,25,874	26 7 per square mile.	Combined Topographical and Revenue Surveys.
Cadastral Surveys on 16 and 32 inches = 1 mile... ...	3,532	5,44,715	154 4 per square mile.	North-West Provinces 16 inches = 1 mile, Rs. 129-2 per square mile. Bengal Irrigation, 32 inches = 1 mile, Rs. 422-15 per square mile.
Total ...	38,583	14,70,589	.....	

14. The general results for the season of the Revenue Surveys alone is given as follows by the Superintendents of Revenue Surveys:—"During the season under review, 16,852 square miles of country were surveyed in detail and completed: 3,532 square miles of Cadastral or Field Survey on the scale of 32 inches and 16 inches = 1 mile, at an average rate per square acre of 10 annas 7 pies and 3 annas 3 pies, respectively, or Rs. 422-14-11 and Rs. 129-2-2 per square mile; 5,979 square miles on the scale of 4 inches = 1 mile, at an average cost of Rs. 48-11-1 per square mile; 7,341 square miles on scale 2 inches = 1 mile, at Rs. 30-0-4 per square mile. In addition to the above, 2,286 square miles of country were triangulated, and 5,076 square miles traversed and surveyed in boundary, and plotted in advance, ready for the detail Surveyors to fill in topography or fields, as required on taking the field in 1875-76."

General results of the Revenue Surveys, 1874-75.

15. In the Upper Circle (North-West Provinces) the Cadastral or "Field by Field" Survey was on 16 inches to the mile, embraced 2,440 villages containing 1,904,038* fields of sizes, varying in different districts from 1·85 acres to 0·61 of an acre, and the cost of survey per acre is 3 annas and 3 pies, or 3 pies less per acre than during the last season (1873-74). In the Lower Circle (Bengal), Shahabad District, the scale of survey being 32 inches to the mile, 351 villages containing 484,806 fields (132,781 acres) were completed,

Cadastral or Field Surveys in the North-West Provinces and Bengal.

* Contain 2,127.776 acres.

the average size of fields being only 0·27 of an acre, and the average cost of survey 10 annas and 7 pies per acre.

16. The decrease in area surveyed by the Revenue Branch during 1874-75, as compared with the previous season of 1873-74,* is equal to 3,049 square miles, and this is due to the cessation of work in the Bhawulpur State and in the Lakhimpur Hills (Assam), and the transfer of the parties to other work on larger scales, the completion of work in the Betul and Bislaspur Districts, Central Provinces, and the consequent transfer of two parties to Cadastral Survey in the Azimgarh District, North-West Provinces, and Shahabad in Bengal.

	Square miles.	Square miles.
* 1873-74.—Scale 2 and 4 inches = 1 mile ...	=17,371	
Cadastral 16 inches = 1 mile	= 2,530	
		=19,901
1874-75.—Scale 2 and 4 inches = 1 mile ...	=13,320	
Cadastral 16 and 32 inches = 1 mile	= 3,532	
		=16,852
Decrease in 1874-75 ...	= 3,049	

17. The very high cost of the Cadastral work in Shahabad, *viz.*, Rs. 422-15 per square mile, or 10 annas 7 pies per acre, is due to the initiatory season of such exceptional sort of work, and the exceedingly small size of the unit, or field (average size 0·27 of an acre), insisted on by the Irrigation Department, which necessitates the adoption of so large a scale as 32 inches = 1 mile for the survey, but even which seems to be declared to be insufficient for certain small portions of the districts in Behar, for the purposes of the Irrigation Department. The requirements of the Irrigation Department, which pays for the entire cost of the operations exclusive of our Imperial Budget, must be carried out; and it is expected that, as further experience is met with, the cost will annually diminish, though, of course, it cannot ever compare with the results of the smaller-scale Cadastral Surveys as conducted in the North-West Provinces.

18. In para. 13 of the last printed report, it was noticed that the increase of Cadastral Surveys would diminish the general outturn, annually, of the Revenue Surveys, and further diminution of area and enhanced average mileage cost must follow, consequent on the orders of Government for the reduction of Revenue Survey Parties. Two parties have already been absorbed, and two more are to follow on the completion of districts in hand.

19. The separate report of the Superintendents of Revenue Survey, Upper and Lower Circles, furnishes further details connected with the working, progress and cost of the Revenue Surveys.

Aggregate results brought up to date.

20. In continuation of the statement given under para. 15 of the last printed report, the aggregate results of the modern Topographical and Revenue Survey up to date are here shown—

	Square Miles.	Cost, Rs.
Total up to 1874	787,806	2,14,66,701
Add for 1875	38,583	14,70,589
Total ...	826,389	2,29,37,290

Cartography.—Geographical and Miscellaneous maps and compilations.

21. The details of work completed in the Geographical, Compiling and Engraving Branches will be found in statements given in the appendix by J. O. N. James, Esq., Assistant Surveyor General in charge. Only the most important geographical maps and publications are here noticed.

22. Considerable additions up to date from surveys in progress have been made to the two general maps of India (without hills), scale 32 and 64 miles to the inch, which it is so important to push on with, and regarding which my attention has been so closely directed. The blanks on the Survey of India are of course more conspicuous, in proportion to the largeness of the scale employed; these gaps it is our chief difficulty to fill up, with a view to bringing out an early edition. The 64-mile map has been cut on the

copper, in four sections, to the full extent of the reliable materials. It is now intended to make the necessary additions to this map from all existing geographical information of those parts of India which have not yet come under regular survey, and this will be done on the stone, transfers from the copper having been made for this purpose, so as to secure a preliminary outline edition of this map at the earliest practicable moment for various Government purposes which are urgent.

23. The 32-mile map, in six sheets, is also a great desideratum, of which two sheets are now ready for the engraver, and will be prosecuted as rapidly as possible. The old sketch lithographed map of India on this scale is now obsolete and worn out, owing to the immense number of impressions taken from the stone. It has served a capital purpose in its day.

24. *Bengal, Behar,* and *Orissa*—scale 16 miles = 1 inch, without hills, corrected to date and photozincographed as a preliminary edition. *Assam*—scale 16 miles = 1 inch, both with and without hills. The outline edition has been photozincographed for immediate purposes.

25. *Assam*—scale 8 miles = 1 inch—sheets 1, 2, 4, and 5 compiled and drawn in outline. This map is in nine sheets and will be lithographed.

26. The Khanate of Khelat and Baluchistan—scale 16 miles = 1 inch—outlines completed. This map has been compiled from the best available information, at the request of the Government of India, Foreign Department.

27. Materials have been furnished from recent surveys for the completion, up to margin of the Atlas Sheets engraving in England, No. 54, full plate, 90 N.-E. and S.-E.; 91 N. E. and S-E. Proofs of 71 N.-E. and S.-E. received from England for completion of blanks, still await the progress of survey in the district of Mandla. For sheets engraving in India, drawings have been given to the engravers for portions of the plates noted in the margin, representing the results of all the latest surveys up to date in Assam, Bengal, the Central Provinces, Khandesh, Kattywar, Guzerat, Bhawulpur Native State, Munipur Native State, Rajputana and Central India. The work on some of these sheets is exceedingly heavy, while on others, only small additions to fill up to margins, or to the extent of survey completed in 1875, have been made. The projections for seventy-four new quarter plates have been completed; of these, thirty-four have been cut on copper.

Indian Atlas Sheets.

Sheet 17—full plate—23 N. W.—S. W.—31 full plate—34 N. W. S. W.—36 S. E.—37 N. E.—52 S. W. N. W.—53 N. E. S. E.—66 full plate—72 N. W.—93 S. E. and S. W.—94. 113, 119, 121, full plates—124 N. E. N. W. S. E. S. W.—125 N. W. N. E.—130 N. W. S. W. and S. E.—131 N. W. and S. W.

28. Standard sheets, as per margin, of the Khasi and Naga Hills Survey, on the scale of 2 miles = 1 inch, projected and completed with hills.

Nos. 43, 76, 77, 78, 80, 81 and 83 hills on two sheets drawn by Lieutenant Woodthorpe, R. E.

29. Of the old series of maps of the Ganjam and Orissa and Chota Nagpore Division Surveys, referred to in para. 25 of the last printed report, the following have been completed.

30. Ganjam and Orissa Survey (old series), 1 mile = 1 inch, sheets Nos. 7, 11, 20, 21, 23, 25, 38, 44, 47, 49, 60, 61, and 85 drawn and completed in the Surveyor General's Office; sheets Nos. 50, 51, 74, 76, 77, 55, 53, 78, 79, and 81 drawn and completed by No. 3 Topographical Party on the scale of 2 miles = 1 inch; sheets 26, 27, 28, and 29 drawn and completed in the Surveyor General's Office; total 23 sheets, on scale 1 mile = 1 inch; 4 sheets on 2 miles = 1 inch.

The whole series of these old surveys, comprising the labors of upwards of twenty years by this party alone, is being rapidly dealt with in this Office, and will, through the agency of photozincography, soon be accomplished and published for general use. Similar old originals of the Chota Nagpore Division Survey, scale 1 mile = 1 inch, sheets 5, 15 and 17, have likewise been finished in the same

See Index Map No. 3 Party in previous report.

manner, and these complete the series of maps of this division, all of which are now available.

31. The usual amount of miscellaneous map drawing, copying, examination and revision of proofs, coloring of printed maps, &c., has also been accomplished, the great extent of the publishing department rendering the business very severe.

32. The labors of the Drawing Department, to keep such an Engraving, Photographic and Lithographic Establishment fully employed, have taxed the energies of my assistants to the utmost. Under the continued able management of Mr. James, these onerous duties have proceeded greatly to my satisfaction, upholding, as they have done very fully, the credit of the Department by the various and extensive publications issued. Mr. Baness, Chief Draftsman, and Mr. Chamarett, Geographical Examiner, both old Surveyors in the Department, merit praise for steady and devoted interest to the progress of geographical knowledge of India, which has advanced with such rapid strides during the past quarter of a century.

Sheets of the Indian Atlas Engraving.

33. *Engraving Branch*—Briefly, the outturn of work is as follows: chiefly in plates of the Atlas of India no less than 133 plates of sorts and sizes have been in hand and advanced certain stages during the year. Plates 2 N. E., 34 S. E., 52 N. E. and 93 N. E. have been completed and published. Old full plates 55, 58, 61, 75, 77, 80, 111, 112, writing recut. Hill work repaired on plates 26, 58, 61; additions and corrections made on plates 78, 102, 106, 115, 116. Railways added, and small additions and corrections made on plates 40, 41, 42, 43, 44, 56, 68.

34. To the following old plates heavy additions are in progress from recent surveys to complete blanks up to margins:—

Sheets 17 and 31—portions of the Bhawalpur Native State.

„ 67 and 88—portions of Oudh for Districts Kheri, Sooltanpur, Rai Bareilly and Pertabgarh.

Sheet 73—portions of District Chanda and the Aheri Zemindary, Central Provinces.

„ 94—Bhadrachellum and Rakhapilly, Godavery Talooks.

Sheets 107 and 108—the Saora Hill Country, Vizagapatam Agency, Madras Presidency.

Sheet 113—eastern half of the Hazaribagh District, Bengal.

„ 119—western portion of Garo Hills District and part of Goalpara District, Assam.

35. Of new quarter plates Nos. 52 S. E. and 105 S. W. have been completed in outlines only and published as a preliminary issue. Nos. 53 N. E. and 72 N. W. have also been completed in outline, and proofs are under examination.

36. In addition, 28 new quarter plates are in various stages of progress, regarding which details are given in the statement in the appendix showing the progress of work in the Engraving Branch.

37. New editions of a large number of the old full size (double elephant) plates engraved in England by the late Mr. John Walker having been required, it was deemed absolutely necessary, owing to the damaged or worn condition of the plates, to have the writing recut, and in some cases the hill etching repaired before printing from. Many of the old plates seem to have been very seriously worn out by printing in England, and it is fortunate we are now in a position to look after them and repair all damages. This has entailed much additional labor and necessarily delayed the progress on new plates.

Miscellaneous maps: engraving.

38. The map of India, 64 miles = 1 inch, in four sections, has been completed in outline, and names, from the actual results of survey up to 1875, and a transfer taken to stone, on which all blanks will be completed from the best available sources, thus preserving the plates intact to receive the final geography of the blanks whenever available.

39. The map of Sindh, scale 16 miles = 1 inch, is in progress, outlines engraved, writing in hand far advanced.

40. Heavy corrections to the map of Oudh, scale 16 miles = 1 inch, have been necessary in consequence of the new system of spelling. This has now been completed.

41. A division map of the western districts of the Dacca Commissionership has been engraved in outline with names on the 16-mile scale and printed for the Imperial Gazetteer.

42. Large additions and corrections, such as new streets and buildings, alterations along the river bank, &c., are in progress on the four copper plates of Simm's plan of Calcutta, with the view of bringing it up to date, and it is hoped that a complete edition of this most useful plan of the Capital of India will be ready for issue, with all the latest improvements, by the end of the now current year. A revised edition to a certain extent was brought out in January of the present year.

43. During the year the amount of copper-plate printing executed is as follows. As the plates are preserved intact to the utmost extent possible and impressions taken from stone, the amount of plate-printing is kept down.

Copper-plate printing.

Impressions printed	12,333
Proofs taken	1,037
Transfers from plates	534
Total ...	13,904

44. Further advantage has been taken of the possession of the copper-plates in this office, as alluded to in para. 36 of last report, by taking transfers to the stone to produce separate district maps, with additions and corrections made on the stone to date for the use of the local authorities. Eleven districts in Bengal* have thus been completed and published by transfers to stone from the copper-plates of the Indian Atlas and form very valuable records. Five more districts are now in hand, and the whole series will very shortly be provided for.

Scale 4 miles = 1 inch.

* Presidency or 24-Pergunnahs District, Jessore, Nuddea, Moorshedabad, Rajshahi, Maldah, Pubnah, Bograh, Bhaugulpur, Patna and Cuttack.

45. But the frequent changes made in the boundaries of districts and their internal sub-divisions in Bengal, and the transfers and changes of districts, sub-divisions, and police circles from one Commissionership or District to another, are a constant source of perplexity and delay to this Department, causing the loss of much valuable time and labor, and seriously detracting from the value of the publications. In many instances, scarcely is a new map of a district or division ready for issue before it is declared incorrect in consequence of such territorial changes, every one of which invalidates two district maps. To issue new and revised editions of such maps, both of divisions and districts and on different scales, every year, is a very serious addition to the labors of this Department, and one causing much confusion in the geographical records.

Serious consequences of too frequent changes of the external limits and internal sub-divisions of districts.

46. The progress of work in the Engraving Branch is most satisfactory and encouraging, the results of the completed plates are of the highest value and importance to the powers and requirements of a Geographical Office, and the effects are more and more developing themselves every year. I have every reason to be well satisfied with the good exertions of the Superintendent, Mr. C. W. Coard, and his staff of European Assistants. The native engravers have been kept steadily at work, and with the exception of a few of the younger apprentices all are employed on regular work of some sort and are making excellent progress.

47. The outturn of work in the Photographic Branch under the superintendence of Captain Waterhouse, Assistant Surveyor General, is given in the following statement:—

Photographic Branch.

Abstract of work performed in the Photographic Branch of the Surveyor General's Office from 1st January 1875 to 31st December 1875.

Maps photographed.	Number of Sections or Sheets.	No. of negative plates.	Prints.			Transfer to zinc or stone.	Number of pulls.	Number of complete copies.	Remarks.
			Collo-type.	Silver.	C. transfer.				
Topographical Survey Maps	191	311	...	356	322	155	24,430	25,770	
Revenue Survey Maps ...	678	1,138	...	40	1,128	331	41,900	33,700	4,000 anastatic. 310 zinco.
District Maps	4	14	...	...	14	9	4,705	2,665	250 anastatic. 4 stone.
General Maps	20	71	...	3	78	25	2,756	2,066	480 anastatic. 210 zinco. 1 stone.
City and Cantonment Plans	36	119	...	...	101	37	9,020	6,140	2 stone.
Miscellaneous	441	542	392	2,469	459	179	61,619	61,980	20 stone.
Anastatic Transfer ...	...	...	...	...	...	47	...	...	
Proofs	...	...	...	...	...	...	1,813	...	
Cadastral Maps, N. W. P.	486	1,144	...	...	1,198	508	19,450	10,050	
Total ...	1,856	3,339	392	2,868	3,300	1,291	155,693	142,371	

48. One thousand eight hundred and fifty-six original subjects have been reproduced by 1,264 transfers to zinc and 27 to stone, from which 142,371 complete copies of maps, plans, &c., have been struck off; 2,868 silver prints of various subjects, 704 carbon prints of convicts, and 392 photocollo-type have been taken.

49. For the Quartermaster General's Department 12,900 maps in sheets and in cloth from the most recent survey for the Delhi Camp of Exercise were printed on the scales of 4 inches and 2 inches to the mile. The importance and value of this work was handsomely acknowledged in His Excellency the Commander-in-Chief's letter No. 2109C., dated 15th February last, and published by G. G. O. No. 203, dated 24th February idem, on the results of the military operations at Dehli.

50. The increase of work in this branch has been very considerable, and will be best understood from the following figures:—

	Original subjects reproduced.	Transfers to zinc or stone.
In 1875	1,856	1,264
„ 1874	1,280	812
Increase during 1875 ...	576	452

51. The amount of printing executed is somewhat less, but this must necessarily vary according to the number of impressions required of each map or subject. Last year (1874) the demand was abnormal, and no less than 27,800 copies of various maps were specially printed for issue to local officials employed on famine relief works.

52. The charts of the Marine Survey Department and Master Attendant's Department are now reproduced by photozincography, thus enabling these departments to issue the sheets immediately after survey with far greater accuracy, speed, and economy than could be secured by any other method.

53. Carbon-printing by the autotype process for obtaining permanent prints of life-convicts has been successfully introduced and worked during the cold season, and further experiments are being made to ensure, if possible, the working of the process during the summer season.

54. Captain Waterhouse's report given in the appendix furnishes full particulars in connection with all the details of work performed in the Photographic Branch. The utility of this branch of the Head Quarters Office for

immediate and rapid preliminary publications becomes more apparent every year, and the demands on it are constantly increasing, but hitherto, under the continued able and energetic supervision of Captain J. Waterhouse, Assistant Surveyor General in charge, it has proved equal to every emergent call for new descriptions of work from all branches of the public service. The applications of photography in both science and art are so numerous and varied that it is difficult to keep pace with all the requirements of the times, more especially with a small and fully occupied establishment and the appliances sanctioned only for the reproduction of maps, but Captain Waterhouse manages to find time for trying new processes and developing the resources of his department to the utmost extent.

55. Under the orders of the Government of India, special arrangements have lately been made for the reproduction of cadastral maps of the North-West Provinces, and for which that Government contributes the necessary funds, which are granted in addition to the regular departmental budget grant. These maps are very numerous, and during the past three years have largely accumulated; it was therefore absolutely necessary to supplement the existing establishment and increase the printing machinery to clear arrears and to provide for the publication of these maps, which are declared to be of the greatest value to the Settlement as well as to the Irrigation Department.

Lithographic Branch.

56. In the Lithographic Branch much useful work has been completed, of a nature not suited to photographic reproduction, and which would have proved too expensive and tedious to engrave, or is not of a final geographical character enough to put on copper. Some of the most important are as follows:—

57. Eastern Bengal—scale 8 miles = 1 inch—sheet 8. Western Bengal—scale 8 miles = 1 inch—sheets 14, 18, 19, 20, thus completing the entire map of the Bengal and Assam jurisdictions in twenty sheets on this useful scale.

Moorshedabad District—scale 1 mile = 1 inch—sheets ...	5, 8, 10
Nowgog District do. do.	... 5, 6, 7, 9, 10, 12
Chanda do. do. do. ...	15
Santhal Pergunnahs do. do.	... 1, 2, 4, 6, 14, 16
Hooghly River Survey—scale 4 inches = to 1 mile—sheets...	1 to 17
District maps of Bengal by transfers from the plates of the Indian Atlas	5 maps—scale 4 miles = 1 inch.
Sheets of the Indian Atlas by transfers from the copper-plates	4 quarter sheets.
Index map to illustrate the progress of topographical surveys and the state of publication of the standard sheets	6 maps.

58. In addition to the above, no less than 145 miscellaneous maps, charts, plans and diagrams have been completed by transfer drawings, or drawing on stone, and printed for various Government Departments. A large amount of chromo or color-printing and tinting from stone has also been executed, and by the adoption of this method a considerable saving is effected in the charge for hand-coloring, and superior style and accuracy ensured.

59. The following abstract shows the general nature and extent of the work performed during 1875 in this branch, the details of which will be found in the appendix given by Captain Waterhouse, in charge, likewise, of this branch:—

Maps, charts, plans, diagrams, &c., ...	New drawings executed on transfer paper ...	...	185
	,, ,, on stone ...	...	22
	Color stones prepared	...	147
	Subjects printed	...	472
	Complete copies, maps, &c., obtained ...		193,449
Professional forms, Departmental orders, headings and foot-notes of maps, &c. ...	Sheets of forms, &c., for type ...	...	2,171
	Complete impressions	...	198,986

60. The total amount of printing of maps, charts, &c., accomplished by the three printing establishments attached to this office is as follows:—

	Maps.
Copper-plate printing	12,333
Zincographic „	142,371
Lithographic „	193,449
TOTAL ...	348,153

The above is irrespective of the departmental forms, &c., and causes an extensive addition to the records of the office, the very large accumulation of which has now been provided for by a suitable record-room built outside the premises, of corrugated iron, by the Public Works Department, and which answers very well, pending the contemplated erection of new offices on the ground purchased by the Government for the purpose.

Issue and sale of maps.

61. During the past year the total issue of maps to all public departments on service free of charge, and to the local agents for sale in Calcutta, Madras, Bombay, the Central Provinces, Punjab, and North-West Provinces, is as follows:—

	Copies of maps.	Value at selling price. Rs.
To Government officials, *bonâ fide* on public service ...	27,044	32,982
To the Geographical Department, India Office, London	2,945	4,240
To six local agents for sale to the public and local service issues	4,763	6,927
	34,752	44,149

62. The net proceeds of the maps sold by the six local agents during the year 1875 amount to Rs. 3,607-10, which, as soon as realised from the agents, will be deposited in the Treasury in accordance with previous practice.

63. Monies realised on Government account during the year, *vide* account current marked D in appendix, amounting to Rs. 5,274-5-9, have been paid into the Treasury Branch of the Bank of Bengal, and the Bank's receipts have, without delay, been forwarded to the Comptroller General. No cash balances are retained. No credit is derived by this Department for the sums realised by the sale of its maps, or for the labor and expense involved by the issue of maps gratuitously to officials. In fact, every additional map produced by this Department involves the office in extra expense for coloring, mounting, and binding, as well as despatching, in meeting the increasing calls of the public service.

64. The business of the sale and issue of maps has grown to very serious dimensions, which it is most difficult to meet, involving much correspondence with persons all over India. The duties of the agents are exceedingly troublesome and embarrassing, owing to the remarkable indefiniteness of the applications, and the commission on such small sums is declared not to be worth the labor and risk entailed.

65. The several Topographical Survey Parties or executive establishments, with details of the progress of each of the field operations for the season 1874-75, are as follows:—

EXECUTIVE ESTABLISHMENTS.

No. 1 TOPOGRAPHICAL PARTY.

GWALIOR AND CENTRAL INDIA SURVEY.

66. The index map of this party attached to the last report (season 1873-74) clearly indicates the field of operations for the Gwalior and Central India Survey, and for the season under review the work was continued west of the meridian of 75° 45′ and of the cantonment of Neemuch through portions of the various Native States noted in the margin.

Portions of Bhainsroragarh, Begum, and Kuakhera in Udeypur or Mewar; of the Soubats of Sitaman, Jawad, Neemuch, and Mandesor in Sindhia's territory; of Soubat Rampura in Holkar's territory; of Sanjet in the Jaura State, and small portions of the States of Jhálawár, Kota, and Partabgarh, all within the Rajputana and Central India Agencies.

67. The triangulation in advance of the detail survey was extended towards the city of Udeypur and south of the operations of No. 7 party in Rajputana; and an area of about 1,700 square miles was covered by 79 secondary triangles by observations at 30 stations, from which 192 points were trigonometrically fixed and 145 elevations determined. The fixed points furnish an average of 1 to every 9 square miles of ground, and the elevations of 1 to every $11\frac{3}{4}$ square miles. Nearly the whole of this secondary triangulation is well within the polygon of the "Karachi or Western Longitudinal Series, Great Trigonometrical Survey," of which the station of Tana is the centre, and has been fully tested by a proper junction with the great triangulation. The average linear error of the secondary triangulation is 2·2 inches per mile, a quantity which is inappreciable on the scale of survey.

68. TOPOGRAPHY COMPLETED.—The detail survey covered an area of 3,073·3 square miles within the square degree No. XI formed by the parallels of 24° and 25′ and the meridians of 75° and 75°-45′, which was duly tested by the Executive Officer, Captain Charles Strahan, R. E., by $132\frac{1}{4}$ linear miles of check routes, besides *in situ* examination while the work was in progress, and he states that all the work "is good and trustworthy." In addition to this area on the 1-inch scale, the city and cantonments of Jhalrapatan and the Fort of Ghagran were surveyed on a scale of 6 inches = 1 mile.

Strength of Party and season's outturn.

	Topography, square miles.	
Captain Charles Strahan, R. E., Deputy Superintendent, 3rd grade, in charge of party ...	25	besides triangulation and test routes.
Lieutenant J. R. Hobday, Assistant Superintendent, 4th grade, ...	152	Also large scale survey of Ghagran Fort and Jhalrapatan.
Mr. H. J. Bolst, Surveyor, 1st grade, rejoined from furlough, 1st May 1875.		
„ R. D. Farrell, „ 4th „ ...	85	Also triangulation.
„ C. A. R. Scanlan, Asst. Surveyor, 1st grade	94	Leave on medical certificate for 4 months.
„ W. J. Cornelius, „ 2nd „	426	
„ P. J. W. Doran, „ 2nd „	271	
„ C. T. Templeton, „ 3rd „	274	
„ W. M. Kelley, „ 4th „	276	
„ G. A. Knight, „ 4th „	279	
Sub-Surveyor A. Samad Khan	103	Died 16th April 1875.
„ Joala Pershad	291	
„ Abdul Subhan, returned from special duty with the Yarkhand Mission, 28th January 1876.		
„ Abdul Gufar	295	
„ Girdhari Lall	246	
„ Mr. John Harris... ...	256	
Total square miles ...	3,073	Topography.

69. In the southern portion of the country which came under survey, Captain Strahan states that the staple produce is opium; "it is plentifully watered by small streams, but very little use is made of the water, the only means of irrigation being the ordinary bucket drawn up by two bullocks; wherever this can be used opium (poppy,

Description of country.

is cultivated." Cereals are much neglected, and the prices of grain of all sorts are very high. The ground in the northern half of the season's work is peculiar, being formed of three distinct steppes; the first scarp rises from the plains to a height of about 600 feet, in latitude 24° 30′, and the ground to the north slopes gradually down to the *Sunjali* river; the second scarp rises about latitude 24° 50′ and falls towards the *Bamni* river; and a few miles north of this occurs the third and highest scarp; these steppes are covered with jungle and are very sparsely inhabited.

70. The height of the water level in the *Chumbul* river, at the ford of *Awhra* or *Aunra*, $\frac{\text{Latitude } 24° 12' 7''}{\text{Longitude } 75° 27' 8''}$ near the village of the same name, was determined and found to be 1,249 feet above mean sea level. Forty-one miles lower down, near the old fort of *Chourassagarh*, the height of the water level is 1,166 feet above sea, showing a fall of 83 feet in 41 miles, or very nearly 2 feet per mile. Much valuable and interesting information is contained in the extract from Captain Charles Strahan's narrative report, given in the appendix.

71. The area of triangulation and topography completed is a good outturn for the season, considering that the senior Surveyor, Mr. H. J. Bolst, who obtained furlough to Europe on medical certificate in November 1873, did not rejoin the party before May 1875 during the recess, and that Mr. Scanlan, Assistant Surveyor, 1st grade, was incapacitated by illness from taking any share in field work for 4 months.* Sub-Surveyor Abdul Samad Khan was also in ill-health and unable to render a full season's work, and I regret to add that, while the party was preparing to return to recess quarters, he died at *Ajmere* on the 16th April 1875.

Opinion on the season's outturn.

* Leave on medical certificate from 1st January to 30th April 1875.

72. Captain Strahan reports in the highest terms on the ability with which Lieutenant Hobday,† Assistant Superintendent, 3rd grade, discharged all his duties, and I have every hope that this very promising officer will soon be fully qualified in every branch of his profession. He is now well able to take a leading part in the duties of an Assistant Executive. Messrs. Scanlan and Cornelius, Assistant Surveyors, are very favorably mentioned by the Executive Officer and strongly recommended for promotion to the higher grades, for which they have served the usually appointed time.

† Passed the final professional examination in July 1875 and was permanently appointed from 7th July 1875, *vide* Revenue, Agriculture, and Commerce Department Notification No. 505, dated 19th July 1875.

73. During the current field season, the plane-table parties will continue the topographical delineation of the country west of the meridian of 76°, north and south of Jawud and Neemuch, and the triangulation will be extended into the eastern half of the degree sheet XIII or up to longitude 73° 30′. The ground remaining for survey extending to Mount Aboo and the borders of Pahlanpur and Mhyekanta and Rewakanta of the Bombay Presidency now begins to be of a difficult nature,—much broken up by small rugged features, jungle-clad, and very sparsely populated; provisions are dear and scarce; but I have full confidence in the Executive Officer, and have no doubt that he will overcome all these obstacles to fair progress with his usual judgment and skill.

Programme for season 1875-76.

No. 2 TOPOGRAPHICAL PARTY.

KHANDESH AND BOMBAY NATIVE STATES SURVEY.

74. In paragraph 83, page 11, of the printed report for 1873-74 the programme of this party for the season under report was fully described, and in accordance with it two detachments were formed—the first and largest under H. Horst, Esq., Assistant Superintendent in charge, to continue the detail operations in the

Part of Khandesh, north of the Tapti river; of Holkar's territory, Mandlésar District; of Rajpur and Pansemal talooks of Barwani, and detached intermixed portions of Sindhia's territory.—Dhar, Ali-Rajpur, Jabua, &c., north of the Nerbudda river.

north-eastern portion of the Khandesh district along the Satpura range on the 1-inch scale, and to prepare ground immediately north and south of the Tapti river, both by traversing and triangulation, for the 2 inches = 1 mile survey of the open and highly cultivated country; the second detachment, under the senior Surveyor, Mr. D. Atkinson, to triangulate north of the Nerbudda between the parallels of 74° and 75° in Degree Sheet No. 7 as shown in the Index Map.

Strength of party and outturn of work.

F. B. Girdlestone, Esq., Deputy Superintendent, 3rd grade, on furlough to Europe.

H. Horst, Esq., Assistant Superintendent, 1st grade, in charge	1,733	square miles of triangulation, assisted by Messrs. Chew, Wyatt, and Wilson; also traversing for 2-inches scale survey.
Mr. D. Atkinson, Surveyor, 2nd grade ...	1,642	square miles triangulation.
Total triangulation ...	3,375	square miles.

	Topography. Square miles.
Mr. R. W. Chew, Surveyor, 2nd grade ...	155
„ A. J. Wilson, „ 3rd „ ...	100
„ A. G. Wyatt, „ 4th „ ...	186
„ W. C. Barckley, Assistant Surveyor, 3rd grade	131*
„ E. Graham, „ 4th „	338
Sub-Surveyor Sheik Omer	313
„ Mr. F. Rozario	215
„ „ H. M. Holtham	185
„ „ Churaman Lall	215
„ „ Lall Singh	75
„ Hyderally	200
„ Bapu Jadu	25
	2,138

The officer in charge, and Messrs. Chew, Wilson, and Wyatt, also completed a total of 251 linear miles of traversing, on the scale of 2 inches = 1 mile, in the Khandesh District.

* Three months' privilege leave, from 4th March 1875, on medical certificate.

75. The early part of the field season being exceedingly unfavorable for work in the Satpura range, the 1st detachment commenced work close along the northern bank of the Tapti river, in the vicinity of the large towns of Chopra and Saoda, and here arrangements were also made for supplies, labor, &c., for the plane-table parties to enter the hills later in the season, when the health of the establishment was not likely to be seriously endangered. The 2nd detachment proceeded to the town of Burwani, in the Native State of the same name, north of the Nerbudda river, and commenced work by laying out two quadrilaterals and five single triangles in connection with the Great Triangulation of the Khanpisura and Singhi Meridional and Guzerat Longitudinal Series. Considerable delay and difficulty was, it is reported, experienced in carrying out this triangulation, in consequence of the station marks of the Great Triangulation being utterly destroyed at the places marginally noted, and by obstructiveness on the part of the Bheels and the people in the Ali-Rajpur, Jabua, and Jobat States.

Kandalwa Station, Singhi Series.
Masabar Station, „

76. The work accomplished by the party is as follows: Triangulation in advance of topography 3,375 square miles, within which area 744 points, or an average of one to every $4\frac{1}{2}$ square miles, were fixed and 350 heights determined, giving an average of one height to every $8\frac{1}{2}$ square miles. In the plains of Khandesh 251 linear miles of traversing on the 2-inch scale was completed, by which 184 village triple-junction marks were fixed, and $101\frac{3}{4}$ miles of traversing on the 1-inch scale, to determine the position of boundary pillars between Khandesh and Holkar's Nimar; and Khandesh and British Nimar was also completed. Of final topography on the 1-inch scale, 2,138 square miles, chiefly in the Satpura range, of the most intricate and difficult ground was completed, all of which was carefully tested by 208 linear miles of check routes.

Season's outturn.

77. This outturn is very fair both as regards triangulation and final topography, when considering the circumstances under which it had to be performed.

78. The ground topographically surveyed is situated between latitude $\frac{21°-15'}{21°-15'}$ longitude $\frac{75°-0'}{76°-15'}$, embracing portions of the district of Khandesh, Native or Holkar's Nimar, and the State of Barwani. The Satpura range of hills extends through it, and hundreds of square miles within this tract are entirely uninhabited, though there is ample evidence that the country must have been fairly populated in former times. Wild animals abound. Tigers, leopards, panthers, bears, bison, and sambar deer are plentiful in the interior; but the sportsman

Description of country surveyed in detail.

incurs serious risk in pursuing these animals through high spear grass and forest which covers the face of the country. The Surveyor, who has to visit every nook and corner in such ground, with the object of tracing up the course of streams or to reach some favorable point of view for the delineation of the ground, is in constant danger and, in addition, is very liable to be prostrated by fever. It was in this ground that one of the Assistant Surveyors of this party, Mr. W. C. Barckley, in the month of March last, while in the execution of his duty, was suddenly attacked by two bears, one of which he shot dead, and wounded the other; curiosity prompted him to go forward too near to the wounded animal, when the infuriated brute rushed on him, inflicting terrible laceration of the face and various other ugly wounds, from the effects of which he has not yet nearly recovered. The Assistant Surveyor, however, by his admirable pluck and good constitution, is, I am happy to state, after severe suffering, in a fair way towards recovery, although he is of course disfigured for life. He has been brought to Calcutta for the sake of medical skill and attention, which he has been fortunate enough to find in a very eminent degree in the General Hospital at this place.

Vide letter to Revenue, Agriculture, and Commerce Department, No. 760, dated 14th October 1875.

79. A little later in the season another plane-tabler's party, while resting near a stream, was attacked by a bear, and the Bheel guide so severely wounded that he died soon after. The solitary bison inhabiting these hills is described as very fierce and vindictive; he stands motionless in some shady spot hidden by long grass, and many are the victims annually, amongst travellers, gum collectors and wood or grass cutters, to his blind fury as he rushes on them and gores or tramples them to death.

80. The only village of any importance is Pal or Paltuppa, latitude 21° 21′ 30″, longitude 75° 56′ 27″, on the left bank of the Suka river, in a valley of the Satpuras, which, the Executive Officer states, is now being re-inhabited. The Aner river flows through the main valley of the Satpuras due west for 36 miles, after which it turns to the south and flows into the Tapti river. The Beda, Kundi Deb, and Goi streams flow northwards into the Nerbudda; the Arnawali stream takes a south-east course and falls into the Tapti near the town of Sherpur. The principal passes are the Gaolanghati, elevation 1,900 feet above sea, practicable for carts and laden camels; the Gadarghati, about 2,000 feet above sea, on the road from Chopra to Khargun, only practicable for bullocks and camels; and the Rupgarh pass, elevation about 1,800 feet, between Dhoulid and Dhulkot, practicable for carts and camels.

81. In the ground triangulated north of the Nerbudda, the Surveyor states that "teak is plentiful, but of stunted growth, in consequence of the Bheels mutilating the trees and so rendering them useless for timber. Logs of sissu are carried both to the coast and to Dhar. About ten miles west of Barwani the Nerbudda, at an elevation of about 400 feet, enters the gorge formed by the approach of the two ranges, Vindhia and Satpura. The gorge must be more than 30 miles in length."

82. The Assistant Superintendent in charge, Mr. H. Horst, has, with much labor and tact, brought a difficult season's work to a successful termination, for which he is entitled to commendation. Messrs Chew, A. J. Wilson, A. G. Wyatt, and W. C. Barckley, also Sub-surveyor Sheikh Omer, are reported by Mr. Horst as having rendered him good aid, and to have performed the duty entrusted to them under many difficulties in a satisfactory manner.

83. During the ensuing season the triangulation in advance will be chiefly, in Degree Sheet VIII, to prepare the ground between the Tapti and Nerbudda rivers, west of longitude 74°50′ and to 74°. The topographical delineation of the ground triangulated during the season under review, north of the Nerbudda, in the Native States of Ali-Rajpur, Jabua, Dhar, Barwani, and detached portions of Holkar's territory, together with a portion of Khandesh, extending to the east and west of the Great Indian Peninsular Railway, near Bhosawul station, will be completed, and the traversing continued on the 2-inch scale in the plains of Khandesh in continuation of the work already completed.

Programme for the field season of 1875-76.

84. The party, it will be observed, has still to work in two detachments in totally dissimilar styles of work, on the hills and on the plains, at convenient and safe seasons of the year, and the difficulties of making proper arrange-

ments for maintaining communication with the detail surveyors and superintending the work are not of an easy character. The operations are of a complicated character, requiring skill and forethought, and there is very much still remaining to be done of a costly nature in a part of the country where wages and all charges are much higher than on this side of India.

85. The tract now under treatment by this establishment of the Bombay Native States between the Tapti and the Nerbudda has never before been attempted to be properly delineated, and it will fill up absolute gaps in the geography of India which have existed throughout British rule.

No. 3 TOPOGRAPHICAL PARTY.

CENTRAL PROVINCES, AND VIZAGAPATAM AGENCY SURVEY.

Part of the Bustar State, in the Central Provinces, and of the Rampa, Golgonda and Rakapili talooks of the Vizagapatam Agency of the Madras Presidency.

86. The scale of this survey, for the reasons assigned in page 13, paragraph 93, of the report for 1873-74, has been reduced from the 1 inch to $\frac{1}{2}$ inch or 2 miles = 1 inch scale, which is sufficient for the wild and unpopulated nature of the country and essentially necessary with the view to getting over the ground quicker, and the preservation of health and life of the persons employed in its delineation.

87. The programme for the season was to complete the topography of the extreme southern portions of the Vizagapatam Agency and Bustar State, as given in the margin, joining on to the Upper Godavery districts; and to extend the triangulation along the western portion of the Bustar State towards the eastern limits of the Ahiri zemindary of Chanda district and the southern boundary of the district of Raepur, in the Central Provinces.

Strength of party and season's outturn.

	Triangulation. Sq miles.	Topography. Sq. miles.
Captain T. H. Holdich, R. E., Assistant Superintendent, 1st grade, in charge	3,080	
Mr. J. Harper, Surveyor, 2nd grade	2,052*	
TOTAL ...	5.132	
Mr. J. A. May, Surveyor, 4th grade		428
„ F. Adams, ditto		473
„ T. E. M. Claudius, Assistant Surveyor, 1st grade ...		457
„ A. Cooper, „ 3rd „ ...		406
„ G. Vanderbeck, „ 4th „ ...		378
„ D. Campbell, „ 4th „ ...		392
„ W. F. Pettigrew, ditto, on medical leave to Europe ...		...
TOTAL ...		2,534

* Mr. J. Harper, on return to recess quarters, died on the 23rd June.

88. The topography obtained covers an area of 2,534 square miles, and connects the previous work of this party with that of the Hyderabad Survey, along the eastern boundary of the Upper Godavery districts of Rakapili, Bhadrachelam, and Cherla, thus filling up another portion of what has hitherto been a totally unvisited and unknown tract in all maps of India.

89. Captain Holdich expresses a very favorable opinion on the general accuracy of the detail survey, which, as far as possible, was tested by him both by short traverses and *in situ* examination; and also on the style in which the several assistants have delineated the principal features of the ground on the reduced scale,—a most difficult task, considering its inhospitable, rugged, and forest-clad nature. The fair standard maps of the season fully bear out this opinion and show a marked improvement on those of previous years.

90. The season's triangulation covers an area of 5,132 square miles. Observations were taken at 47 stations, by which the positions of 277 points and 157 elevations were trigonometrically determined. The hardships and exposure to which both Captain Holdich and Mr. Harper were subjected in conducting this triangulation seriously affected their health, and I greatly regret to add that, soon after his return to recess quarters—very late in the season—Mr. Harper was completely prostrated and died on the 23rd June 1875.† Mr. Harper is a serious loss and very much regretted.

† *Vide* letter to Revenue, Agriculture, and Commerce Department No. $\frac{522}{F}$, dated 20th August 1875.

91. The total outturn of work, considering the peculiarly unfavorable nature of the country and short duration of the field season (4 months only), is very creditable to all concerned; more could not be expected even under more promising circumstances in so short a time. These results were apparent to me when I had the opportunity of examining the field sections in the Executive Officer's office.

Opinion on the season's outturn of work.

92. A full description of the ground topographically surveyed this season was given in the appendix of the last report, page 37, to which may be added the following notes:—"The Bailadila range, running north and south, rises to a height, at its southern extremity at Nandiraj, of about 4,000 feet above the sea level, and forms the step from the general plateau of Jeypur and Bustar to the plains of the Godavery basin below. The hills themselves, being bare of jungle at the summit, were easy to survey, though excessively difficult to move about on from their inconceivable ruggedness of surface. The sides and slopes are clothed with dense jungle, including bamboos and cane-brakes. There are no villages on the range, and few within reach of its foot, and from the foot of the hills eastward stretches away a broken hilly district, about even with the general level of the plateau. Perhaps the chief feature of interest about this part of Bustar is the amount of teak timber in the forests. Teak trees of great size and girth are common on all the small hills below the Bailadila range eastwards."

Description of country.

93. Of the ground triangulated south of the Indrawutti river, a very complete description, together with much other interesting information, is given in the extract from Captain Holdich's report in the appendix. Of the Bhopalpatnam talook, or district, in the State of Bustar, Captain Holdich states:—

"Bhopalpatnam is on the low level of the Godavery valley, only a few hundred feet above sea; but it is the most civilised part of Bustar I have yet passed through. Villages are large, if not plentiful, and supplies easily procuarable. All the cultivation of Bustar seems centred in Bhopalpatnam."

94. Of the Kootroo talook, which lies between Bhopalpatnam and the Indrawutti river, he remarks as follows:—

"It possesses the same monotonous characteristics of jungle and grass, interspersed with a confusion of irregular but picturesque hills, possessing no apparent continuous system. The general level of this district is high, being about 1,000 feet above the sea level, with some of the more defined peaks and hills rising to above 2,000 feet in altitude. Were it not for the deadly monotony of color and the depressing effect of one vast unending sea of jungle, the scenery in many parts would be grand. The Indrawutti itself is a beautiful river, every mile of its course presenting picturesque effects in a variety unequalled by any river south of the Himalayas that I have seen in India."

95. Monuments—"Menhirs"—raised in memory of the dead along the sides of roads, were found throughout the country, and are described as upright stones, very similar to tombstones, only varying according to the nature of the stone used; they are not carved or shaped in outline and are of all sizes and shapes; some seen were 10 or 11 feet high; but when of this size were always of thin slabs of sandstone.

96. The whole eastern basin of the Godavery abounds in game. Tigers are plentiful in the Rampa hills and low country about Beji and Yelnagonda, "where villages are constantly deserted on account of their depredations." In the Rampa and Bailadila hills, and in the hills bordering the Indrawutti from Bhopalpatnam to Bhamagarh, bison, in herds, are found. Snakes are plentiful, and there are several large varieties in the jungles in addition to the boa-constrictor.

97. The only exports of the country are gall-nuts, skins, and horns; near the rivers the principal trade is in timber. The imports are chiefly rice and salt.

98. There still remains an area of only 1,030 square miles between latitude $\frac{19^{\circ}\ 30'}{20^{\circ}\ 15'}$, longitude $\frac{80^{\circ}\ 30'}{81^{\circ}\ 0'}$ to be triangulated, and about 6,500 square miles for topographical delineation in Western Bustar, as shown in the index map given in the last report, to establish a junction with the completed work of the Revenue Survey in the district of Raipur and the Ahiri zemindary of district Chanda, and to complete all the work allotted to this party. Of this, it is expected that the

Future operations.

area to be triangulated, and some 3,500 square miles of topography south of the Indrawutti river, will be completed during 1875-76, leaving only about 3,000 square miles of topography north of the Indrawutti for the season 1876-77, and I look forward with considerable anxiety to the termination of our labors in this part of the country, where the health and lives of so many able and valuable members of this department have been lost during the past twenty-five years.

99. The party was inspected by myself at Ootacamund in May last, and it affords me great pleasure to record my appreciation of the services rendered by Captain Holdich, R.E., who, though suffering from the ill-effects of the terrible climate, has most zealously and ably brought to a successful termination his second season's work in this very difficult country. All the surveyors and assistants under him have given perfect satisfaction. Messrs. May, Adams, and Claudius, the senior hands of the party, have for many years past rendered good service under very trying circumstances. Mr. Adams is strongly recommended for promotion, to which he is also entitled by length of service in his present grade; but I regret there is no vacancy at the present moment.

100. All the assistants have suffered much from fever, and have only recovered and been able to renew their labors in the field by the circumstance of repairing to the hills to recruit strength during the recess. My presence with the party was beneficial, in devising the future programme for the next two seasons, with the necessary arrangements for keeping up proper communications so as to ensure the completion of the entire tract of country allotted for survey to this the oldest-established topographical party within the time specified.

101. Mr. J. McCay, 3rd grade Assistant Surveyor, was transferred from No. 6 Khasia and Garo party, to fill the vacancy caused by Mr. Harper's death, as it is absolutely necessary that the strength of the party should be maintained to secure the completion of all the area remaining for survey by the close of the season 1876-77.

No. 4 TOPOGRAPHICAL PARTY.

NORTH-EASTERN DIVISION, CENTRAL PROVINCES SURVEY.

102. The programme of this party for the season was to complete the triangulation of the southern portion of the Balaghat district, on the borders of Bhundara and Seonee, and the topography of the south-east part of district Mandla on the borders of Raepur, and of the Pandaria and Kawarda estates or zemindaries in district Belaspur; also the forest reserves in Mandla, on the larger scale of 4 inches = 1 mile.

The Pandaria and Kawarda zemindaries of district Belaspur, Tehsils Mandla and Ramgarh of district Mandla, and the eastern portion of the Balaghat district of the Central Provinces.

103. SEASON'S OUTTURN:—In addition to the triangulation in the southern portion of the Balaghat district, it was necessary to triangulate closely two small valleys in the centre of the Mandla district, and to connect the large scale traversing of forest reserves with the triangulation; all this was satisfactorily accomplished. Observations were taken at 34 stations, by which an area of about 800 square miles was covered with 136 points, and the eleva-

Strength of party and season's outturn.

Lieutenant-Colonel G. C. Depree, S.C., Deputy Superintendent, 1st grade, in charge ... } 800 square miles triangulation, 245 linear miles check route.

	Topography, Sq. miles.	Forest reserve survey 4 inches =1 mile.
Mr. G. A. McGill, Surveyor, 2nd grade	109	4·71*
„ J. Vanderputt „ 3rd „	161	40·96
„ A. James, Assistant Surveyor, 1st grade ...	272	9·61
„ J. A. Barker „ 2nd „ ...	245	17·32
„ J. H. Wilson „ 3rd „ ...	243	12·30
„ G. L. Fleming „ 4th „ ...	146	11·03
Sub-Surveyor M. S. Dutt	191	32·52
„ Eusuf Shariff	175	52·98
„ Imam Shariff	289	12·55
„ Shere Shah	224	3·20
„ Atma Sing.	138	4·19
	2.193	201·37

* Mr. McGill also completed 175 linear miles of traversing for the Forest Reserve Survey.

tions of 77 points determined, which were fairly distributed on hill tops, plains and valleys, so as to afford bench or obligatory marks in every part of the country, giving an average of 1 point to every 6 square miles, and one height to every $10\frac{1}{3}$ square miles of ground. Topography was obtained for 2,193 square miles of country, within which 201·37 square miles, or 128,877 acres of forest reserve lands, were surveyed on a scale of 4 inches = 1 mile. During the course of the detail survey, all village tri-junction marks were entered on the field sheets, and have also been given on the fair standard maps. Lieutenant-Colonel Depree, Deputy Superintendent, in charge, having furnished all the triangulation remaining to be done, examined the plane-tables by no less than 245 linear miles of check routes, in addition to *in situ* examination, and declares that he is well pleased with the results, which is highly satisfactory.

104. Of the ground triangulated in the Balaghat district, Lieutenant-Colonel Depree reports that

"it is more thinly inhabited, impracticable, and wild, than any I have before met with. Until the grass is burnt off the face of the country, the natives do not enter certain parts at all. Nothing whatever was known of this tract of country before."

Forest reserves.

105. The forest reserves completed are those of Jagamandel, Motinala, North Phen, South Phen, Kulikapa, and portions of Topla and Banjar valley.

Area of the Pandaria estate, district Belaspur.

106. The Pandaria estate or zemindary, in district Belaspur, completed during the season, has an area of 483 square miles, and it contains 340 villages, in which are a total of 8,691 houses.

Opinion on the season's work.

107. A fair outturn of work has been accomplished, and the whole rendered, as usual, in excellent time and in approved style. The ground for the most part was extremely difficult, and the large scale survey of scattered forest reserves necessitated special arrangements, by which the time for the regular 1-inch scale survey was somewhat curtailed. It was, moreover, not advisable to keep the assistants out too late in such exceptional parts of the country.

Programme for season 1875-76.

108. No more triangulation in advance of details remains to be done in the area allotted to this party, to connect with all the surrounding previously completed Revenue Surveys in the Central Provinces; but it will be necessary to supplement the minor triangulation of former seasons by a few additional points here and there in intricate ground, to facilitate the progress of detail surveying during the course of its execution. The Topla, Banjar valley, and Bareila reserves will be taken up and completed on the 4-inch scale, and the topographical delineation of the western portion of the district of Mandla, and the northern half of the Balaghat district, will be completed; in all, about 2,200 square miles in Degree Sheets VI, VII, and VIII.

109. There will then be left only about 1,250 square miles of topography to finish during the following season 1876-77, and the party will be reduced in strength accordingly to deal with this small area; after completing which, to meet the orders of Government for the reduction of the departmental estimates, it must be absorbed.

110. With this and the small remaining area in Bustar, on the Indrawutti river, to be executed by No. 3 party, the whole of the Central Provinces will have been brought to a satisfactory conclusion, and effected within the last 20 years by the Topographical and Revenue Surveys conjointly. Looking to the variety and nature of the several districts and States composing this jurisdiction, amounting to about 114,000 square miles territory, almost equivalent to the area of Great Britain and Ireland, it is a matter for great congratulation.

111. Lieutenant-Colonel Depree, Deputy Superintendent, in charge, continues to maintain the efficiency of the party in every respect, and his able and economical management deserves special mention. The several surveyors and assistants have given equal satisfaction. The senior Surveyor, Mr. McGill, held temporary charge of the party during the Deputy Superintendent's absence on privilege leave for three* months, brought up the office work, and conducted it into the field entirely to my satisfaction.

* August to November.

112. Mr. J. A. Barker, Assistant Surveyor, 2nd grade, was transferred to No. 5 party from 1st October 1875, in order to meet a pressure for greater progress in that survey.

113. Messrs. McGill and Barker have served in their present grades since January and October 1871, respectively, and are consequently entitled to promotion by length of departmental service, and admitted good and efficient services rendered in the field; but I regret that the state of the department at present does not admit of their advancement to the next higher grades.

No. 5 TOPOGRAPHICAL PARTY.

BHOPAL AND MALWA SURVEY.

114. As explained in paragraph 118 of the last printed report, the operations for the season under review were intended to extend through portions of Degree Sheets IV, V, VII, and VIII, as shown in the index map, and embraced portions of the several Native States marginally noted. The party changed hands by the departure on furlough of Captain Riddell, and the substitution of Captain Wilmer, Assistant Superintendent, in his place.

Part of the Kalia Khera Nizamut in Bhopal, portions of the Soubats of Augur, Ujain, Shajehanpur, and Indore, in Holkar's territory, and portions of Dewas, Rajgarh, Narsingarh, and Kilchipur, Native States in the Central India and Rajputana Agencies.

115. The triangulation was extended through the eastern half of Degree Sheets VII and VIII, latitude $\frac{22°\ 30'}{24°\ 0'}$, longitude $\frac{75°\ 30'}{76°\ 0'}$ round Indore, Ujain, &c., covering an area of 3,385 square miles by observations at 54 stations, from which 371 positions were fixed, and 371 heights trigonometrically determined, giving on an average 1 point and 1 height for every 9 square miles of country. Triangulation for the cities of Narsingarh, Dewas, Augur, and Mehidpur, for a survey of these places, on a scale of 12 inches = 1 mile, was also finished. The topography of 2,237 square miles of ground was obtained in the south-west quarter of Degree Sheet V, and the north-west quarter of Degree Sheet IV, in the Narlada, in Kalia Khera of Bhopal, and in Narsingarh, all of which was duly tested by 187½ linear miles of check routes and examination *in situ* by the officer in charge and his senior assistant, and found to be accurately delineated. The survey of the city of Narsingarh, and the city and cantonment of Sehor, was completed.

Strength of party and season's outturn.

	Triangulation. Sq. miles.	Topography. Sq. miles.
Captain R. V. Riddell, R.E., Deputy Superintendent, 2nd grade—On leave to Europe.		
Captain J. R. Wilmer, Assistant Superintendent, 1st grade, in charge	2,050; also triangulation of Dewas city.	
Mr. C. F. Hamer, Assistant Surveyor, 1st grade	1,335; ditto of Narsingarh, Augur and Mehidpur cities.	
TOTAL	3,385	
Mr. E. A. Wainright, Assistant Surveyor, 2nd grade		288
„ H. T. Kitchen, „ ditto		285
„ W. H. Lilley, „ 3rd grade		252
„ J. C. Murray, „ 4th „		168
„ A. Kitchen, „ 4th „		288
„ T. Downes, „ 4th „		273
„ G. R. Copping, „ 4th „		242
Sub-Surveyor Prem Raj...		107
„ Abdur Rahim		217
„ Gobardan Dass		117
„ Shib Charan, Probationer—under instruction ...		...
TOTAL		2,237

In addition to above, 187½ linear miles were run of check routes. Mr. Wainright and Sub-Surveyor Gobardan Dass completed a survey on the 12-inch scale of Nursingarh city. Sub-Surveyor Prem Raj completed the details of the city of Sehor on 12 inches.

116. The ground surveyed in detail this season has been fully described in the reports of previous years, the party prosecuting its operations systematically from east to west through the Bhopal State, north of the Nerbudda river and south of the parallel of 24°, which is the limit of No. 1 party. A few addi-

tional notes from Captain Wilmer's narrative are given in the appendix. He states also :—

"The country triangulated was uninteresting, being very flat, with isolated, low, flat hills, patches of jungle here and there, but generally cultivated throughout. Opium is the chief product about these parts; other grains are grown, but in small quantities. Wheat is very expensive, the average price being 11 seers for the rupee. Wherever there is cultivation, the black cotton soil prevails. Near the peak of Singarchaori (2,218 feet above sea) the scarps of the Vindhia range are bold and well-defined, and the hills are covered with forest. During the months of October and November fever is prevalent, but after this the country is fairly healthy."

117. The party is stated to have suffered greatly from fever at the commencement of the season.

Opinion on the season's outturn of work.

118. The outturn of triangulation and topography is very good, and all the work has been carefully tested and is fully approved. Captain Wilmer, in this the first year of his charge of the party, has furnished the best proofs of his ability as an executive officer, for which he always gave high promise; and it affords me much satisfaction to add that, in addition to his other excellent qualities, he has observed the strictest economy in all the expenditure connected with the season's operations.

Good services of assistants.

119. Captain Wilmer reports in very satisfactory terms on the good services of his assistants, and especially acknowledges the efficient aid rendered, both during the field and recess seasons, by Mr. C. F. Hamer, his senior Assistant Surveyor, who has been strongly recommended for promotion, being senior of his grade, both by Captain Riddell and the officer at present in charge. Mr. Wainright and Mr. Lilley, having both served the prescribed periods in their respective grades, are recommended for promotion, which, I much regret, cannot be accorded to either of the above assistants in the present unfortunate state of the department.

Programme for the next field season.

120. The programme for the season 1875-76 is as follows :—The completion of triangulation from the Nerbudda northwards up to latitude 23° 30′ between the meridians of 76° and 77° so as to prepare for topography all the ground in the southern half of Degree Sheet IV, and all in Degree Sheet VI. The detail survey to be taken up of the north-west quarter of Degree Sheet IV, south-east quarter of Degree sheet VII, and the north-east quarter of Degree Sheet VIII, or for the country between latitude $\frac{23^\circ\ 30'}{24^\circ\ 0'}$ longitude $\frac{75^\circ\ 30'}{76^\circ\ 30'}$ and latitude $\frac{22^\circ\ 30'}{23^\circ\ 0'}$ longitude $\frac{75^\circ\ 30'}{76^\circ\ 0'}$.

121. This will have the effect of squaring up all the work along the Nerbudda river, up to a little beyond the meridian of Indore and Ujain, and will complete about half the area assigned to the Bhopal and Malwa Survey, which it is most desirable to push on with.

Additions to the strength of the party.

122. For this purpose, an Assistant Superintendent, Lieutenant Gore, R.E., has been posted to this party, having been transferred from the Great Trigonometrical Survey, in order to relieve the estimates of that branch. Mr. J. A. Barker, Assistant Surveyor, 2nd grade, was likewise transferred from No 4 party, from which his services could be well spared, in order to effect greater progress in Bhopal during the current season.

123. It is very gratifying to record that the most effective and ready assistance has been throughout rendered by the Political Agent and by the Bhopal Native State, for which our obligations are due. Her Highness the Begum has been duly supplied with all maps and plans as published, and she has greatly appreciated the excellent large plan of her capital city.

No. 6 TOPOGRAPHICAL PARTY.

KHASIA, GARO, AND NAGA HILLS SURVEY.

Naga Hills, south of the district of Sibsagar in Assam.

124. As was explained in paragraph 134 of the last report, this party for the season under review was employed in three separate detachments.

125. The first, under Major Godwin-Austen, accompanied the Daphla military expedition against the tribes on the northern frontier of Assam, and the operations of this detachment will be separately reviewed.

126. The second detachment, under Captain Badgley, and the third, under Lieutenant Woodthorpe, R.E., were employed in the Eastern Naga Hills, south of the Sibsagar district, extending from the Doyang river on the west to the Dihing on the east, and the work performed by these two detachments will be now treated of.

Strength of party and season's outturn.

	Topography.	Triangulation.
	Sq. miles.	
Captain W. F. Badgley, Deputy Superintendent, 3rd grade	657	792 square miles by Captain Badgley and Mr. Chennell.
Lieutenant R. G. Woodthorpe, R.E., Assistant Superintendent, 2nd grade	1,507	
Mr. A. W. Chennell, Assistant Surveyor, 1st grade ...	...	
,, J. McCay, ,, 3rd ,, ...	1,075*	
Square miles	3,239	792
Overlaps and margins	1,075	
New area mapped	2,164	square miles

* Quarter-inch scale.

127. Under the orders of the local Government it was arranged that Captain W. F. Badgley, Deputy Superintendent, assisted by Mr. A. W. Chennell, Assistant Surveyor, with Lieutenant Holcombe as Political Officer, should enter the Eastern Naga Hills from Jaipur and work down in a south-westerly direction to meet the detachment under Lieutenant R. G. Woodthorpe, R.E., Assistant Superintendent, assisted by Mr. J. McCay, Assistant Surveyor, and accompanied by Captain John Butler, Political Agent, Naga Hills, which was to enter the hills from Golaghat and work north-eastward to meet Captain Badgley. This programme was adopted with the object of securing the exploration and survey of all the hill-country inhabited by the Eastern Naga tribes between the meridians of 94° and 95° 30′ and between the Patkoi range and the district of Sibsagar.

Outturn of work by Captain Badgley's party.

128. Captain Badgley was instructed to start his triangulation from a side of the Assam Valley Series, Great Trigonometrical Survey, in the vicinity of Sibsagar, and to triangulate into the hills immediately to the south and east, with a view to obtain a good basis for the topography, and to connect work in the South Luckhimpoor hills, east of the Dihing River, executed by Captain Samuells of the Revenue Survey during a previous season. This he succeeded in doing, assisted by Mr. Chennell, in a very satisfactory manner, and had secured 792 square miles of triangulation and 657 square miles of topography up to the 2nd February 1875, on which date the party was suddenly attacked by Nagas from the villages of Sanua and Ninu, assisted by others from the village of Noka, who entered the camp very early in the morning, under the pretence of furnishing supplies, and treacherously murdered Lieutenant Holcombe, Political Officer, and eighty natives, besides severely wounding, in the space of a few minutes, Captain Badgley and fifty-one men, of whom some died afterwards.

Lieutenant Holcombe and eighty men treacherously murdered by Nagas.

129. The party numbered 2 officers and 195 men; of these 1 officer was killed, 1 severely wounded, 80 men killed and 51 wounded, of whom some died shortly after.* It was entirely due to Captain Badgley's fortitude and presence of mind, under very trying circumstances, and while suffering from no less than four serious flesh wounds—received in personal combat with several Nagas, two of whom he killed—that the remnant of the party, carrying the dying and wounded, were extricated from these hills and brought safely to the station of Jaipur, where medical aid was obtained on the 7th February. Captain Badgley was, from the nature of his wounds, of course, unable to take any further active part in the field again; but I am thankful to record that under the great care and attention of the medical officer and good friends at Dibrugarh he rapidly recovered, and regained strength sufficient to return to his duties at Shillong by the time the party went there for the recess.

* Reported to Government in letter No. 351, dated 17th February 1875.
No. 67F., dated 1st June 1875.

130. The detachment under Lieutenant Woodthorpe entered the Naga Hills south of Golaghat and proceeded into the interior, accompanied by Captain Butler, Political Agent; but survey work had barely been commenced in the vicinity of the large Naga village of *Wokha* when the party was attacked, on the 5th, and again on the 10th January 1875, by the Wokha men; and it was only when they were fairly beaten and acknowledged their defeat by surrendering the murderers of an inoffensive Kuki porter, whom they had killed some days previous to the attack of the 5th January, that the party was able to proceed further east.

Work accomplished by Lieutenant Woodthorpe's party.

131. The defeat of the Wokha men and the occupation of the village—which is the largest and most important in this part of the country—by a small party of the 44th Native Infantry, to keep open communication with the plains of Assam, had an excellent effect on the surrounding Naga villages, most of which now sent in friendly deputations to the Political Agent, Captain Butler, with presents of fowls, rice, &c. After this the party proceeded working in a north-easterly direction along the outer ranges of the Naga Hills with the intention of connecting its work with that of Captain Badgley's and then turning back to complete what remained further south up to the Patkoi range. But on the 17th February 1875 the very vague rumours which had hitherto reached Captain Butler, regarding the sad disaster which had befallen Captain Badgley's party, were fully confirmed, and he received instructions at the same time from the Chief Commissioner to close survey work on this side, and proceed at once to join the punitive expedition against the Eastern Nagas concerned in the murder of Lieutenant Holcombe and the 80 men of his camp.

132. By the 24th February, Lieutenant Woodthorpe and Mr. McCay reached Buruar-chali by forced marches and there had to await the arrival of the troops from Dibrugarh. On the 13th March the force started into the hills, and during the interval (24th February to 12th March) Lieutenant Woodthorpe, assisted by Messrs. Chennell and McCay, was most advantageously employed in reconnoitring and surveying as much of the outer hills as could be visited. On the advance of the troops every opportunity was taken to extend the topography. A good junction was established with Captain Samuells' work on the east, and the whole length of the outer and middle ranges south of district Sibsagar and part of Lakhimpur, or about 150 miles in length by 25 to 30 miles in breadth, has been surveyed.

133. The area surveyed by this detachment was 1,507 square miles on $\frac{1}{2}$ inch and 1,075 square miles on the $\frac{1}{4}$ inch scales.

134. The season's total outturn amounts to 792 square miles of triangulation and 3,239 square miles of topography; but from the latter must be deducted 1,075 square miles of margins and overlap, leaving 2,164 square miles of actually new area surveyed. Considering all the very serious difficulties and delays the party experinced during the season, the outturn is more than we could reasonably have expected.

Season's total outturn.

135. Valuable information regarding the Naga tribes and country visited during the season is given in the appendix of this report from the narratives submitted by Captain W. F. Badgley, Deputy Superintendent, as well as by Lieutenant R. G. Woodthorpe, R.E., Assistant Superintendent.

136. Captain Badgley states that in the Eastern Naga country

"the hills rise in successive parallel ranges from the plains to the Burmese watershed, and the rivers naturally flowing between them take the same north-east or south-west direction, breaking out through the ranges to empty themselves after crossing the plains into the Brahmaputra, the only exception of any note being the southern branch of the Diku, which draws a long valley between high ranges of hills, as yet unsurveyed, and runs directly northwards."***
"The low outer ranges are not as a rule inhabited or cultivated; but from beyond these to the watershed the hills are well populated and bared by cultivation, except in the valleys (the villages always being built on the hill tops or points of spurs), which it would be toilsome to cultivate and besides dangerous among such treacherous and bloodthirsty people. The villages are more numerous and smaller in the eastern half of the tract than among the Angamies and other tribes to the west, the average number of houses in each being about sixty; though the number of inhabitants must not be judged from this, as the houses are larger and more than one family inhabit each.

"The lower and outer ranges are covered with wood and undergrowth, but without any fine timber, and the tops of the highest ranges, being uncultivated, are also covered with forest. The rocks throughout are sandstone or shale, the latter being accompanied by tepid salt springs, and the former in several places overlaying coal deposits, which have this year been explored by the Geological Survey. The rivers are not navigable within the hills."

137. The Nagas throughout these hills are divided into several distinct clans or tribes; each is at feud with the neighbouring ones, and "the practice of taking heads, which is always carried on in a treacherous and usually cowardly way, and in which no distinction of age or sex is made," prevents communication and commerce between the tribes.

138. The following extract from Lieutenant Woodthorpe's report furnishes some idea of the ignorance and the state of barbarism of these Nagas:—

"We noticed with curiosity that most of them had covered their shields with strips of plantain bark, which made them glisten most brightly. Some of the shields picked up in the jungle and paths, which had been thrown down in the retreat, were simply strips of this bark on a bamboo framework. I expressed my surprise at this to one of my Synteng coolies, and he said at once, 'Oh! they think the bullets are fire, and that if they pass through any substance full of moisture, the fire will be quenched and the bullet become harmless.'"

Good services of the party.

139. Throughout the season it will be seen the party has labored against exceptional difficulties and obstacles. These frontier explorations through hills inhabited by treacherous and unfriendly people, with but scanty camp equipment and provisions, entail constant anxiety and need special qualifications on the part of the officers conducting them. Both Captain Badgley and Lieutenant Woodthorpe are eminently qualified for such work, and to their tact and energy is due the measure of success which has attended our explorations on this frontier for some years past. To Captain Badgley is due high praise for his spirited conduct during the attack, and for the masterly retreat he conducted with the remnant of his detachment after such terrible slaughter,—conduct which has elicited favorable comment from the military authorities in the Court of Inquiry which was held at Dibrugarh.

140. Both officers have cheerfully undergone great hardships and have proved themselves equal to every difficulty which has arisen season after season. I cannot too highly commend their valuable services, and I trust Captain Badgley may not go altogether unrewarded for what he has undergone with such credit to himself. The Government of India, in letters as per margin, were pleased to remark as follows:—

Vide Revenue, Agriculture, and Commerce Department No. 446, dated 28th June 1875.
Vide Revenue, Agriculture, and Commerce Department No. 455, dated 29th June 1875.
Military Department *Notification* No. 574, dated 3rd June 1875.
Gazette of India, No. 23, dated 5th June 1875.

"I am directed to acknowledge the receipt of your letter No. $\frac{F}{101}$, dated the 5th instant, and in reply to say that His Excellency the Governor General in Council has observed with satisfaction that the services rendered by the officers of the Survey Department, noted in the margin, have been favorably noticed by the Officer Commanding the expedition sent to punish the Naga villages concerned in the late massacre of the Naga Hills survey party."

Captain W. F. Badgley, Deputy Superintendent.
Lieutenant R. G. Woodthorpe, R. E., Assistant Superintendent.
Mr. A. Chennell, Assistant Surveyor.
Mr. J. McCay, Assistant Surveyor.

141. Captain Badgley reports very favorably on the exertions of Mr. A. Chennell, Assistant Surveyor, 1st grade, who has done good service for several years on this frontier, and whom he strongly recommends for promotion to the next higher grade, but which cannot at present, I regret, be complied with, owing to the reduction of the survey estimates.

Programme for the next field season.

142. The Chief Commissioner, Assam, having pressed for the survey of several lines of boundaries between the Garo and Khasi Hills, and between the districts of Kamroop, Goalpara, and Mymensing with the Garo Hills district, the party has again necessarily been divided into two detachments, one under Captain Badgley, with Messrs Chennell and Roberts, Assistant Surveyors, to complete the boundary work, and the other under Lieutenant Woodthorpe, R.E., assisted by Mr. Ogle, Assistant Surveyor, to continue the survey and exploration of the Naga Hills, taking it up from where it was left off last year, with the view of penetrating into the extreme north-east Naga country to define the British limits on that part of the frontier, under the guidance of Captain Butler, Political Agent.

143. I regret, however, to add that, while this report has been under preparation, authentic information has been received that, while the Naga exploration party was marching through the hills towards the valley of the Doising river, it fell into an ambush, on the 25th December 1875, laid by Nagas of the village of Pangti, south-east of Golaghat only 28 miles, and this treacherous attack, for which no cause has as yet been assigned, resulted in the death of Captain John Butler, Political Agent in charge of the expedition, on the 7th January 1876, from the effects of a spear-wound in the right breast. The sad death of this experienced and able officer and leader of the party, so greatly to be deplored, quite stopped for a time the progress of the exploration; but work has, I am happy to be able to state, again been resumed under the direction of Lieutenant R. G. Woodthorpe, R.E., Assistant Superintendent, with another civil or political officer attached, and I trust, by the complete arrangements now made under suitable guards, the success of the party will be secured for the rest of the season.

144. It is of great importance that this extreme north-east frontier should be sufficiently defined and better known all round the head of the Assam valley; and the Government of India, in the Foreign Department, having expressed decided views as to this being the best time to prosecute such explorations for the attainment of the necessary geographical knowledge for ordinary administrative purposes, after the refractory tribes or villages have been properly punished for their past misconduct, it is to be hoped that now the remainder of the hill tracts surrounding the Assam revenue-paying districts may be rendered fairly accessible to our surveyors, who will in a very short time reduce the present complete blanks immediately in connection with the British districts, and the ignorance prevailing regarding such localities so close to civilised towns or stations, to an entirely different state of things, which must prove beneficial to the local officers administering the country.

DAPHLA HILLS MILITARY EXPEDITION SURVEY.

Daphla Hills, northern frontier of Assam.

145. The Government of India, on the recommendation of His Excellency the Commander-in-Chief, Lord Napier of Magdala, having determined that a strong survey party should accompany the military expedition into the Daphla Hills, on the northern frontier of Assam, it was intimated by telegram to Major Godwin-Austen, Deputy Superintendent, who was at the time on furlough in Europe, that his services were needed to assume charge of this party, to be formed of the strength noted in the margin. Major Godwin-Austen reported his return to duty at my headquarters on the 27th October 1874, where he obtained all the necessary equipment of instruments, stores, &c., for the use of the survey before starting for Assam.

Strength of Party.

Major H. H. Godwin-Austen, Deputy Superintendent, 2nd grade, in charge.
Lieutenant H. J. Harman, R.E., Assistant Superintendent, Great Trigonometrical Survey, 1st grade.
Mr. M. J. Ogle, Surveyor, 4th grade, transferred from No. 6 party.
Mr. W. Robert, Assistant Surveyor, 3rd grade, transferred from No. 6 party.
Mr. J. L. Lister, Assistant, Botanical Gardens, Calcutta, attached to the party as Botanical Collector.
1 Taxidermist, 1 Collector, } Natives from the Indian Museum, Calcutta.

146. The services of Lieutenant H. J. Harman, R.E., Assistant Superintendent, Great Trigonometrical Survey, in charge of the Assam Valley Triangulation, were placed at my disposal for employment with this party, and as his presence at Shillong was most opportune, he was directed to entertain the necessary field establishment and make all other arrangements for the field until such time as Major Godwin-Austen could reach Gauhati and assume charge of the party.

Triangulation in advance into the Daphla Hills.

147. Pichola Mukh, on the Loohit branch of the Brahmaputra river, in the Durrung district, a little above Bishnath, was the rendezvous, and Narainpur, on the Dikrung nullah, the headquarters of the expeditionary force, was reached by the survey party on the 2nd December 1874, when immediate steps were taken

to start some triangulation in the direction of the hilly tract to be entered. This was done by adapting the side Nikori Chapri T. S. to Rodonga T. S. of the Assam Valley Triangulation, on the banks of the Brahmaputra river, as a base extending northwards a short series of triangles into the Daphla Hills. Seventeen minor secondary triangles were laid out, the last station of observation being 42 miles in a direct line from the initial base. Fifty points were fixed and 37 heights determined over an area of 2,300 square miles, between the parallels of 27° and 28°, and the meridians of 93° and 94°. The ground triangulated embraces somewhat more than the eastern half of Degree Sheet XXVIII of the Khasi, Garo, and Naga Hills Survey,—*vide* Index Map of No. 6 Topographical Party, given with the report of the last season.

148. This was amply sufficient for a good reconnaisance on the $\frac{1}{2}$ and $\frac{1}{4}$ scales, supplemented, as this triangulation was, by that of the great triangulation, of which Major Godwin-Austen remarks as follows :—

"I cannot conclude this section of my report without referring to the work of Mr. W. G. Beverley of the Great Trigonometrical Survey, who, from the series on the Brahmaputra, fixed such a multitude of points in the outer ranges as far as they were visible; their accuracy is very great; few peaks, indeed, escaped the field of his theodolite; only four were found out of position, and those are marked as doubtful. These trigonometrical points proved of great use to us, and extension of triangulation would have been quite unnecessary had we been alone confined to the area they cover."

149. As the survey could only proceed with the advance of the military force and its occupation of the country, the work was necessarily much impeded and the triangulation and topography was conducted simultaneously. Altogether 2,375 square miles were surveyed,—1,185 square miles on 2 miles =1 inch and 1,090 square miles on 4 miles = 1 inch; but from this must be deducted 670 square miles of overlaps and margins, leaving 1,705 square miles of entirely new topography obtained. The work accomplished by each member of the party is given in the margin.

Area topographically surveyed.

Major Godwin-Austen,	...	1,090 square miles on $\frac{1}{4}$ inch scale.
Lieutenant H. J. Harman, R. E.,	...	760 square miles on $\frac{1}{2}$ inch scale.
Mr. M. J. Ogle,	...	525 ditto. ditto.

The triangulation was executed conjointly by Major Godwin-Austen, Messrs. Ogle and Robert.

150. These results, though not large for a whole season, are exceedingly good for the short time the surveyors were permitted to remain in the country. They furnish valuable geographical information for a hitherto totally unknown portion of our eastern frontier. The country was evacuated by the military force as early as the 18th February, and with it the survey party had unfortunately to quit the Daphla Hills, having been only $2\frac{1}{2}$ months at work. Major Godwin-Austen then sought permission to visit the ranges on the northern frontier of the Lakhimpur District; but this was refused on political considerations, and all that then could possibly be done was to explore and map the lower ranges along the western frontier of the Daphla Hills on the Lakhimpur border, which was successfully accomplished up to the gorge of the Burroi river. On the 15th March field work ceased, and the party were obliged to return to recess quarters at Shillong on the 2nd April.

151. A map on the scale of 4 miles = 1 inch, showing the results of the season's work in the Daphla Hills, compiled by Major Godwin-Austen, has been published, on which the approximate course of the Subansiri river, which was visible to that officer, is given. The position of some peaks beyond or north of the river have also been fixed. The information furnished in this map is a valuable addition to our geography beyond the northern frontier of Assam, and it is greatly to be regretted that the country to the east and west, which is totally unknown to us, was not visited and mapped at the same time, as was so much desired, as such information beyond our frontier is invaluable in times of emergency.

152. Lieutenant Harman, R.E., was detached to explore and map the valley of the Ranga river, the Daphlas inhabiting this tract having signified their desire to receive a European officer into their villages. Owing, however, to a failure in the transit of supplies for this detachment, Lieutenant Harman was

compelled to retire from the hills about the middle of February. His work, combined with that of Major Godwin-Austen's, furnishes reliable geography for the Ranga river and all its principal tributaries, besides fixing the position of several Daphla villages, the size and situation of which were previously unknown.

153. Major Godwin-Austen obtained some valuable information relating to the Daphla country,* which with the geographical and geological notes extracted from his narrative was duly submitted to Government as per margin,† and is now given in the appendix of this report, together with extracts from Lieutenant Harman's narrative, all of which will be found to contain much interesting matter.

* *Vide* No. $\frac{D}{74}$, dated the 13th July 1875.
List of villages in the Daphla Hills and estimated population.—*Daphla Vocabulary.*

† Surveyor-General's letter to Revenue, Agriculture and Commerce Department, No. 761 F., dated 28th September 1875.

154. Major Godwin-Austen reports very favorably of the efficient aid rendered him by Lieutenant Harman, R.E., Assistant Superintendent, Great Trigonometrical Survey; he spared himself no labor to forward the work entrusted to him, and his zeal and energy were most praiseworthy. Lieutenant Harman is an officer of great promise, and I had much satisfaction in communicating my appreciation of his services on this occasion to the Superintendent of the Great Trigonometrical Survey.

155. Mr. Ogle, Surveyor, 4th grade, rendered, with his usual zeal and enterprise, much good service; and Mr. Robert, Assistant Surveyor, 3rd grade, is also reported as having performed his share of duty with success. Both these good assistants are strongly recommended for promotion to higher grades, in consideration of many years of arduous labor on a difficult frontier and the zeal and intelligence with which they perform all their duties. Mr. Lister, Assistant, Royal Botanical Gardens, Calcutta, who was attached to the party, worked very assiduously in collecting plants, seeds, and dried botanical specimens.

156. Major Godwin-Austen's long and valued services in connection with explorations beyond our frontier have frequently been brought to the notice of Government. Certainly no officer could have realised larger or more important results with the means and time at his disposal, and I have pleasure in recording once again my appreciation of his zeal and ability as an accurate and clever geographer and explorer. This officer again obtained leave to Europe for six months, under section 11 of the Furlough Rules of 1868, on urgent private affairs, from the 11th August 1875,‡ and has subsequently obtained an extension in England, as his services are not required at the present time.

‡ *Vide* Notification No. 795, dated 6th August 1875.

157. It is to be hoped that these explorations on the Northern Assam frontier will be continued, and that thus our knowledge will be increased of the country and the people inhabiting the narrow strip of hills between the Assam valley and Thibet. Most of the tribes along this frontier visit the Assam valley. There are, it is believed, no insuperable difficulties in the way of visiting and exploring these hills which tact and proper precautionary measures may not overcome.

No. 7 TOPOGRAPHICAL PARTY.

RAJPUTANA AND SIMLA SURVEY.

158. In consequence of the temporary employment of Captain George Strahan, R.E., Deputy Superintendent in charge, in connection with the Transit of Venus observations, as stated in para. 149 of the printed report for 1873-74, from which duty he did not return until the 27th December 1874, Lieutenant E. P. Leach, R.E., Assistant Superintendent, conducted the party into the field in Rajputana, and started the operations for the season at the usual time.

The British districts of Ajmere and Mhairwara and portions of the Native States of Jaipur, Jodhpur, Kishengarh, and Shekawati in the Rajputana Agency.

tonments, towns, &c., the work was suddenly stopped and declared to be unnecessary. A full report on the origin, object, and extra expense entailed by this survey of Simla was rendered as per margin, and towards the close of September, after the outbreak of cholera, on a representation made by a Sanitary Committee assembled to consider the means of obtaining a supply of water for Simla, who were totally unable to proceed with their investigations without such a survey as had been fortunately carried out by this department, instructions were received (*vide* Revenue, Agriculture, and Commerce Department letter No. 809, dated 30th October 1875) to continue and complete the extension survey as originally projected, with such further additions of contour levels and extra area as the Committee might declare to be necessary.

* No. 487F., dated the 14th August 1875.

166. This important work was therefore recommenced in October, and carried on until the end of November, so as to meet all the pressing requirements of the Engineer to the Committee who was on the spot, when an area of 10,756 acres was completed, making in all a total of 16,375 acres, on the 6-inch scale, by the time it was necessary to go down to the plains for the regular survey duty in Rajputana. The original sections of the Simla Extension Survey having been transmitted to this office, I have been enabled to reduce and print the work, for the use of the Water-works Committee, at a very early date, without interfering with the new programme of the Rajputana Survey, as so essential. The sheets, both of the Simla as well as the Environ Extension Survey, have been declared by the Engineer of the Committee to be of the utmost importance and value in the inquiries now being instituted.

167. The general survey of Simla and Jutog having been previously completed, the boundaries of states referred to in paragraph 141 of the last report were also examined and laid down during the recess, and the areas of each carefully ascertained. A complete record of these results, which had entailed much careful and laborious investigation, was lodged in the office of the Deputy Commissioner of Simla, vide, in his letter No. 1456, dated 30th October 1875, to the address of Lieutenant E. P. Leach, R.E., Assistant Superintendent, officiating in charge No. 7 party, has recorded his opinion regarding the accuracy of the boundaries given on the plan as they existed at the time of survey, and his recommendation that they should now be adopted and published on a second edition of the 24-inch plans, which is being done.

168. The 20 sheets of the large-scale survey have been reduced and generalised into a convenient-sized plan, on the scale of 8 inches to the mile, by Captain Strahan, which will form a very convenient and handy guide and index to the station and properties. The characteristic and effective drawing of the ground by Captain Strahan on this plan is now being copied on the stone for lithographic reproduction, and will very shortly be published.

169. The remainder of the original project, to take up the military cantonments of Dugshaie, Subathoo, and Kussowlee, in accordance with the despatch of the Secretary of State and long-established departmental practice, together with the lines of communication between them, will remain in abeyance pending the special orders of the Government of India in each case, which will be applied for at the proper time. All other large-scale surveys of cantonments, cities, towns, and sanitaria, met with in the course of the regular operations, are likewise suspended under the above orders.

170. The services of an experienced officer having been required to start a new topographical survey of the Mysore State, in the Southern Peninsula, Captain George Strahan, R.E., Deputy Superintendent, 2nd grade, who held charge of this party and had most successfully conducted its operations for a period of eleven years, was recommended* for this duty, and, with the sanction of Government, was transferred to the charge of No. 8 Topographical Party from the 1st October 1875. Lieutenant E. P. Leach, R.E., Assistant Superintendent, 2nd grade, consequently again assumed charge of No. 7 party, from the date of Captain Strahan's departure from Simla, *viz.*, 5th October 1875.

Transfer of Captain George Strahan, R.E., Deputy Superintendent, to the charge of the Mysore Survey, No. 8 Topographical Party.

* *Vide* Surveyor-General's letter No. 590, dated 16th March 1875, to the Secretary to Government, Revenue, Agriculture, and Commerce Department.

159. It had been arranged, in accordance with the season's programme, that Lieutenant Leach, and Mr. Todd, Assistant Surveyor, should extend the triangulation from the work of previous seasons northwards, through portions of the Degree Sheets X, XI, north of Jodhpur and of Ajmere, and the topography to be completed of portions of Degree Sheets IX and X, immediately west of Ajmere and Kishengarh State, to the parallel, and west of the Sambhur Lake by the rest of the party.

Strength of Party and Season's outturn.

		Triangulation square miles of Ajmere and Kishengarh.	Topography 1-inch scale square miles.	Large scale 12-inch survey acres 2,497.
Captain George Strahan, R.E., Deputy Superintendent, 2nd grade, in charge		...	...	...
Lieutenant E. P. Leach, R.E., Assistant Superintendent, 2nd grade ...		3,000	...	...
Mr. E. S. P. Atkinson, Surveyor, 4th grade ...		...	510	...
„ R. Todd, Assistant Surveyor, 1st grade ...		2,160	150	...
„ C. Tapsell „	1st „ ...	...	20	7,493
„ F. Kitchen „	1st „ ...	...	465	...
„ W. Stotesbury „	1st „ ...	...	336	...
„ W. McNair „	2nd „ ...	...	605	...
„ F. Warde „	3rd „ ...	...	420	...
„ P. White „	4th „ ...	...	390	2,628
Sub-Surveyor Mr. J. Noah	4th „ ...	...	305	...
„ Harlal Singh	4th „ ...	...	270	2,433
„ Kalkapershad	4th „ ...	...	270	10,519
	TOTAL ...	5,160	3,741	25,570

Check routes by Captain George Strahan, 209 linear miles; Mr. Stotesbury, 35 linear miles.

Season's triangulation.

160. The total area triangulated in advance of the detail survey covers 5,160 square miles, which comprises most of the remaining good area, or cultivated and thickly inhabited tract up to the margin of the desert of Bikanir. Observations were taken at 64 stations, by which 618 points were fixed and 306 elevations determined, giving an average of 1 point to $8\frac{1}{3}$ square miles, and 1 elevation to nearly 17 square miles of country. The country triangulated is very easy and open, little better than a sandy plain, with groups of sand-hills at long intervals, and a larger number of heights were not necessary in such ground. Only one river, the Sursati, was met with near the town of Reah; it is thickly wooded on both banks, but is dry during the greater part of the year. A brief description of the ground over which the triangulation was carried is given in the appendix of this report.

161. The city and cantonment of Ajmere and the city of Kishengarh were also triangulated by Captain George Strahan, and 119 points were fixed for the large scale (12 inches = 1 mile) survey of these places, much required by the local civil authorities.

Topography completed.

162. The topography completed covers 3,741 square miles of ground, and embraces nearly the whole of the British district of Ajmere, about half of the small Native State of Kishengarh, and a small portion of the Jodhpur or Marwar State. The detail survey was duly tested by 244 linear miles of check routes, and the cities and cantonments of Ajmere and Nasirabad and the city of Kishengarh, in all 25,570 acres, were surveyed on a scale of 12 inches to the mile. During the progress of the detail work in the district of Ajmere, at the request of the Deputy Commissioner, the boundaries of "Istamradar" villages were defined and inserted on the maps.

163. The season's total outturn both in triangulation and topography is exceedingly good, and the Deputy Superintendent in charge states his satisfaction with the quality and accuracy of the work which he tested.

Commencement of the survey of the approaches to Simla.

164. Captain George Strahan, R.E., having obtained 3 months'* privilege leave at the close of the field season, Lieutenant E. P. Leach, R.E., Assistant Superintendent, again took over charge and conducted the party back to recess quarters at Simla as before, after which the survey of the approaches to Simla on the east from Mashobra, Mahasu and Phagu was carried on in extension of the Simla survey on the reduced scale of 6 inches to the mile. Thirty-six square miles were closely triangulated up to the period of the setting in of the heavy monsoon by observations at 20 stations, from which 146 points and 72 heights were fixed.

* From 14th April to 14th July 1875.

165. Of the detail extension survey, 5,619 acres were completed, when, by the orders of Government,† marginally noted, on the general question of the Simla and all large-scale military surveys of can-

† Revenue, Agriculture, and Commerce Department letter No. 478, dated 6th July 1875.

tonments, towns, &c., the work was suddenly stopped and declared to be unnecessary. A full report on the origin, object, and extra expense entailed by this survey of Simla was rendered as per margin, and towards the close of September, after the outbreak of cholera, on a representation made by a Sanitary Committee assembled to consider the means of obtaining a supply of water for Simla, who were totally unable to proceed with their investigations without such a survey as had been fortunately carried out by this department, instructions were received (*vide* Revenue, Agriculture, and Commerce Department letter No. 809, dated 30th October 1875) to continue and complete the extension survey as originally projected, with such further additions of contour levels and extra area as the Committee might declare to be necessary.

* No. 487F., dated the 14th August 1875.

166. This important work was therefore recommenced in October, and carried on until the end of November, so as to meet all the pressing requirements of the Engineer to the Committee who was on the spot, when an area of 10,756 acres was completed, making in all a total of 16,375 acres, on the 6-inch scale, by the time it was necessary to go down to the plains for the regular survey duty in Rajputana. The original sections of the Simla Extension Survey having been transmitted to this office, I have been enabled to reduce and print the work, for the use of the Water-works Committee, at a very early date, without interfering with the new programme of the Rajputana Survey, as so essential. The sheets, both of the Simla as well as the Environ Extension Survey, have been declared by the Engineer of the Committee to be of the utmost importance and value in the inquiries now being instituted.

167. The general survey of Simla and Jutog having been previously completed, the boundaries of estates referred to in paragraph 141 of the last report were also examined and laid down during the recess, and the areas of each carefully ascertained. A complete record of these results, which had entailed much careful and laborious investigation, was lodged in the office of the Deputy Commissioner of Simla, who, in his letter No. 1456, dated 30th October 1875, to the address of Lieutenant E. P. Leach, R.E., Assistant Superintendent, officiating in charge No. 7 party, has recorded his opinion regarding the accuracy of the boundaries given on the plan as they existed at the time of survey, and his recommendation that they should now be adopted and published on a second edition of the 24-inch plans, which is being done.

168. The 20 sheets of the large-scale survey have been reduced and generalised into a convenient-sized plan, on the scale of 8 inches to the mile, by Captain Strahan, which will form a very convenient and handy guide and index to the station and properties. The characteristic and effective drawing of the ground by Captain Strahan on this plan is now being copied on the stone for lithographic reproduction, and will very shortly be published.

169. The remainder of the original project, to take up the military cantonments of Dugshaie, Subathoo, and Kussowlee, in accordance with the despatch of the Secretary of State and long-established departmental practice, together with the lines of communication between them, will remain in abeyance pending the special orders of the Government of India in each case, which will be applied for at the proper time. All other large-scale surveys of cantonments, cities, towns, and sanitaria, met with in the course of the regular operations, are likewise suspended under the above orders.

170. The services of an experienced officer having been required to start a new topographical survey of the Mysore State, in the Southern Peninsula, Captain George Strahan, R. E., Deputy Superintendent, 2nd grade, who held charge of this party and had most successfully conducted its operations for a period of eleven years, was recommended* for this duty, and, with the sanction of Government, was transferred to the charge of No. 8 Topographical Party from the 1st October 1875. Lieutenant E. P. Leach, R.E., Assistant Superintendent, 2nd grade, consequently again assumed charge of No. 7 party, from the date of Captain Strahan's departure from Simla, *viz.*, 5th October 1875.

Transfer of Captain George Strahan, R.E., Deputy Superintendent, to the charge of the Mysore Survey, No. 8 Topographical Party.

* *Vide* Surveyor-General's letter No. 590, dated 16th March 1875, to the Secretary to Government, Revenue, Agriculture, and Commerce Department.

171. A report on the observations at Lahore, made by Captain George Strahan during the "Transit of Venus," was duly submitted to Colonel Tennant, R.E., under whose orders he was acting at the time, an abridged copy of which is given in the appendix of this report.

"Transit of Venus" observations by Captain George Strahan, R.E.

172. Captain George Strahan's valuable services have repeatedly elicited my best acknowledgments. His high professional abilities and zeal will, I am assured, secure him success in every undertaking, and the new Mysore Topographical Survey could not possibly be in better hands.

173. Lieutenant E. P. Leach, R.E., Assistant Superintendent, 2nd grade, now officiating in charge of this party, rendered excellent service both in the field and recess, which is cordially acknowledged by Captain Strahan, and I am much indebted to the Assistant Superintendent for the very able and satisfactory manner in which he has brought to a successful termination, in a very limited time, and at mere nominal extra cost, the survey of the eastern approaches to Simla and the Simla estates boundary—work which cannot fail to prove of the utmost importance to the civil and imperial authorities of this rising sanitarium.

174. The Deputy Superintendent records a very favorable opinion on the services rendered, both in the field and recess, by Messrs. Kitchen, Stotesbury, and McNair, Assistant Surveyors. Mr. McNair deservedly receives special mention for both the quantity and quality of his work, and the ability and zeal with which he discharges all his duties. He is well deserving of promotion to a higher grade, and I greatly regret that in the existing state of the department this reward is temporarily denied him.

Opinion on the good services of Assistants.

175. This party is second to none in the department, and the manner in which the assistants have devoted their time to out-door work in the hills during the recess, when the weather permitted, without sacrificing in the smallest degree the computations and mapping of the Rajputana survey in the plains, deserves the highest praise. They have, in fact, for a period of four seasons, done double duty by recessing in the hills, by which the Government have obtained a most valuable large-scale survey of Simla and environs, at the merest nominal extra cost, as fully detailed in my report above quoted.

176. As a nucleus for the formation of the Topographical Survey Party (No. 8) in Mysore, Messrs. Kitchen, Stotesbury, and McNair, three very efficient assistants, were transferred from No. 7 party from the Pro- tober 1875, and proceeded with Captain George Strahan to Banga ore ut the preliminary triangulation during the current season—well in

Transfer of Assistants.

" Assistant Surveyor, 1st grade, was transferre l t nd Central India Survey, with effect from he above vacancies; and the reduced stren ar the nature of the ground to be de

Surveys.	Number of Tri												
	1st class.	2nd class.	3rd class.	4th class.	5th class.								
No. I.—Survey ...	...	79	259	...	...	7·0							
„ II.— „ ...	12	349	1,104	...	3·1	9·3	1·8						
„ III.— „ ...	3	19	47	304	1·5	11·6	...						
„ IV.— „ ...	...	48	186	...	...	4·0	...						
„ V.— „ ...	4	96	...	...	4·9	3·5	0·2						
„ VI. { Khasi, Garo and Naga Hills ...	...	24	...	107	...	11·6	...						
„ VI. { Duphla Military Expedition Survey ...	...	17	83	...	...	11·8	...						
„ VII.— ...	...	95	933	39	...	4·7	...						
	19	727	2,612	450	...	...	...	...	...	...	6·9	1,063	

1875-76 in Rajputana is as follow
the Degree Sheets XI and
of the Gurhagurh Series,
possible. The topo
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On 1 inch scale.

NOS. 8 AND 9 TOPOGRAPHICAL PARTIES.

NANDIDRUG AND NAGAR DIVISIONS, MYSORE SURVEY.

Preliminary organisation and commencement.

180. The Government of India, in the Foreign Department,* having directed that immediate steps should be adopted to commence a professional topographical survey of the Mysore State, estimated to contain about 27,004 square miles, for which the Native State should pay two half parties, one by drafts from the existing Imperial Topographical Surveys, and the other by transfers from the Trigonometrical Branch, for the purpose of reducing the estimates of the Great Trigonometrical Survey, were formed of the preliminary strength noted in the margin,† with the object of starting the necessary skeleton triangulation in advance during the current season of 1875-76, as a basis for the topography which will be carried on during the ensuing season, when the establishments will be recruited to the usual full strength with an additional officer each, the budget estimate for which has been sanctioned by the Chief Commissioner of Mysore at Rs. 80,000 for each party.

* *Vide* Foreign Department Proceedings, No. 2546, dated 19th December 1874.

Letter from Revenue, Agriculture, and Commerce Department, No. 433, dated 23rd June 1875.

† *No. 8 Topographical Party.*	*No. 9 Topographical Party.*
Captain George Strahan, R.E., Deputy Superintendent, 2nd grade, in charge.	Captain J. R. McCullagh, R.E., Assistant Superintendent, 1st grade, G. T. S., Officiating in charge.
Mr. F. Kitchen, Assistant Surveyor, 1st grade.	Mr. L. J. Pocock, Surveyor, 4th grade.
Mr. W. Stotesbury, Assistant Surveyor, 1st grade.	Mr. J. W. MacDougall, Assistant Surveyor, 1st grade.
Mr. W. W. McNair, Assistant Surveyor, 2nd grade.	Mr. E. J. Connor, Assistant Surveyor, 1st grade.

181. These two half parties, under Captain George Strahan, R.E., Deputy Superintendent, 2nd grade, transferred from the Rajputana Topographical Survey (No. 7 party), and Captain J. R. McCullagh, R.E., Assistant Superintendent, 1st grade, transferred from the Trigonometrical Branch, were deputed to Bangalore fully equipped, and commenced work, taking the initial element from the ample principal triangles of the Great Trigonometrical Survey, covering that country in the northern portion of the Mysore State, during the month of November 1875, so as to follow in the wake of the completed revenue and assessment measurements of the fields.

182. On the recommendation of the local administration, the Government of India has decided,‡ after much discussing of the that the scale of 1 mile to the stone for $(\frac{1}{63,360})$ is to be ... published.

‡ Revenue, Agriculture, and Commerce Department letter No. 157, dated 16th February 1876.

ame as that of all the independent Native Subject, to take up the military canton-
itish India, but only half that of the comwlee, in accordance with the despatch
vey of the Bombay districts, where the established departmental practice, together
revenue details of the boundaries between them, will remain in abeyance pend-
183. With the experience of the Government of India in each case, which will be
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try and it State, in the Southern Peninsula, Captain

Transfer of Captain George Strahan, R.E., Deputy Superintendent, to the charge of the Mysore No. 8 Topographical Party.

George Strahan, R. E., Deputy Superintendent, 2nd grade, who held charge of this party and had most successfully conducted its operations for a period of eleven years, was recommended* for this duty, and, with the sanction of Government, was transferred to the charge of No. 8 Topographical Party from the 1st October 1875. Lieutenant E. P. Leach, R.E., Assistant Superintendent, 2nd grade, consequently again assumed charge of No. 7 party, from the date of Captain Strahan's departure from Simla, *viz.*, 5th October 1875.

* *Vide* Surveyor-General's letter No. 590, dated 16th March 1875, to the Secretary to Government, Revenue, Agriculture, and Commerce Department.

APPENDIX.

31

STATEMENT A.

Showing progress and present cost of each survey during season 1874-75, *with general average mileage rates.*

SURVEYS.	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 on the 1" and ½" scales.	Total cost of survey.	REMARKS.
No. I.—Gwalior and Central India ...	3,073	1,700	30	192	8·9	145	11·7	3,850	60,336	
„ II.—Khandesh and Bombay Native States ...	2,138	3,375	193	744	4·5	349	8·6	2,302	59,580	
„ III.—Central Provinces, & Vizagapatam Agency ...	2,534	5,132	47	277	16·5	157	32·7	8,000	52,452	
„ IV.—North-Eastern Division, Central Provinces ...	2,394*a*	800	34	136	5·9	77	10·4	2,350	58,339	*a.*—Includes 201 square miles of margin.
„ V.—Bhopal and Malwa	2,237	3,385	54	371	9·1	371	9·1	2,565	49,542	
„ VI. Khasi, Garo and Naga Hills ...	3,239*b*	792	18	73	42·4	52	59·5	3,140	69,257	*b.*—On ½" scale, including 1,075 square miles of margin.
„ VI. Daphla Military Expedition Survey ...	2,375*c*	2,300	19	55	41·8	37	62·2			*c.*—On ½" scale, including 670 square miles of margin.
„ VII.—Rajputana ...	3,741	5,160	64	618	8·4	306	16·9	3,465	64,838	
	21,731	22,644	459	2,466	...	1,494	...	25,672	4,14,344	

STATEMENT B.

Professional results and value of the season's Triangulation, and average number of Plane-Table fixings of detail survey, season 1874-75.

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 detail survey.	No. of linear miles of check line run.	REMARKS.
	1st class.	2nd class.	3rd class.	4th class.	1st class.	2nd class.	1st class.	2nd class.	3rd class.	4th class.			
No. I.—Survey ...	...	79	259	...	...	7·0	1	2·2	12	...	8·9	132	
„ II.— „ ...	12	349	1,104	...	3·1	9·3	1·8	4·4	8·4	...	7·2	208	
„ III.— „ ...	3	19	47	304	1·5	11·6	...	4·8	13·92		2·2	147	
„ IV.— „ ...	...	48	186	...	...	4·0	...	19·0	20·5	...	9·5	245	
„ V.— „ ...	4	96	...	...	4·9	3·5	0·2	2·3	7·5	...	7·2	187	
„ VI. Khasi, Garo and Naga Hills ...	...	24	...	107	...	11·6	...	9·8	50·6	...	...	...	
„ VI. Daphla Military Expedition Survey ...	...	17	83	...	...	11·8	...	6·5	35·1	...	0·19	...	On ½ inch scale.
„ VII.— ...	...	95	933	39	...	4·7	...	4·4	18·9	...	6·4	244	
	19	727	2,612	450	...	...	...	...	...	...	6·9	1,063	

STATEMENT C. 32

Comparative results and costs of Seasons 1873-74 *and* 1874-75.

	Final topography, square miles.	Triangulation, square miles.	No. of stations observed at.	Number of points fixed trigonometrically.	Heights determined trigonometrically.	Cost.	Rate per square mile. Rs. A. P.	Remarks.
Season 1873-74 ...	24,103	19,623	311	2,276	1,965	4,25,041	17 10 2	
„ 1874-75 ...	21,731	22,644	459	2,466	1,494	4,14,344	19 1 0	
Difference ...	— 2,372	+ 3,021	+ 148	+ 190	— 471	— 10,697	+ 1 6 10	

APPENDIX D.

Abstract cash accounts of monies received from 1*st January to* 31*st December* 1875.

Dr. *Cr.*

Items.	Amount.	Total Amount.	Items.	Amount.	Total amount.
To Map Sale Account.	Rs. A. P.	Rs. A. P.	*By Transfer Account.*	Rs. A. P.	Rs. A. P.
Amount received from sundries...	1,477 0 9		Amount paid to Bank of Bengal, No. 152, dated 19th January 1875	189 8 0	
Sales by Mr. Ball, successor to the Punjab Printing Company	168 4 0		Amount paid to Bank of Bengal, No. 154, dated 19th January 1875	100 0 0	
Sales by Curator of Government Books, N.-W. Provinces ...	114 0 0		Amount paid to Bank of Bengal, No 230, dated 28th January 1875	123 0 0	
Thacker, Spink & Company ...	3,230 1 0	4,989 5 9	Amount paid to Bank of Bengal, No. 644, dated 22nd March 1875	186 0 9	
To Refund Account.			Amount paid to Bank of Bengal, No. 689, dated 31st March 1875	3,230 1 0	
Amount received from Mr. J. H. O'Brien, Probationary Assistant Surveyor, in full 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	Amount paid to Bank of Bengal, No. 730, dated 5th April 1875	114 0 0	
			Amount paid to Bank of Bengal, No. 1105, dated 25th May 1875.	63 0 0	
			Amount paid to Bank of Bengal, No. 1466, dated 6th August 1875	181 4 0	
			Amount paid to Bank of Bengal, No. 1566, dated 3rd September 1875	840 8 0	
			Amount paid to Bank of Bengal, No. 1727, dated 21st October 1875	11 12 0	
			Amount paid to Bank of Bengal, No. 1802, dated 3rd November 1875	102 0 0	
			Amount paid to Bank of Bengal, No. 2041, dated 30th November 1875	48 4 0	
			Amount paid to Bank of Bengal, No. 42, dated 6th January 1876	85 0 0	
TOTAL ...	...	5,274 5 9	TOTAL ...	...	5,274 5 9

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

Memorandum showing the total amount recoverable from the Map-sale Agents for 1874-75, *to be shown in Account Current for* 1876.

	Rs.	A.	P.
Messrs. Thacker, Vining & Co., Bombay, due for 1873-74	296	14	0
due for 1875	207	0	0
Curator of Government Book Depot, Central Provinces, Nagpur, due for 1874	302	0	0
due for 1875	71	6	6
Messrs. Cotton and Morris, Simla, due for 1874	50	14	0
W. Ball, Esq., Successor to the Punjab Printing Company, Lahore	175	8	0
Curator of Government Books, North-West Provinces, Allahabad	84	6	6
Messrs. Higginbotham, & Co., Madras	22	7	0
Messrs. Thacker & Co., Calcutta	3,041	14	6
TOTAL	4,270	14	5

APPENDIX. 33

Description by CAPTAIN C. STRAHAN, R.E., *Deputy Superintendent, in charge No.* 1 *Gwalior and Central India Topographical Survey, of the country plane-tabled.*

Central India Agency.
Rattangarh, Mallargarh and Mandisore.

THE general features of the country plane-tabled were fully described in last year's reports and require but little more to be said about them. We filled in up to the meridian of 75°, which brought us to within a few miles of Neemuch. The southern portion is open and undulating and pretty thickly inhabited, but, on the whole, not a very fertile country; it is plentifully watered by small streams, but very little use is made of the water, the only means of irrigation being the ordinary leather bucket drawn up by two bullocks. Wherever this can be employed, opium is cultivated, this being the staple produce of the country, wheat or barley being quite the exception. During the rains "bajra" and "jowar" are grown, and on the produce of these the villagers live, but the immense labor bestowed on the opium, to the neglect of all cereals, makes the price of grain of all sorts very high. Wheat flour varies according to the season from about 8 to 10 or 11 seers, and gram from 11 to 15 seers, to the rupee. Even "jowar" atta is only about 16 seers to the rupee. The northern half is very different; in latitude 24° 30′ a scarp rises abruptly from the plains to a height of about 600 feet, and then gradually descends to the Gunjali river, a branch of the Chumbal, flowing from west to east, at about the latitude 24° 50′, where there is another scarp of a similar description, but even more abrupt and less broken than the southern one; from the summit of this the ground again slopes down to the Bamni river, also flowing from west to east into the Chumbul, which it joins at Bhainsrorgarh.

A few miles north of the Bamni river, a third and still higher scarp rises; but this fell north of the 25th parallel of latitude and was consequently out of our work. These steppes are covered with jungle and very sparsely inhabited, and from the very flat nature of the country, were difficult and tedious to survey. It was not an easy matter to give points to assist the detail Surveyors, as although from the summit of one scarp you could see all to the south of you, it appeared one unbroken sheet of flat jungle, and ordinary signals were useless. White flags and heliotropes were the only things of any use, and by means of these a sufficient number of points were fixed to enable the details to be put in by plane-table traversing. Along the course of the Gunjali are numbers of small villages, Ruttangarh, Kheri, and Kuakhera, being of a tolerable size and well known, but to the south of this strip of cultivated country, as far as the edge of the southern scarp, there is scarcely a village, the men who worked this constantly having to encamp in the jungle, wherever they could get water, their supplies being brought to them; this was particularly the case in sheet 68, surveyed by Mr. Cornelius and Sub-Surveyor Abdul Gufar. Below the third or northern scarp and on either side of the Bamni, there is a far larger area of cultivated ground, and the district of Begúm, belonging to one of the great Chiefs of Mewar, is especially fertile.

This second steppe is also more inhabited than the first, although here, too, there are large paces of mere jungle. At about the meridian of 75° 30′ the Chumbul river enters our work from the south, and we now bid farewell to it after having surveyed it for 443 miles, with the exception of 35 miles in the Rajputana party's work. Where it crosses the 24th parallel of latitude, our southern boundary, the river forms a long still deep pool, impassable except in boats at the junction of the Choti Kâli Sind river; there is a rapid forming a very easy crossing even for carts, but there is no road down to it by which carts could descend; deep water again appears until you reach Bassi, where there is an excellent ford about knee deep, with a gravelly bottom. The next crossing is at Awhra, where the bed is shingly; the stream is strong and over a man's knees, but carts get over without much difficulty; there is a great deal of traffic across here. I deduced the height of the water level at this ghât trigonometrically and found it to be 1,249 feet above the sea. There are one or two other fords or ferries, shewn on the maps, between Awhra and Gujarth, where the road from Jhâlra Patan to Neemuch crosses, and where there is both a ford and a ferry; the ford is not good, being very rocky; but it is passable for horses and camels. The river then flows up a large valley, about 11 miles long and 5 miles wide at the mouth, gradually narrowing to 6 miles at the head, formed by converging angle in the

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Rámpúra, Bhanpúra scarp. In this portion there is one good ford at Kachi Kera, near Garod, there being in the dry weather only about 2 feet of water with a shingly and sandy bed. There is also a deeper ford near Gaunri. The river can be crossed at other places also, but with difficulty and only when the water is very low. The river flows on the western side of this valley in a fairly straight course, till it is abruptly turned to the east-south-east by the scarp at the end, beneath which it flows for 1½ miles, when it suddenly turns up north-west, breaking through the scarp, and runs between precipices in a perfectly straight line for 3 miles, the water falling over a succession of rapids; on the high promontory thus formed by the river on its left bank is the old fort of Chourássagarh, 350 feet above the river, the water level here being 1,166 feet above the sea, shewing a fall in the river bed of 83 feet in 41 miles from Awhra, or almost exactly 2 feet per mile. From precipice to precipice, at the mouth of this gorge, is upwards of 1,000 yards, the river in cold weather occupying a very small portion in the centre; from the water to the foot of the precipices is a steep slope formed by the rocks and débris fallen from above. The country above trends steadily downwards in the direction of the course, the bed getting narrower and narrower until after about 2½ miles the rocky slopes below entirely disappear, leaving nothing but the precipices on either side, the water lying in a large deep pool, filling up the whole valley. From side to side the valley here is only 350 yards in width. For 10 miles from Chourássagarh the river flows between these rocky banks, there being only two places on the eastern bank and one on the western where you can even scramble down to the water's edge. About 5 miles from Chourássagarh you can cross the river over rocks. It then emerges in the Gunjali valley and meets the second scarp, but this it avoids by flowing round the eastern flank of it; there is a good ford as well as a ferry immediately below, where the Gunjali joins it. It then continues in a northerly direction below this range, with a small strip of more or less cultivated country between it and the foot of the hills, till it meets the Bamni river at Bhainsrorgarh. The water level here is 1,009 feet above the sea, giving a fall of 157 feet in 30 miles from Chourássagarh, or nearly 5 feet per mile. At Dotero and between Kherli and Raipur are ferries; about a mile south of Bhainsrorgarh is a ford over boulders, and at the place itself is a much frequented ferry where the Rajah levies a small tax on all travellers; two large boats are available here. A little more than 3 miles before it reaches this place the whole river falls down a succession of small cataracts into a cleft in the rocks, the total fall being, I should think, about 80 feet; in one place there is a clear drop of 20 or 30 feet. The sides of this cleft are worn away into most curious shapes by the action of the water, and in one place when fishing here, I found my line carried far beneath my feet, shewing how much the rocks below must have been eaten away. Where this fall takes place the whole bed of the river is 600 yards in width, but in the cold weather all the water flows into this cleft, the remainder being one great sheet of bare rock, which gradually descends to the water level below the falls by a succession of steps, the strata being nearly horizontal. This place is well known locally by the name of "chulis," which I believe signifies whirlpools, and a most appropriate name it is.

From Bhainsrorgarh it flows north-east till it meets the third and northern scarp about 4½ miles from that place. Here again is a ford, but not a good one, over large blocks of rock. It breaks through this in a similar way, flowing in a nearly straight line for about 12 miles, where it takes a curious bend to the westwards, but quickly resumes its north-east course to Kotah, which city is just at the foot of the back slope of the third steppe. This is in the Rajputana party's work, and the exact height of the water level here I do not know; but judging by a station in the city on the river bank, it cannot be more than 850 feet (it is probably less than this) above the sea, giving a fall of 159 feet from Bhainsrorgarh in about 26 miles, or about 6 feet per mile. Thus from Awhra, on the Central India plateau, to Kotah, a distance of just 100 miles by the river, the fall is 400 feet, or 4 feet per mile on an average slope. Beyond Kotah the river still flows north-east, but meets with no more hills, and its course is a comparatively quiet one; it is kept in this direction by the range of hills which extends from Búndi to Dholpúr. Between Kotah and the 26th parallel of latitude it receives three large tributaries, the Káli Sind, and Párbati from the south, and the Banás, which rises in the Aravalli hills, and flowing eastwards breaks through the hills and joins the Chumbul almost at right angles from the north-north-west. At Páli, the junction of the Párbati and Chumbul, the height is again determined, *viz.*, 593 feet, which makes the fall from Kotah to Páli 3 feet per mile. I am sorry to say there are no more heights taken, but a height has been trigonometrically deduced at the junction of the Kúári and Sind, which must be within a foot or two of the height of the junction of the Chumbul and Jumna; judging by this, the junction of these two, which is out of our work, would be 350 feet above the sea, which would shew a fall of 243 feet in 256 miles, or a trifle under a foot a mile. Below the Banás there is only one tributary from the south, *viz.*, the Kúnú, which rises near Goonah, and none from the north. The other rivers to the east of the Kúnú, which fall within our district, are the Kúári, the Asan, the Sind, and the Betwa, but they all join the Jumna below the Chumbul; the drainage of Ulwar and Bhurtpore to the north is all into the Jumna above the Chumbul. Thus until now the whole country surveyed by this party has been drained by rivers which eventually join the sea in the Bay of Bengal; in future, however, the rivers in the south of our district flow south or south-west and find their way to the Gulf of Cambay. The cantonment of Neemuch is very nearly on this watershed, and is 1,600 feet above the sea.

A line roughly drawn through Pertabgarh, Neemuch, Bara Sádri to Udipur, and thence rounding the sources of the Banás up to the Aravalli range to Ajmir, would point out this part of the great watershed of India.

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Notes on Jhálra Pátan and Gagron.

In 1872-73, Lieutenant Holdich, R. E., commenced a plan of the cantonments of Jhálra Pátan on the 12″ scale; these cantonments, however, were found to be little more than a collection of mud huts built round the Rajah's palace, the real old city being about 4 miles to the south, situated to the east of a good sized lake, the palace being built on the large masonry dam. A small square fort overlooks the town from the summit of a jungle-covered hill to the north. The city itself is also walled and is the real capital of the State, although the Rajah has taken up his residence at the cantonments, first commenced, I believe, by his grandfather, the son of the celebrated Zalim Singh, prime minister of Kotah, and who was made Rajah of Jhalawár by our Government on account of the services of his father. At about 2½ miles to the north of the cantonments is the fort of Gagron, in the Kotah territory, of which also a plan was required, and as the 12″ scale would have been too large, I obtained leave to survey the whole position on the 6″ scale, incorporating Lieutenant Holdich's work round the cantonments; this we completed during this season. The name of the city was originally Pátan, but was re-named Jhálra Pátan by the first Rajah, who was a Jhálra Rajpút. It is situated at the foot of a low range of hills running from south-east to north-west; the drainage from these hills to the north-west of the town is collected into a good sized lake by a large and very solid masonry dam about two-thirds of a mile long, on which are sundry temples and buildings, as well as the old palace. The town lies behind this dam, the general level of the ground being the same height as the water of the lake in the cold weather. Between the city wall and the foot of the hills are a number of gardens watered by a small canal, broug. rom the lake. Except on the lake side, the city is protected by a good masonry wall with circular bastions and a ditch capable of being filled with water from the lake. This ditch, however, ceases in the centre of the eastern face. From the west and passing by the city on the south at a distance of 400 or 500 yards flows the Chandrabagh river, which then bends to the north-east, and passing through the hills joins the Káli Sind, after about 4 miles of open country. From the north of the town a metalled road is carried over a very low part of the range and continues due north to the cantonments. Between this road and the Chandrabagh, on a hill 150 feet above the city, is situated the small square fort mentioned above; it has never been completed and is of no importance. The country to the north of this small range is flat and fairly well cultivated, and through this is the road to the cantonment locally always called the "Chauni." From the north city wall to the Rajah's palace in the "Chauni" is 4 miles 3 furlongs. This new palace is enclosed by a high, apparently strong masonry wall, forming an exact square, with large circular bastions at each corner and two semicircular ones in the centre of each face, the length of each face being 735 feet. The principal entrance is in the centre of the eastern side, and the approach to it is along the principal street of the bazar running due east and west. A great deal of building is going on in this part of the "Chauni," and no doubt in time will be a well-built place. The interior of the palace walls we were not allowed to survey, and I do not know much about them; the buildings are large and high, but by no means architecturally beautiful. A little more than a mile to the south-west of this palace is a sheet of water, formed by damming up the drainage on the north side of the range of hills already mentioned in connection with the city; below this lake and watered by it are several gardens, and in the centre of one the Rajah is building himself a bungalow, surrounded by a canal to be kept full of water from the lake. About a mile and a half to the east of the Chauni is the Káli Sind river, which just here flows nearly north and south, and is the boundary between Jhalawár and Kotah. To the north is the road leading to Gagron Fort, 2½ miles distant, passing over rocky undulating ground; it is unmetalled, but is passable for carts, although decidedly rough and bad. A quarter of a mile from the fort, the road crosses the Au river, into the Kotah territory, the bed of which is between high banks and is about 200 yards across. During the cold season the water is not more than 40 or 50 yards wide, quite shallow, flowing over pebbles close under the southern bank. The remainder of the bed is sandy or shingly. Half a mile to the south-east this river joins the Káli Sind.

Gagron is situated on a straight rocky ridge running south-east and north-west, and consequently parallel to the low range between Jhálra Pátan city and cantonments. The city, such as it is, is on a low part of the ridge, the large and important fort protecting it on the south-east, whilst a smaller and half ruined fort protects it on the north-west; the city is also itself surrounded by a masonry wall connected with these forts, so that from outside the whole place appears to be one. No objection is made to your entering the town or northern fort, but neither Native nor European is allowed inside the south-eastern, which commands the town thoroughly, and is separated from it by a deep ditch cut in the solid rock and a high strong wall. As already mentioned, the Au river is about 400 yards from the fort, and flowing parallel to its south-western face, joins the Káli Sind almost at right angles; the two together then pass through a gap in the ridge, over rapids, turning the south-east extremity of the fort and form a large and deep pool of water. The course of the Káli Sind is here abruptly turned to the north-west by a second ridge, similar but even more rocky and somewhat higher, than that on which Gagron is situated; it continues its course between these two ridges, flowing directly below the north-east face of Gagron for a mile and a quarter, when it again abruptly turns to the north-east and passes through a gap in the second ridge and thence finds its way through the higher ranges beyond. Thus the Káli Sind and the Au flow very nearly parallel to each other at a mean distance of about 600 yards, but in contrary directions, Gagron being situated between them, but immedi-

ately above the Káli Sind. In flood time the whole space between the two ridges is filled with water almost up to the fort walls, on the precipice above, and not many years ago the city itself, which lies low between the two forts, was flooded, the Au and Káli Sind joining each other through it, thus isolating the south-east fort. Such a body of water not being able to escape fast enough through the small gap in the second ridge, a portion of it makes its way up the valley to the south-east, and escapes through another gap and flows up the next, a much larger valley, and rejoins the main river at the foot of the large hills beyond.

In former years Gagron appears to have been a small town with an unimportant fort crowning the top of the ridge; Zalim Singh, however, seems to have thought it a good military position, and built the present fort completely surrounding the old one which now forms a sort of citadel on the top. The south-western face of the ridge was completely built up with solid masonry from the level of the ground to nearly the foot of the old walls; at the south-east extremity the wall runs along the top of the rocks, with the exception of one huge outlying solid bastion nearly circular, which rises from the river bed; the north-east face of the ridge being naturally very precipitous, the wall is carried along the top; the north-west end which overlooks the town is strongly fortified, a deep ditch has been cut through the top of the ridge under the walls and continues nearly to the end of the fort under the south-west face, but gradually getting shallower till it dies away. The principal entrance is from the town. You first cross a ditch by a permanent stone bridge and pass between two high bastions, but without any gateway; the road then curves a little to the right, slightly ascending between very high walls, and you find yourself before the great gate; on the left of, but outside this gate is a small postern leading down to the river. On entering you pass close to a large excavation in the rock intended to hold water, but when I was there it was quite dry. Beyond this you pass through a high wall, but with no gate, and find yourself among a number of old buildings, all more or less in ruins, except the one occupied by the Killadar. A second wall is then met with which is, I believe, the north-west wall of the original fort. You get into this inner place by a zigzag and through a large gateway and find a tolerably open space with trees about it, some long lines of buildings under the walls on the right, where sepoys live, a store-house or magazine, and the ruins of a palace. A wall again divides this into two, and from behind this is a sloping road between two walls through a postern down to the river. This is no longer used and is built up. The exit from the citadel to the south-east is by a simple door-way in the wall, from which there is a descent till you come to the end wall immediately over the river and to the large circular bastion already mentioned. Turning to your right and walking back towards the town, but outside the citadel, you find yourself in a narrow space with a small precipice surmounted by the citadel wall on your right and protected by the ramparts on the top of the huge south-west walls on your left. These ramparts are 60 or 70 feet above the ground outside. Continuing along this path you reach a ramp by which you ascend to the walls overlooking the town and protecting the principal entrance. On the north-east face there is but one wall, the precipitous nature of the hill here rendering a second and lower wall unnecessary.

The noticeable feature in the country around Gagron is the extreme straightness and wonderful parallelism of the two ridges, not only immediately at the place itself, but for 2 or 3 miles on either side. The larger hills beyond, again, although much broken, also shew a similar character, and in the valleys where the Káli Sind lays bare the rocks below it is equally marked. Both hills and valleys are thickly wooded, and those long straight walls of jagged rock projected up above the jungle are very striking. The gorge by which the river finds its way out into the open plains is very fine, high precipices alternating with wooded slopes on either side. One precipice, absolutely vertical, I plumbed, and found to be 307 feet in height. This is known by the name of the "Gid Kerai" or Vulture's Precipice, and it is said was formerly used as a place of execution by the Kotah Rajahs, the victims being precipitated on the rocks below. The tops of these hills are the culminating points of the range, and the slopes from them to the open country beyond are very gradual. Sambur and Cheetal abound here, more especially near the banks of the Káli Sind; numbers of tigers, too, wander up and down the valleys, but it is difficult to shoot them in the cold weather, as they escape through the thick jungle over the hills; bears, too, are to be found, but I did not see any. There are numerous foot-paths up and down the hills principally used by wood and grass-cutters, but there are only two at all frequented passes, one nearly north of Gagron, up the Amjar valley to Panwar, and the other about 2¼ miles further up the range, which leads to Rajpura; they are both stony and rocky and not fit for carts, but passable for laden camels. During the dry season many of the rapids are fordable on foot, but are very rocky, and the rocks being slippery and the stream strong, they are by no means nice fords. Below the fort is a very good ford, but the ascent into the fort is not good; horses can go up and down, but with some little difficulty. At the junction of the Au and Káli Sind a large boat is kept, but is not much used during the cold weather. Continuing up stream you reach the Tolaghatti ford, which is very rocky, but passable for horses; the next is the Manderi ford, due east of the "Chauni," which is passable for carts; the road is cut through the banks on each side, the left side of the river bed being a rocky slope, the remainder stony and shingly; the water is about knee-deep, running swiftly over large stones; it is a good deal used, being on the principal road to the east from the "Chauni"; above this again there are other fords fit for horses to cross, but they are not much used except by wood-cutters. The Au and Káli Sind rivers form the boundary between the Jhalawár and Kotah territories, and "chowkies" are built on either side of the river at the Manderi Ghát. Jhalawár also has one at Tolaghatti,

and Kotah one on the Amjar Pass, and two on the upper pass near the village of Nolan. A small toll is taken from travellers crossing the frontier at these chowkies.

Principal towns.

The principal towns met with in the detail survey were Begúm and Bhainsrorgarh (belonging to two of the Rauji or principal Chiefs of Udipur, a Subat of Holkar), Mandisor (a Subat of Scindia), Dekan, Rattangarh Kheri, and Singholi in the Jawad Subat of Scindia, Sanjit and Mullargarh Tehsils of Jaura.

Begúm is situated on the Bamni valley in the midst of a very fertile district, but of no very great extent, on account of the hills to the north and the mass of jungle to the south. The palace at Begúm is a very conspicuous object from all the hills around. *Bhainsrorgarh* is also on the Bamni, and is built on a tongue of land at the junction of the Bamni and Chumbul; it is surrounded by a wall, and except from the north, is strongly situated. The Rauji's palace is at the southern extremity on the edge of a precipice, washed at the base by the Chumbul river; the summit of the palace is 160 feet above the river. The Bhainsrorgarh district is not a very rich one, as a very great portion of it is waste land covered with jungle, and very sparsely inhabited. Most of the revenue comes from the Kundal valley south-east of Bhainsrorgarh. *Rampura* I mentioned in last year's report, and I need not repeat what I then said. *Mandisor* is a large town on the Sau or Seu river; it has a small deserted and half-ruined fort near it. The Indore and Neemuch road passes through this place, and it will be, I believe, eventually a station on the State Railway. A considerable trade with Bombay in cotton cloths is carried on from here, and it is also famous for its workers in leather and dyers. Over Kheri is a fort called Rattangarh, the place being generally known as *Rattangarh Kheri*. The fort was originally rather strong, but the walls have been in several places blown up, so as to render it untenable. The other towns need no separate notice of them.

Passes and roads.

In mentioning the passes I will commence from the east, describing in succession each pass over the three steppes already mentioned, and also over a fourth subordinate one between the first and second. The first met with is a mere foot-path, but passable for unladen bullocks or horses to the east of Goalámba; the road connects Khilchipur near the Chumbul and Neoli.

The next pass up the scarp is about a mile to the east of the Chumbul, at *Khilchipur*, and thence continues due north to Bhainsrorgarh over easy country. This is accessible for laden camels.

Again to the west of the river at the same place is a foot-path leading from *Gurla* to *Kuakhera;* horses can go up and down, but it is almost, if not quite, too rocky for camels. About 3 miles to the south of this is *Kuna* ghatti, where there is a good Banjara track, which presents no great difficulty to laden camels. This leads to Bhuj and thence to Kuakhera. Between this and the salient angle of the scarp to the south are only one or two very small foot paths.

From Rampura is a pass tolerably easy for laden camels, which ascends the scarp close to *Besla*, thence to Bhuj and Kuakhera. From *Chadarpura*, at the foot of this pass, a Banjara track strikes off to the west, passing by Badáno, Mátasara, Nanagaum, and Suasra to Kunjera; this is also accessible to camels.

To the west of Rampura is Dhodarghatti, leading up to Amad and Mátasará. This is fit for carts with a little difficulty. From Kukresir there is a road to the north ascending the scarp at Kotri, thence on to Suásra, near which it joins the Banjara track through the jungle above. North of Málahera are two small and unimportant passes up which camels can go, connecting Malahera and Suásra. From *Parda*, about 2½ miles west of Mahera, is a good pass fit for carts, the road leading either to Kunjera or to Dekan.

North of *Malkhera* is another road, only accessible for camels, but easily made fit for wheeled vehicles. The next is from *Lasur* up an easy gradient, but in its present state only passable for camels.

By *Morwan* runs the high road from Neemuch to Dekan, or by Rattangarh Kheri to Singholi; it is unmetalled, but is a well marked track, and carts go along it easily. This completes the passes in the first or Rampura steppe as far as we have surveyed the country in detail. In the subordinate scarp north of this we find a pass north of Chokri to Lohara, up which laden camels can go.

To the west of Kunjera connecting it with Dekan are two roads which ascend the steppe by paths accessible for camels, but not very good.

Over *Barda* is a foot-path fit for horses only. North of *Paroni* is a camel road to Dekan. We then come to the road from Lasur northwards, which ascends this scarp close to *Malgadth*, and is fit for carts; the road continues on to Dekan.

From *Daroli* the high road from Neemuch, above-mentioned as passing by Morwan divides into two, one going direct to Rattangarh Kheri and Singoli, the other round by Dekan. Both these passes can be ascended by carts.

By *Manda*, the Banjara track ascends and continues on to Nimoda; the gradient is easy, but would require clearing before carts could pass it. There is another foot-path over Mendri.

In the second scarp there are no passes beyond mere footpaths from Bhainsrorgarh to Kuakhera. From this large village there is a difficult pass up to Kanpur and thence to Bhainsrorgarh. Camels can barely, if at all, get up it.

Then come two or three unimportant footpaths barely fit for horses, after which is the Agran pass accessible for camels, the road above continuing north to Dangar Mau or Bhainsrorgarh, or to the north-west to Sangoli. From Nimri is another camel road to Singoli.

Between Nimri and Rattangarh Kheri there are only footpaths, not even accessible for laden bullocks except, perhaps, at Lohara, where I think camels might, perhaps, ascend.

At *Rattangarh Kheri* the Neemuch and Singoli road ascends the steppe by an easy gradient. The road is wide and is accessible for all wheeled vehicles; it was laid out and made by our Government before we made over the Jawud district to Scindia.

At the third scarp very little falls within our work, and I consequently cannot give a description of the different passes. From Bhainsrorgarh are two roads to Kotah, one ascending by the *Lashkarghatti*, and the second by the *Imlighatti*, further east. The first-named is the more direct and better of the two. They are neither of them fit for wheeled vehicles. There are, I believe, two other passes to the west, but I think they are not much more than paths, or at most only fit for camels; but this portion of the country is beyond our limits.

Roads.

Full details of all the great roads of communication are entered in the forms for routes which are sent in as soon as complete, so it would be useless to enter them again in this report. In the flat cultivated country to the south the roads are all good tracks and present no difficulties to carts; the passes up the hills have been already described, but it should be borne in mind that although the country above is flat, there are no cart road through the jungles except the high road from Neemuch to Singhi and those used by the grass and wood-cutters; these latter are not shewn on the map, as they lead nowhere, merely going to places where the wood and grass are collected.

The Neemuch and Singoli road is in reality the only cart road through this wild tract. From Singoli carts can go up the Bamni valley to Begúm, but not eastwards to Bhainsrorgarh. Indeed, all round Bhainsrorgarh there is hardly such a thing as a country cart to be found. Carts can also travel up the Gunjali valley from Kuakhera to Jat.

Rivers.

The principal rivers met with are the Chumbul, the Choti Káli Sind, the Seu or Sau, the Retam, the Gunjali and the Bamni; all these latter are tributaries of the Chumbul, flowing from west to east, except the Káli Sind, which joins it from the south-east. None of them are navigable, nor could they be rendered so, the Chumbul even never having more than a few miles of deep water, without a rapid.

Inhabitants.

The great mass of the inhabitants are Rajpúts, but in the large towns, more especially Mandisor and those in the Jaura territory, a good number of Mahomedans are found; most of the officials in Mewar are of this class. Much of the trade of the country seems to be carried on by Borahs from Bombay; they are to be met with all over this part of the country, especially in Rampura and Mandisor. Apparently they do not go northwards into the jungle, nor did we meet with them on the Kotah side of the Jhálra Pátan range of hills. The aboriginal tribes are represented by the Bhíls, who are found in all the wild jungly tracts. They do not marry or mix with the Rajpúts, but often live in the same village, one part being given over to them and being occupied by them entirely; they are quiet and inoffensive, generally avoiding Europeans if met suddenly in the jungle, probably from the fear of being made to act as guides or coolies. Farther west we shall come to the more warlike tribes of Bhils, who appear to be of a very different character. Bands of dacoits have caused a good deal of trouble in the uninhabited parts of the country, more especially on either side of the Chumbul, just north of Chourassagarh, where there is a very large strip of disputed territory lying between Udipur and Holkar. Travellers from Bhuj to Kuakhera, or from Khilchipur to Bhainsrorgarh, have to pay for guards before entering this jungle, or they are infallibly robbed; the tax is about 6 annas for each sepoy. These dacoits never molested our parties.

Products.

The great product of the country is opium, of which great quantities are grown wherever the black cotton soil is met with and water is available for irrigation. The Borahs are, I believe, the chief opium agents; it all passes down country to Indore. Iron ore is found in the second steppe.

Soil, climate, &c.

The soil in the low-lying parts is mostly rich black cotton soil, but all the high parts are very rocky, and in consequence there are immense tracts of waste land. Notwithstanding the large area of forest, there is very little valuable timber. The climate during the cold

weather is very pleasant; the sun, of course, is powerful, but until February not oppressively so, and it is on the whole healthy. As the hot weather draws near, the country north of Rampura becomes decidedly hotter than the open country to the south; moreover, water becomes scarce, and much of it is very bad. Nearly all the sickness may be more or less attributed to the bad water. Jamudi (in Abdul Samad Khan's board), formerly a great place for smelting iron, is now entirely deserted, except by a few miserable-looking Bhils, entirely from this cause. Peplia Gurla is another case. Badano, Matasara, and the villages near them were evidently larger and of more importance some time ago, and the present inhabitants give this as the reason why they have so much decreased.

Extract from the Narrative Report of H. Horst, Esq., *in charge No. 2, Khandesh and Bombay Native State Topographical Survey.*

The following account has been submitted by Mr. D. Atkinson, Surveyor 2nd grade, for incorporation with my report. The area, *viz.*, 1642 square miles, has been carefully triangulated, and the results are very satisfactory. They will doubtless prove still more so when the 1st class triangles are properly connected.

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Central India.
Jhabua, Jobat and Ali Rajpur.

"The Vindhia mountains extend over the whole limit of the country triangulated on the right bank of the Narbudda, with a series of falls rising in a chain of hills on the bank of the river equal in height to the main range. The Sathpura range also encroaches with its northern face on to the left bank of the river.

"About 10 miles west of Barwani, the Narbudda, at an elevation of about 400 feet, enters the gorge formed by the approach of the two ranges, Vindhia and Sáthpura. Its debouchure has not been visited, and may be beyond that limit. The gorge must be more than 30 miles in length, the entrance of which is named by the natives Haranphar, or the leap of a deer. It is said that a deer pursued by a Bhil escaped at this spot by leaping across the chasm; another legend names the great Rám as the hunter. A fair idea can, therefore, be formed as to the narrowness of the torrent in the gorge. The Umri, Hathni, and the Or are the three principal tributaries flowing into the Narbudda, the last-named joining far west of the limit of the season's triangulation.

"There are many roads leading to the Málwa plateau, but the main one is that which leads from the valley of the Narbudda to the coast.

"Teak is plentiful, bu of stunted growth, in consequence of the Bhíls mutilating the trees and so rendering them seless for timber. Logs of sissoo are carried both to the coast and to Dhar. Mango trees are re, but tamarind and nim abound. The fruit of the tamarind, as in other parts of India, is gathered here, and is allowed to fall off and decay. Date trees are plentiful, but towards the west give place to the palmyra.

"The general appearance of the country is that of its having once been in a very prosperous state, and that great commotions have rolled over it, which are fully borne out by its history. Fever and guinea-worm are said to be prevalent. No member of the party escaped fever in the early part of the season, but towards the close of January the health of the camp improved, and later on there was no sickness, except that the Surveyor was laid low.

"The gorge of the Narbudda presented a serious obstacle to the progress of the work. The signallers had to follow the example of the Bhils and swim across by the help of logs of wood, depending on the help of the guides who, if not closely watched, would not hesitate deserting at a critical moment. Often have the khalasies complained of the Patels of villages arming themselves with sticks and turning them out without guides, refusing even to allow them to take rest. The Dufladar, while suffering from fever, was once placed in this predicament, when a Beloochi coming up collected men from a neighbouring village and had him carried into my camp. On one occasion the Bhils fired into the Surveyor's people while marching, who had to make a detour to avoid further molestation, and reached the encamping ground at midnight, bringing in some arrows which they picked up. The Surveyor, though not actually molested, was closely watched, until he was recognised by a youth as one who had encamped there three months previously, when the Patel, or headman of a village, and his son and son-in-law came and expressed their regret at the attitude the Bhils had shown, and declared they were absent from the village at the time, and convinced him they were not to blame by accompanying the camp up the Vindhias to Gumanpur station.

"The Thakoors of Bori and Borjar of the Jabua and Jobat States, respectively, showed considerable opposition, the former in particular, but the latter, though obliging at first, refused all assistance latterly, because the Surveyor had not it in his power to grant a request he preferred to the effect that the Rajah of Ali Rajpur should be prevented from opening a market in a neighbouring village.

"It is a matter of great regret that want of time prevented the Surveyor from collecting any legends of the Bhils, who claim descent from the great Hya, whose seat of Government was at Máheswar (Mahesvati) long before Chittore was founded, or the ancestors of the Ranas of Udepur migrated to India from across the Himalayas."

Mr. Horst's description of the country surveyed in detail.

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"The detail survey on the scale of one mile = 1 inch of that portion of country which lies between Lat. $\frac{21°15'}{21°45'}$ and Long. $\frac{75°0'}{76°15'}$ coloured *burnt sienna*, was completed, comprising parts of Khandesh (British), Native Nimar (Holkar's), and a small portion of Barwani in the north-west corner, embracing an area of 2,138 square miles, in the wildest and most rugged part of the Sathpura range which separates Khandesh from Native Nimar, and contiguous to country previously surveyed, *colored pink*, and to British Nimar in the Central Provinces."

Locality and area of survey.

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"No towns lie within this tract, and there are only three or four villages of any consequence, which, however, border on the northern limit excepting Pal, or Pal Tappa more commonly, once a flourishing place, judging from its ruins, in Lat. 21° 21' 30" and Long. 75° 56' 27", situated on the left bank of the Suka river in a valley of the Sathpuras, which is now being re-inhabited. The lands have been made over to an enterprising Zemindar, a Native of Oude, rent-free for twelve years, five of which have expired, who has persuaded about 100 families of Kunbies, Bhils and Banjaras to settle. If not deserted again through sickness and the depredations of wild animals at night, Pal should soon rise in importance, and being the only village in that part of the range, will be most convenient for wild Bhils, who will prefer going there to more civilized parts in order to barter the produce of the forest for grain. The water is good, flowing from a perennial spring into a large masonry reservoir.

Villages.

"The principal river is the Aner, which takes its rise 2 miles south of Sirwil Choki, Lat. 21° 15' and Long. 75° 42' 30", and runs due west for 36 miles through the main valley of the Sathpuras; it then turns southwards at right angles, and, breaking through the range 4 miles west of Lasur village in the Chopra Talooka of Khandesh, falls into the Taptee. There are a few Bhil hamlets along the banks, but the climate is so deadly from the commencement of the rainy season to the end of December, that even these aborigines are obliged to remove their habitations to higher and more open parts. The minor rivers are the Beda, Kundi, Deb, and Goi, which flow northwards into the Narbudda, and the Arnawati, which takes a south-east course and falls into the Taptee near Shirpur. About four months ago this torrent caused serious damage to property at Shirpur, when the water came down with a rush at 2 A. M. and swept everything before it, the inhabitants narrowly escaping with their lives, mainly through the exertions of the Mamlatdar and Sub-Judge.

Rivers.

"The Sathpura range which spreads over the tract under report is exceedingly wild and desolate. Scarcely a habitation exists over hundreds of square miles, although there are the sites of numerous villages still distinguishable, which prove that these mountains were fairly populated in former times; but owing to the notoriously deadly climate, impure water, and the ravages of wild animals, the inhabitants either settled in Khandesh or dispersed themselves in Holkar's territory. The extreme stillness which reigns in this wilderness is painful to a degree; nothing is to be seen but interminable jungle which closes every scene from the view, while the Surveyor regularly forces his way through spear grass up to his head in height, and endeavours to avoid thorns of the khair or catechu, which are so strong and sharp that even the tough hide of an elephant is scratched. No supplies are to be had for love or money, and the anxiety caused from this source was endless. Were it not for the very satisfactory arrangements made by Mr. Moore, the late Collector of Khandesh, which were carried out by his successor, the assistants employed on the detail survey would have been simply starved out.

Mountains.

"The country between Khandesh and Native Nimar (Holkar's) starting from Palkunda, or Paratkunda, the tri-junction point of Khandesh, Khandwa (Cen. Prov.) and Native Nimar which runs westward along the Sathpura range to Rajmali, the tri-junction of Khandesh, Native Nimar, and Barwani, over a distance of 86 miles, has been surveyed with the greatest possible accuracy every pillar, of which there are 68, being shewn in its true position, and bearing the proper number assigned to it by the Settlement Department.

Boundary between Khandesh and Native Nimar.

"The interior of the Sathpuras abounds with game of every description. Bison, sambur, several varieties of deer, nilgau, wild fowl, &c., tigers, leopards, panthers, and bears are to be found in numbers, especially the last named, in the more damp parts and along the banks of rivers. It is most dangerous sport going after bears and bison. The single sportsman, and

Game, &c.

not less so the surveyor or traveller, unless very cautious indeed, stands a fair chance of being mangled by a bear or suddenly charged by a solitary bison, than which a more fierce and vindictive animal does not exist, as he stands motionless, hidden by the high grass, and from which there is no escape unless the rifle bullet takes effect, for he comes down with irresistible force and is more to be dreaded on foot than a tiger. Several Bhils and grass-cutters are annually killed while collecting gums, &c., coming suddenly up to these fearless animals in the high grass.

Reclamation of forest land.

"Mr. Chew states that an attempt is being made to bring the neighbourhood of Bara Dhupa, a plateau about 2,750 feet above sea level, under cultivation by a company of natives who have obtained a lease from His Highness Holkar on very easy terms; but intending settlers are deterred by the difficulties of the road and the long distance at which supplies are obtainable. Several of those who have from time to time been induced to settle have left, driven out by fever and the hardships they have had to encounter.

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Roads and passes.

"The chief line of communication is the old Agra and Bombay road intersecting plane tables 25 and 27, which is kept in good repair although not metalled. There are chokies or posts at certain intervals for the protection of travellers. The traffic is heavy just at present, but as soon as the Holkar State Railway is completed, it will naturally be drawn away. The road goes through the Gaolanghati pass in Lat. 21° 35′ and Long. 75° 6′, the crest of which is about 1,900 feet above sea level. Another important road goes from Chopra in Khandesh to Khargun in Native Nimar, *viâ* Dhoulid and Dhulkot, but is not practicable for carts in the Gadarghati pass, where it is extremely difficult even for laden camels, though with very little expense it might be converted into a good road. There are chokies along this road also for the protection of travellers, who are always accompanied by one of the chowkedars from post to post. Supplies are not procurable anywhere. The crest of the Gadarghati pass is about 2,000 feet above sea level. A branch from this road strikes off from Dhoulid and goes *viâ* Chirmara through the Rupgarh pass, the crest of which is about 1,800 feet above sea level, and there joins the main road at Dhulkot. It is practicable for camels and laden carts also, with the exception of one part to the north of the Rupgarh pass, through which empty carts are taken. A third road goes from Raver on the Great Indian Peninsula Railway line *viâ* Pal and Sirwil choki, about 6 miles beyond which it meets the road just described, and also runs through the main valley of the Sathpuras, parallel to the Aner river, and is practicable for laden camels.

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

Bastar.

Description of country in Bastar.

The description triangulated ground must be confined to districts south of the Indraoti. I regret that Mr. Harper's notes of the country north of that river are so incomplete that I cannot venture to compile a description from them, more particularly as the district of the Mardian (or Abajmard) hills, north of the Indraoti, is one of very peculiar interest, containing, as it does, the most primitive specimens of the aboriginal race of Gonds. This tract (Colonel Glasfurd writes), might be called "the heart of Gondwana; it is here you will find the Marias in all their aboriginal simplicity and purity, for the reason that this is the point where they are furthest removed from contact with the Marathas on the west, Telingas on the south, and Chuteesgarh and Bustar hybrid tribes on the north and east."

The Indraoti from the point where it emerges from the ghauts of the Jeypore plateau, on the east to Bamragarh, flows through a vast forest-covered district rising on the right bank towards the north into the hills of Abajmard. To the south it gradually falls towards the low lying tracts of the Bhopalpatnam talook in the south-west, whilst it merges on the east and south-east into a mass of broken, irregular hills, which characterise the western limits of the great Jeypore and Bustar plateau. The whole of the Kootroo talook enclosed by the bend of the river to the south-west from Bamragarh possesses the same monotonous characteristics of jungle and grass, interspersed with a confusion of irregular but picturesque hills possessing no apparent continuous system. The general level of this district is high, being about 1,000 feet above sea-level, with some of the more defined peaks and hills rising to above 2,000 feet in altitude. Were it not for the deadly monotony of color and the depressing effect of one vast unending sea of jungle, the scenery in many parts would be grand. The Indraoti itself is a beautiful river, every mile of its course presenting picturesque effects in a variety unequalled by any river south of the Himalayas that I have yet seen in India.

South west of the Kootroo talook lies the district of Bhopalpatnam. Bhopalpatnam is on the low level of Godavery valley only a few hundred feet above sea, but it is the most civilized part of Bustar I have yet passed through. Villages are large, if not plentiful, and supplies easily procurable. All the cultivation of Bustar seems centred in Bhopalpatnam. From the neighbourhood of Bhopalpatnam a very marked and well defined range of hills called

"Gadalgoota" runs in a south-easterly direction, terminating near Albaka, and following or rather determining the course of the Godavery. Part of these hills has already been surveyed by the Hydrabad party, but the ridge of them defined the boundary between the Godavery districts and Bustar, and all their north-easterly slopes fall within the limits of our own work. The range culminates in that wonderful peak which takes its name on the Hydrabad maps from the village of Doli beneath it. The ascent of this peak (already described in previous reports) is difficult and tedious from the extraordinary fissures which intersect the path. A little north of the village of Doli, on the plateau below the peak, is a feature of great interest in the vast number of tumuli or kistvaras scattered over the surface of the hill. The number and extent of them is very remarkable.

Between the Gadalgoota hills on the west and the Bailadilas on the east, the general nature of the country might be described in exactly similar terms to those used for the Kootroo district further north. Forest jungle, interspersed with open tracts (of no great extent) of dense rank grass is the prevailing feature. Villages are fewer and water is scarce, except in the immediate neighbourhood of the Talpur and Chintawaga streams. There is one good road leading to Maddir and Bhopalpatnam from Cherla and Dumagudiam, which runs parallel to the Gadalgoota range between those hills and another small and disconnected but still well-marked range, extending from a little south of Thonki Ghât to the hill station of Gadigura near Kotteapili. Along this road there are good villages at intervals and some small extent of cultivation. Beyond this, however, extends a dead level of jungle to the Bailadila hills and the plateau. The physical aspect of the low districts still further south in the neighbourhood of Yelmagonda, Beji, Kaler, &c., has been already described in last year's report in much the same terms as those already used. These were the districts under topographical survey, and with the Rampa hills completed by Mr. Claudius, need not again be referred to. Messrs. May and Claudius have added some interesting notes on these districts.

Roads.

Four principal roads may be referred to traversing the Bustar jungle, all of them being good, wide, well-marked tracks running over soft, and generally sandy soil, quite unbridged, but good for wheeled traffic of the native sort until ghâts or passes are reached. No. 1 is the continuation of the road (lately metalled) from Rajahmundry, to Rampa *viâ* Chodaveram, Moradapali, Valumra, and Lakiwaram to Kaler and Damagudiam, the only practicable route up the Godavery valley on its left bank. This road from Rampa or Chodaveram (which latter is the most directly in the route), follows a gradual rise through the Rampa hills, until its highest altitude is reached a few miles beyond Valumra. The gradient is so far easy and good for riding or baggage animals, and could be made available for carts. Beyond this between Valumra and Lakiwaram is a ghât road descending about 2,500 feet through a rough and irregular pass, which follows for the most part the rocky bed of a small stream. It is the regular Banjari route, but its roughness is considerable, and prevents anything like rapid marching. No. 2 runs from Damagudiam or Beji *viâ* Yelmagonda, Chintulnar, Jiggorgonda, Kaikia, Katakalian, Chitapur, and Danpunji to Bustar; a branch road from Chintulnar runs to Vijapur. The ghât is reached a little beyond Jiggergonda, and from this point it is impracticable for carts. It is the principal Banjari route of the country. No. 3 has already been referred to, running from Damagudiam *viâ* Cherla, Kondeagudeen, and Madder to Bhopalpatnam, a little to the east of the Gadalgoota range. This is a good road, practicable for country carts the whole distance during the cold weather. No. 4 is the continuation of the direct road from Sironcha *viâ* Bhopalpatnam, Thonki Ghât, Jaither, Byramgarh, &c., to Bustar. This, too, at the best season of the year is open to country wheeled traffic. There are many small tracks in the jungles from village to village, distinguishable probably only in the cold season, and shifting their position (as indeed do the main roads and villages) from year to year. The villages along these routes are scattered at generally wide intervals, and are never more than a collection of mud and wattle huts thatched with grass.

Building.

Throughout the whole district of Bustar, I have only yet seen one very small Hindoo temple at the village of Gadma to represent the stone architecture of the country. The presence of this temple, utterly insignificant as it is, however points to a once higher degree of civilization in the country than exists now.

Rivers.

Of rivers, the Sileru and the Saveri fall within this season's topography for a part of their course. It may be as well to mention that in our maps we have followed the spelling that has been formerly used. The Sileru (or Sil-air "rocky river," the termination "air" or "yer" referring to a stream) is not inaptly described by its name. Mr. Claudius had opportunities of observing it, which he has utilized in his notes. The Saveri is frequently called, near its junction with the Seliru, Savair, the termination being evidently "yer" again, but what the word "sav" "death", "refers to it is impossible to say. The Saveri is a fine, full-flowing stream even in March and April. It has apparently a good sandy or rocky bottom throughout its course for 40 miles above Rakapili. It is very full of rocks in the neighbourhood of Kaler, where it is crossed by the only route running from Beji and Damagudiam *viâ* the Valumra ghât to Rampa. At this point (Kaler) is a ferry, but the river can be forded

at a point not far from Mot during the hot weather months. The Indraoti, which is the only other large river met with in the surveyed districts, will be better described after closer observation by detail surveyors.

Inhabitants, manners, customs &c.

The vast jungle of Bustar included between the Saveri and the highlands of Jeypore on the east, to the Godavery district taloks on the west, is occupied almost exclusively by the aboriginal tribe of Koi or Koitor. In the Sironcha district and north-east of it towards Kootroo, the people call themselves Gottawar, but in the opinion of Colonel Glasfurd, this name is only a gradual corruption from Koitar, and he classes them together as one great tribe. Certainly in such of their manners and customs as are open to the observation of the traveller, without deep enquiry into the details of their observances, bear out this opinion. To a stranger, however, the distinction is fully insisted on by the people themselves. Of four or five men out of any village near the banks of the Indraoti north of Bhopalpatnam, the majority will call themselves Gottur, or Gotti, and a few, "Kois," the latter declining to be classed with the Gotturs in any sense.

It is beyond the power, though, of any officer engaged in survey operations to enter otherwise than superficially into ethnological questions. All the aboriginal Gond tribes appear to be suspicious and timid to a far greater degree than the Bhils and Shanas of the more northerly tribes of India. Time is required to gain their confidence before any hope can be entertained of arriving at the truth of asking questions; and to this must be added the difficulties raised by a very natural hostility to the progress of survey operations and the requirements thereof. It frequently happens that villages are deserted at the approach of a camp, and here, as further south, the desertion of a village not unfrequently results in its total abandonment.

No part of the aboriginal tribes south of the Indraoti appears to be entirely free from Hindoo and Telinga influences. Towards the western edge of the jungle and the boundary between it and the Godavery districts, the Kois become much mixed with the lower castes of Hindoos and Telingas, the Dhers or Mahars, a very low, but very useful caste of cloth-weavers existing in great numbers in the larger villages along the direct route between Cherla and Bhopalpatnam. In the Bhopalpatnam talook, a small agricultural tribe of Gonds called Naiks is found. From their name one would be inclined to believe the tradition of this being formerly a powerful and warlike tribe; not much of the warrior now remains to distinguish them; they are simple agriculturists, not differing in appearance from the Gottawars surrounding them. In the Bhopalpatnam talook, which certainly contains the largest clearings and most important villages, Hindoos (principally Mahars) and Mahomedans are found; but in all the remoter villages buried in the recesses of the vast Bastar forest to the north and east are none but Gottawars becoming more primitive, and also more intelligible in their observances, the farther they are removed from the Godavery. In the farthest wilds of Kootroo and the fastnesses of the Abajmard hills, the real aboriginal Gond will, I hope be brought to light innocent of the contaminating influences which distort the extraordinary rites of his more civilized brethren.

The great family of Kois is split up into numerous sub-divisions or castes analogous to those of the Gond tribes in the Chanda district, and something like a classified list of these castes may possibly hereafter be arranged with the help of the detail surveyors. It is, however, as I have before remarked, more difficult for a surveyor to obtain information of this sort than for any ordinary traveller.

Towards the south in the neighbourhood of Yelmagonda, Vijapur and Beji, the Kois are a slight, dark skinned, well made and active race, with clear, high pitched voices, often very musical, with very little hair on their faces, which are usually as smooth as a woman's, and wearing but one small cloth round their loins, with necklets and armlets of beads and brass. Brass ornaments are rare, but are evidently fashionable when obtainable, while strings of beads to the depth of many inches falling over their chests form the principal ornament, if not the principal clothing, of the Koi. A leather band decorated with cowries round the waist cloth is not uncommon. The hair is gathered into a knot behind the head, and with the head necklace combines to give the Kois a peculiarly feminine appearance. Further north on the borders of the Sironcha Talook and in Bhopalpatnam, the Gottur certainly appears to me to be a better developed and physically stronger man than the Koi southwards. The shade of color is distinctly lighter, as a general rule, but in the matter of intelligence and activity there is little to choose, the Gond everywhere appearing to be a naturally sharper individual than his uneducated Aryan brother.

I once witnessed a Gottawar dance celebrating the anniversary of a villager's death, and I imagine that the dress worn on that occasion was what a Gond would consider "full". There was much addition to the ordinary amount of beads, and more brass armlets than I had ever seen before, but the head dress of peacock's feathers, with a slight turban, the small circular leather shields decorated with cowries, and the knives as side-arms, were decidedly unusual to ordinary dress. The dance was a monotonous performance, a sort of break down, the dancers following each other in a close circle. It was more of a "walk round" than anything else to the sound of horns and drums. Further north again, beyond the Indraoti, the

Gond of the Abajmard hills wears absolutely no clothing at all. This fact has not yet come under my observation, but the Vakil of the Bustar durbar attached to Mr. Harper's camp assured me of the fact. It requires verification, however.

Among the Kois of the southern districts the women always appeared to be well and decently dressed. Here again the Gotturs seem to differ. An upper cloth over the breast and shoulders being the exception and not the rule with them.

About their manners and customs I made many enquiries, but I feel quite unable to decide as to the value of the information obtained. I believe that, as a rule, rites and ceremonies are very vaguely understood by the people themselves, but there are some outward tokens of their observances common throughout the country.

The ordinary method of disposing of the dead is cremation. The body is almost invariably buried in the shadow of the "mohwa" tree, and in many instances the appearance of the tree led me to suspect that the corpse was actually bound to the tree itself in an upright position. The sacrifice of buffaloes or cows to be eaten by the guests is an invariable accompaniment to the ceremony in all cases where the relatives of the deceased can afford it. In the Beji and Vijapur districts, evidences of this ceremony were not nearly so common as further north, but in Bhopalpatnam and Kootroo, the two upright posts, a foot or so apart, and a few feet high, sometimes elaborately carved, with a flat stone between them resting on smaller stones as supports, with a wooden figure of a peacock, perched on the top of one of the posts, was a common incident in the morning's march. The posts and stone serve a double purpose, not only as a sacrificial altar, but as a monument to the deceased. The peacock was often a very good imitation; in one instance of a recent burial I found the wooden bird covered with gaily colored handkerchiefs and cloths twisted to represent its crest and tail, and most ingeniously imitative of its smart original, both as to color and shape. The ashes in this case were above ground and covered with a neat wicker work sort of hencoop; this again was decorated with gay flags and streamers, the whole arrangement being close to a narrow foot-path in the densest wilds of the jungle. A cow's tail not unfrequently is nailed to, or twisted round one of, the posts, and this part of the outward ceremonial clearly connects the Gottur and Koi. The monument of the Koi is described by the Reverend Mr. Cain (missionary at Damagudiam) as a post with a cow's tail nailed to it. I never happened to meet with one in the neighbourhood of Damagudiam.

Rude stone monuments, "menhirs."

The most lasting monuments of the country are, however, the "menhirs" or upright stones (precisely like tombstones, only varying according to the nature of the stone used) planted in memory of the dead along the sides of well known roads. These "menhirs" are found throughout the country, but in much greater numbers towards the hills and plateau on the east than in the lower tracts of the west. I believe myself that both the stones and the posts already described are planted by the same tribe of Kois, the nature of the monument to be raised to their dead being determined by the easy accessibility of a good quarry of laminated sandstone or otherwise. No architectural decoration of any sort is attempted on these stones. They are of all sizes and shapes. I never saw writing on one of them (Gondi is an unwritten language, I believe), nor was there any appearance of the stones being even shaped in outline. I have seen them 10 or 11 feet high, but when of this size they are always of such thin slabs of sandstone that no curiosity is raised as to how they could have been put in position. Menhirs are plentiful, but outside the Godavery districts, east of the Gadalgoota hills and south of the Indraoti, I never identified a single cairn or stone monument of any more elaborate description than these.

Trilithons.

All this tract will be well explored this season. Mr. May speaks of a trilithic monument between Penta and Deorpili which was found a few miles below Sunkom near the right bank of the Saveri. A similar monument (two upright stones with one horizontal) was mentioned by Mr. Campbell on the bank of the Siller in the Jeypore district. The local explanation in both cases decided these to be monuments raised to the memory of the dead, and I have little doubt that the one spoken of by Mr. May is identical with one mentioned by Colonel Glasfurd in a letter to me, as erected to the memory of a good woman "said to be very charitable and benevolent." Mr. Claudius mentions two trilithons in the Rampa hills,—one at Valumra and another close to a high road south-west of Gerteru. Colonel Glasfurd writes of cairns and dolmens in the Mardian country, which will, I hope, come under observation during the next cold weather, but cairns and dolmens or anything of a higher order, of architecture than the monoliths or trilithons referred to have not been found east of the Godavery districts so far.

In Mr. Ferguson's widely read book—"Rude stone monuments—" referring to the cromlechs with crosses found near Mangapet on the right bank of the Godavery river during the progress of the Hydrabad survey, the author first points out that the cross is of the 6th or 7th century. That no Christian community could have existed after the Mahomedan invasion at the end of the 13th century, but that a form of Taiping Christianity may have been intro-

duced from the north owing allegiance to Prester John, and then says, "there can be little doubt that this group is not solitary. Many more will be found when people open their eyes to look for them." They have not been found so far anywhere in the region mentioned, and I should much doubt whether they have been overlooked in the Hydrabad plateau. The one further remark of Mr. Ferguson's bear so directly on survey operations that I may be excused for quoting it.—"In so far as the History or Ethnology of the central plateau of India is concerned, or its arts or architecture, the Nizam's dominions are absolutely a *terra incognita*. No one has visited the country who had any knowledge of these subjects, and the Indian Government has done nothing to enquire, or to stimulate enquiry into these questions in that country, yet if I am not very much mistaken, the solution of half the difficulties, ethnological or archæological, that are now perplexing us lies in the surface of that region for any one who will take the trouble to read them—Page 478, 'Rude stone monuments.'"

I have no wish to speculate on the bearing of future discoveries upon present knowledge of this hazy subject. It is quite clear that there exists in Bustar a people who are in the constant habit in present times of erecting a class of monuments usually supposed to be prehistoric and to represent the first rudiments of civilisation dawning on man. To assign special ages to a special class of architecture would appear to be as great an error as to classify the world's history into ages of stones, bronze, and iron. The same people in Bustar who erect what may fairly be called in common language "tomb-stones," use sharp stone implements to cut strips of bamboo and the stems of creeping plants into a natural twine.

Forest trees.

In the Bastar jungles it will be sufficient to say that, as far as my knowledge of the subject extends, all the trees mentioned in the Central Provinces' Settlement Report of 1869 are represented. The finest teak by far is found about the foot of the Bailadila hills, at Deoraj, or on the slopes and at the foot of the smaller hills in the Beji, Chintulnar and Vijapur Talooks. In fact, the best timber as might be expected is in the most inaccessible localities.

Wild animals.

Probably few districts in India of the same extent so universally abounds in game as the eastern basin of the Godavery. Tigers abound in the Rampa hills and in the rank grass of the low broken country about Beji and Yelmagonda, where villages are constantly deserted on account of their depredations. Farther north in the Vijapur, Bhopalpatnam and Kootroo Talooks they are not so common, although occasionally found throughout the plain country. Where there are hills, such as the range on which Gokur Hill Station, Bordaguta Hill Station, are situated, evidences of them are constant. I have seen their tracks in the morning closely following those of the pack bullocks that had marched during the previous night. Man-eaters among them are common. But, perhaps, one of the finest fields for tiger-shooting now left in India is the actual valley of the Godavery itself in close proximity to the river, where, during the hot-weather months of March and April, they may be heard of at almost every village on the route. The Godavery valley abounds in game of all sorts, both large and small. Large flights of Kulan may be found feeding along the banks of the river, and the ease with which this usually wary bird may be approached shows how little they have lately been molested by the sportsman. Deer of several varieties are found, although not in large numbers, the most common being the chital, or spotted deer, while bears and leopards (probably panthers also) make up with the tigers the list of the larger game. In the Rampa and Bailadila hills, and again in the hills bordering the Indraoti from near Bhopalpatnam to Bhamragarh, there are herds of bison constantly roaming. They are difficult to discover in the dense jungle, and still more difficult to approach from the roughness of the hills in which they live, and which apparently they never leave for the plain country. Along the banks of the Indraoti from a little south of Bhamragarh to Mudhota and Chetterkote, as well as up the Nye Bereh (Dog River), wild buffaloes take the place of the bison; the buffaloes, I believe, adhere to the plain country and the low swampy ground covered with rank high grass that borders the Indraoti river. I have never heard of them at any great distance from the river. In appearance they resemble the common buffalo rather than the far finer and more powerful animal known to sportsmen in Assam. It is not very difficult to approach them closely on foot (when in a herd), and until wounded they show no great fierceness of disposition. Spotted deer are found wherever there is a good stream and thick cover. They abound chiefly (as might be expected) in neighbourhoods where tigers are scarce. Colonel Glasfurd speaks of "bara singha" in the neighbourhood of Bhamragarh and at Chetterkote and Mudhota. Possibly he may refer to the "marsh" deer rather than the true "bara singha." "Sambhar" and "neilghai" are common enough in the southern districts, and the former are found wherever there are hills all through Bastar. The smaller species of deer known as jungle sheep is plentiful, but I believe there is not a single antelope of any sort (unless the "neilghai" can be so classed) in all Bastar. Small game is scarce outside of the immediate valley of the Godavery. To any one well acquainted with the subject, I believe Bastar would afford an interesting field of enquiry in the matter of snakes. I have seen several that are quite new to me, and traces of some that, in point of size, quite equal the monsters of Assam. The boa-constrictor is quite at home throughout these regions, and from the marks of them that I have observed, as well as the cast-off skins found now and then, there is no difficulty in believing the tales that are told of their size voracity and extraordinary powers of digestion.

Products.

The products of the country are so few, that Bastar will, I fear, add little to the trade that is now opened with the coast by the regular traffic of river steamers between Rajahmundry and Enchanpali. Gallnuts, skins and horns are about the sole exports. The principal trade no doubt near the river is in timber, as mentioned by Mr. May. The imports chiefly will be rice and salt, at present imported by the Banjaris. A certain amount of rice is grown near the larger villages in the north, sufficient for home consumption, but the principal grain of which nearly each small village can boast its poor-looking field is jowar (cholam), a clearing for its cultivation being easily effected by axe and fire. A species of bean is also almost universal, clinging in clusters to the grass-thatched roofs of the village huts.

Climate.

The climate of so large an area of hill and plain country varies, of course, considerably. During the cold weather months the chief peculiarity in the low districts of Beji and Chintulnar is the prevalence of dense fogs at night. The extreme damp of one-half of the twenty-four hours, and the excessive power of the sun in this low-lying and hill-surrounded tract during the other half, is a peculiarity that has its effect on the progress of survey operations. Even the best seasoned of wood cannot resist the effects of such constant change. It is not only exceedingly inconvenient to the triangulator in its effects on the stand of the instrument, producing errors which far outweigh all errors of observation, but the plane-table assumes a new shape under its influence, and some of the party working with unseasoned boards found very considerable difficulty in adjusting errors so caused. The heat in these low districts and in the Godavery valley during the hot months (last season the hot weather set in with the 2nd week of February) is most excessive. Its low elevation, combined with the peculiar formation of the hills, the constant presence of huge jungle fires and wide-spread volumes of smoke, thickening the atmosphere without affording relief from the strength of the sun's rays, combine to render the districts of the Godavery basin above the gorge so hot and suffocating during the early months of the hot weather, that it is questionable whether the early cold weather months would not afford a better working season even with the certainty of sickness increased by the inevitable malaria at that time of the year. With the higher elevation of the more northern and western districts the climate improves in point of temperature, and I have reason to think that the jungles of the most northern talooks of Narainpur and Purlakot adjoining the revenue survey districts are considerably less malarious than those of the hill country further south. In fact I think the members of the party may be congratulated on having left the worst districts behind them.

Notes by MR. J. A. MAY, *Surveyor, 3rd grade.*

Bastar.

That portion of the Bastar district lying between the parallels of 18° 0′—18° 15′ and meridians 81° 0′ 30″—81°30′ which fell under my immediate observation is similar in its general aspect to the surrounding country except to the north-east, where the ground is intersected by high ranges supporting table-lands from 1,000 to 2,000 feet above sea level, and which join on to the extensive and elevated plateau further north, on which the Bailadila range stands. The rest is low undulating forest land, about 600 feet above the sea, interspersed with isolated ranges, some of them rising to over 2,000 feet, and numerous hillocks which barely top the jungle, breaking up the ground in some localities into most intricate and difficult ravines. These little hills are for the most part composed of grey sandstone and white felspar rocks, containing a large quantity of iron, but the low ghât near the village of Mailasuri, over which the road from Damagudiam to Jiggergonda passes, seems to be formed entirely of mica schist.

Streams are very abundant, but, unfortunately, few retain any water for half the year, and it is only in the larger streams that pools at great intervals are to be found. It is owing to this want that the villages in the plains are so few and scattered, desertions being frequently caused by the failure of this necessary, aided in no small measure by the ravages of small-pox, which is a perfect pest in the country during the months of January and February. The Damagudiam authorities have done much in checking the advance of this disease by the introduction of vaccination among the people.

Of the different tribes or classes of people inhabiting this part of the district I had occasion to remark two in particular, the Reddies and Kois. The Reddies are said to be the highest class of Telugus, and are most probably settlers from the coast; they are in appearance and habits much like the Konda Doras in Jeypore. They seemed to me to be unwilling to render any assistance to my camp, and are, on the whole, conceited, though they have been found more tractable in other parts of the country.

The Kois, however, who form the greater part of the population, and are evidently a branch of the great Gond family, are a simple and willing people, extremely ignorant, even as to their own usages and customs, so that a stranger would find the greatest difficulty in getting any information from them; I have for my part been usually referred to an old man at Mailasuri village who was said to know all things.

There is nothing remarkable in their funeral rites,—cremation,—which is common to both, being the usual mode in which they dispose of their dead, except in the case of small-pox, when burial is adopted.

A few slabs or a heap of stones generally marks the grave or the place where the ashes lie; monumental erections are very scarce; the only ones met with by my camp were at the village of Penta, on the right bank of the Kolab or Saveri, and which consisted of a couple of upright slabs three or four feet high, supporting a third. These are, I was told, usually erected to the memory of some wealthy personage, or the headman in a village.

The manner in which the Kois conduct their matrimonial alliances is as follows: connections are rarely formed with strangers, as they usually choose among their own kins-folk, cousins being the nearest degree of consanguinity permitted to marry. The young man desirous of matrimonial honors starts on a reconnoitring expedition to the adjacent villages, and finding a damsel to his taste, he returns home, and mustering a dozen or so of his friends sets out for the village of his "*chere amie*," where he waits for an opportunity of finding her alone, which, as it is usually a preconcerted affair, soon offers, when the girl is pounced upon, but in the endeavour to carry her off, the parents, apprized of the circumstance by her screams, raise an alarm, and make a show of resistance, and sometimes a mock-fight is enacted in the event of others of the girl's villagers interfering; she is, however, eventually allowed to be taken away. The next day the parents of the young woman proceed to the house of their daughter's abductor and protest against his conduct, but a formal proposal of marriage on the part of the young man, and the offer of a liberal dowry, soon soothes the feelings of the old people into compliance; the day is then fixed for the nuptials, and at the appointed time, friends and relatives repair to the place determined upon for the ceremony, where the future pair are made to sit each in their respective sister's laps. In this comfortable position the bridegroom spins a short hempen cord noosed at one end like a halter, which he flings over his intended's neck, drawing her over to himself; this with the accompaniment of drums, dancing, and copious draughts of foul "mohwa" liquor *ad libitum* brings the business to a close.

Polygamy is tolerated, but only the comparatively wealthy can avail themselves of its privileges, as every additional wife costs twice as much as the last.

Among other tribes a few settlements of Mahomedans are to be met with, but these are chiefly hired servants of the Rajah, who have small areas of land allotted to them, instead of being paid from the treasury, and who may be called upon at any time for service.

The language current in the country is Telugu, though each tribe has a dialect of its own besides.

The through roads of communication are those from Rajahmundry and Damagudiam, passing through Beji, Mailasuri and Amapeta to Jiggergonda, Bastar and Sunkom; they are almost everywhere practicable to cattle and beasts of burden, being the routes generally taken by Banjaris, in fact originally formed by them. There are also numerous cart tracks intersecting the ground to the west, made by speculators in teak, which is very plentiful and of good size in these parts, and who barter salt for the timber, the price of a tree, after felling and clearing, being a rupee's measure of salt. This measure, however, varies in its internal capacity in proportion to the amount of honesty inherent in the timber merchant, the simple minded villagers being perfectly satisfied with its external dimensions.

Domestic cattle are very numerous, constituting the only wealth of the people, who are otherwise extremely poor.

Wild animals are abundant, such as tigers, buffaloes, "nilghai," bison, and almost every variety of deer.

The following is a list of the most useful trees and plants to be found, with their English, Hindi and Botanical designations:—

Teak (Tectona-grandis).
Mohwa (Bassia-latifolia).
Giant-creeper (Bauhunia scandens).
Olibanum (Boswellia Thurifera).
Ebony (Diospyros Melanoxylon).
Aonla (Emblica Officinalis).
Mango (Mangifera Indica).
Kussum (Schbichera Trijuga).
Tamarind (Tamarindus Indica).
Gallnut (Terminalia Chebula).
Torchwood.
Bamboo (Bambusa Arundinacea).
Dhowra (Conocarpus-latifolia).
Lancewood (Grewia Elastica).
Bael (Ægloe Marmelos).
Babool (Acacia Arabica).
Palm (Borasses flæabelliformus).
Khair (Acacia Catechu).
Ber (Zizyphus Jujuba).

Notes by Mr. T. E. M. CLAUDIUS, *Assistant Surveyor, 1st grade.*

Bastar.

The tract of ground surveyed by me between Latitude $\frac{17^\circ\ 30'}{18^\circ\ 0'}$ and Longitude $\frac{81^\circ\ 35'}{82^\circ\ 0'}$ comprises an area of 457 square miles, which I must divide into two parts, the northern but smaller portion having an area of about 200 square miles, which I cannot otherwise describe than as

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one of the worst, if not the very worst bit of ground in the eastern ghauts. This opinion has not been formed by myself alone, but by the oldest surveyors in this party. The southern portion of my board, however, was more inhabited and traversible. The Peddakonda range, which has very nearly a parallel course to the Sileru river, and which for a short distance divides the good from the bad country, has already been described by Colonel Saxton and Major Glasfurd, the latter officer having visited the table-land with the object of becoming acquainted with any special adaptations that may form it into a sanitarium at some future period. The cairn erected by Major Glasfurd about 4 miles south-west of the Great-Trigonometrical Survey Station certainly marks the best spot on the range where water is conveniently procurable from a perennial spring. The river Sileru, or, properly speaking, Siler, the literal meaning of which translated from the Telugu signifies rocky river, "*sil*," rock, and "*er*," river, runs diagonally through the northern portion of my season's work, forming a valley through a large mass of hills for about 30 miles, having on the south the Gabra, Kons and Peddakonda ranges, all averaging between 4 and 5,000 feet, and on the north, undefined shapeless masses of hills, almost totally void of habitation, but of much less elevation. This river from the well known village of Kondakamberu, in my own work of season 1872-73, to its junction with the Saveri, a distance of about 72 miles, forms a natural boundary between (to the north) the Jeypore Territory and to the south Golgonda, Rampa, and Rakapili. From a little distance below Kondakamberu, and up to its confluence with the Saveri, a length of 68 miles, the bed and banks are on both sides, but more especially the southern, extremely rocky. There are two rapids, one abont 7 miles south-west of Kondakamberu, where it has a fall of 30 or 40 feet, and another just before it leaves the hills near Konda Hill Station, from which point it flows placidly into the Malkangiri and Rakapili plains. It is unfordable along its whole course, and from Kondakamberu to the village of Polur, a distance of nearly 55 miles (all of which it has been my lot to survey), not a single ferry exists. This to a surveyor causes the greatest inconvenience and loss of time. During the season under review I considered myself extremely fortunate in finding an old canoe (probably brought down by the rapid current from some remote place), and which was just able to convey one man at a time at one of the three miserable villages in the valley above-mentioned. Making up my tent ropes and traversing ropes into one long cable I had the ends firmly fastened to trees on either bank, a distance of about 260 feet. Then fastening bamboos and logs of wood on both sides of the canoe to prevent a capsize, my camp and myself were gradually and carefully conveyed across, the rope affording the means of locomotion to and fro; this process cost me nearly a day, but had I not adopted such a measure, the loss of time by having to make a detour by the Polur ferry would have been more than four-fold. The three villages already mentioned, which are 4 and 5 miles apart, were built by a few reckless beings, who, I have no doubt, only temporarily setted there; they informed me of their own accord that their principal means of subsistence was by hunting up and living on the remains of sambhur, deer and bison killed by tigers. This novel and apparently precarious mode of living will undoubtedly seem quite improbable to many, but during the time I was occupied in surveying this wretchedly wild and unhealthy tract, not a single day passed by without coming upon the carcase of some wild animal half eaten by tigers or panthers. No part of any ground that I have ever seen during the period of my service in the Department so teemed with wild animals as this valley, and it was quite a common occurrence to come upon the fresh haunts and "pugs" of tigers, in many cases where they had actually got up and moved away into the long grass on hearing our approach. In the more inhabited parts of the Rampa hills, they have caused, and are still causing, great depredations. Villages which seemed flourishing and prosperous the previous year were entirely deserted on this account on my visiting the same spots this season. Notwithstanding the reward offered by Government for the destruction of these beasts, the villagers seem too timid to go after them, or even to watch over a "kill," and many of them seemed very thankful and grateful when I presented them with quantities of arsenic, giving them full directions how to apply and use the same whenever an opportunity offered. Towards the south and about the ground where I joined on to the Hydrabad Survey, a single wild elephant roams free and unmolested. I had the pleasure of coming across the animal, but without an opportunity of having a good shot; this elephant, I was told, has been in existence beyond the memory of any man now living thereabouts.

The tribes I met with were the Reddies, Koiwars, and Doms. The Sileru in the portion surveyed by me seemed completely to separate the first two, the Koiwars belonging entirely to the north of the river, although they are, I believe, found elsewhere. The Reddies occupy the whole of the Rampa, Rakapili, and part of the Golgonda hills, and stand foremost amongst the Telingas. I found them a very intelligent, well-informed race, who seemed always willing to do anything in their power required by people entering those parts. My camp suffered very much from fever, especially while I was at work along the Sileru valley, and at one time every one of my lascars were so prostrated that for a whole week I had to go out working without one of them in attendance, and it was then that I was able to appreciate the assistance of these Reddies, who were brought to my camp from long distances; they learned the work of a lascar so quickly that I was actually sorry when the time arrived for me to dispense with their services. My experience of them, therefore, differs widely from the account given of the same class of people by Mr. May, who was working in the plains of Bastar, and the only way I can account for this is partly that the Reddies of the ground surveyed by me have less intercourse with civilized people, and were pleased with the novelty of their work, and partly from the difference that invariably exists between people of the highlands and those of the lowlands.

A singular case of superstition which is so common among the ignorant was brought to my notice. While surveying the boundary between Golgonda and Rampa in season 1873-74, a dispute arose about a small bit of jungle, which both sides claimed. Having distinctly mapped the disputed boundary, I playfully told the principal men, that whichever of them was uttering a falsehood would assuredly be taken away by a tiger. On passing through this season, I was very much surprised to hear that the poor fellow on the Rampa side, and one of the disputants, had been not long after I left carried away by a tiger. The story was told all over the country, and wherever I went, the headman of each village would inform me of the sad occurrence in a most solemn manner, giving me credit at the same time for being able to foretell such a catastrophe.

The only structures met with marking any memorable time or occasion were two tomb-stones, as already mentioned in the Narrative Report, and one small, old, ruined temple at the well-known village of Gurteru, the remains of which are held in great veneration, and villagers are every morning to be seen offering their devotions there. The slabs of stone are rudely embossed with images, which, I believe, belong to Hindoo mythology.

Extract from the Narrative Report of CAPTAIN J. R. WILMER, B. S. C., *Assistant Superintendent in charge No.* 5, *or Bhopal and Malwa Topographical Survey.*

Central India.
Bhopal, Jhalawar Augor, and Indore.

The members of the party were divided into two divisions, the one surveying the Narbudda and country north, including a portion of the Vindhya range. The country here is very hilly and covered with forest jungle. The southern scarp of this range, which runs generally east and west, begins to be more broken up, and is not so well defined as it is further east. The country lying between the foot of the scarp and the Narbudda is well cultivated, open, and flat. The ground surveyed by the second division is generally open and free from jungle. It is, however, rather undulating to the north, where this party's work joins that of the Gwalior survey.

The principal rivers that have come under survey this season are the *Narbudda*, which forms the boundary between the British and Bhopal territories. The *Newaj*, and a small portion of the *Káli Sind*, both of which have their source in the northern scarp of the Vindhya range. The minor rivers running north are the *Ghar* and *Dudi*. The *Kolar* and *Chip* rivers have their sources in the Vindhya range, and flow south into the Narbudda river. The former, before flowing south, runs east for about 26 miles through the range. The general width of the Narbudda is about 650 yards, increasing in some places to about 1,000. The bed is generally sandy, but here and there are large rocks and rapids; the banks are steep and well defined. It is fordable just before the rains in only two places, and there are eleven ferries in the 39·7 miles that have come under this year's work, with the exception of those mentioned above; its tributaries, which flow from the north, are insignificant.

The cities of *Sehore* and *Narsingarh* were surveyed on a large scale this season, and have been fully described by Captain Riddell in his Narrative Report of last year. The military cantonments of *Mhow* and *Augur* and city of *Indore* were met with by the triangulating parties, but the description of them will come into the report of next season, when the standard sheets in which they occur have been surveyed in detail.

The general communication between the villages consist of unmetalled roads or paths, The great Deccan road has been met with and surveyed for 46 miles. Several tracks cross the Vindhya range, but are not suitable for carts or laden cattle. There are two principal passes, one commencing from Budni, west of Hoshungabad, running west, along the foot of the range through Jamunia, Barda, Dhawa, Lowa Khari to Sehore. Good drinking-water is to be had at Dhawa at the foot of the hills. The other goes from the village of Larkin to Pipalton, thence to Sehore; both are practicable for carts and laden cattle.

The country triangulated by Mr. Hamer was that between the Khanpisura Series Meridian of 75° and the western portion of Mr. Horst's work of last season. The nature of the country is the same as described by him, being rather hilly and jungly. The country triangulated by myself was uninteresting, being very flat, with isolated, low, flat hills, patches of jungle here and there, but generally cultivated throughout.

The triangulation emanated from the Khanpisura Series; the southern station being situated on a high peak of the Vindhya range, 2,218 feet above sea level, called Singarchaori hill station. The scarps of the range at this point become much bolder, and communication is impossible, except where paths have been made, and the hills are densely covered with forest-jungle.

Grain of all kinds and opium are cultivated. Of the latter a considerable quantity is grown; the inhabitants apparently prefer to grow it, and the cultivation of grain thereby suffers and is very expensive, being on an average of 11 seers for the rupee.

The soil where cultivated is the black cotton soil. The climate at the commencement was not good, fever being very prevalent, but warm, dry and healthy towards the end.

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

Eastern Naga Hills.
Description of the country and people.

The hills rise in successive and parallel ranges from the plains to the Burmese watershed, and the rivers naturally following between them take the same north-east or south-west direction, breaking out through the ranges to empty themselves after crossing the plain into the Brahmaputra, the only exception of any note being the southern branch of the Diku, which drains a long valley between high ranges of hills as yet unsurveyed and runs directly northwards. The ridges of the hills and the bottoms of the valleys are narrow; there are not throughout more than four or five level spaces either above or below, and those are of very limited extent, the most level being the place at which we were encamped when attacked at Ninu, which was not only the most level and best watered, but also the most beautiful place I saw in the hills. The lower and outer ranges are covered with wood and undergrowth, but without any fine timber, and the tops of the highest range being uncultivated, are also covered with forest. The rocks throughout are sandstone or shale, the latter being accompanied by tepid salt springs, and the former in several places overlying coal deposits which have this year been explored by the Geological Survey. The rivers are not navigable within the hills.

The climate of the eastern half of the tract surveyed was, as far as I experienced it, remarkable for rain. I find from a reference to my notes that we were constantly having rain which lasted for several days at a time, and during the time that the military expedition against Ninu was in the country, it was almost constant. This altogether embraces a period from December to the middle of April. The weather in the winter was otherwise very pleasant, the sun, as usual in these latitudes, often hot, but the air cold and enlivening, and occasionally after a fall the forest on the summits of the Patkai from frozen rain appeared as if covered with snow.

The low outer ranges are not, as a rule, inhabited or cultivated, but from beyond these to the watershed the hills are well populated and bared by cultivation, except in the valleys (the villages always being built on the hill-tops or points of spurs) which it would be toilsome to cultivate, and besides dangerous among such treacherous and blood-thirsty people. The villages are more numerous in the eastern half of the tract, and smaller than among the Angamies and other tribes to the west, the average number of the houses in each being about sixty, though the number of inhabitants must not be judged from this, as the houses are larger, and more than one family inhabit each. The houses of the Chief were always very large and hold many persons. That of the Chief of Mulong, for instance, is more than 360 feet long by 100 broad, and has a balcony at one end; and several of the other Chiefs' houses seen were of equal size, and the population is as large as can be well supported with their "jhoom" method of cultivation. Most of the eastern tribes cultivate but little rice, their chief stand-by being a sort of yam (katchu). They have cattle in some places, and pigs, goats and fowls everywhere, and eat besides a great variety of wild produce, animal and vegetable, some of which, *e. g.*, what are commonly called garden-bugs, appear abominably nasty to us. I did not notice that they cultivated cotton anywhere, which may be either the result or origin of their habit of dress. the tribes being generally distinguishable from one another by the greater or less scantiness of their clothing, or by the entire absence of covering. Among the tribes I first saw inhabiting Tablung, Kongan, Jaktung, &c., the males went entirely nude; the females, however, were well clothed, which made the dress of the females to the eastward the more remarkable, for there, though the men were decently dressed with broad aprons reaching to the knees, the women's only clothing, except beads and ornaments, was a strip of cloth five inches broad round the buttocks, which to our eyes made their nakedness more naked, and indeed, excepting in the case of the very young, produced a strong feeling of disgust. Some of them went quite naked.

I saw altogether four tribes in my tour, distinguished by tattoo and language as well as dress. At Kangching the people struck me at once as resembling the Semas, whom I had seen the year before to the west, and they said that they had come several generations before from that side. The men do not tattoo, have the hair cropped round as if a bowl had been put on the head, and wear a black apron ornamented with beads. The men of Tablung, Jaktung, &c., tattoo a single line down the forehead and nose, and two broad bands from the outer parts of the arms over the shoulders to meet in a point at the waist, wear no clothes and shave the head, except a broad tuft brought forward and a small one behind. At Mulung, and east to Lungva and Joboka, they wear aprons, usually of Assam silk; tattoo the face with small dots and lines and the body with bands, as at Tablung, and wear nearly all their hair in front cut short over the forehead, the back hair being tied in a pigtail over a bamboo about nine inches long. East of these from Utu to Bansang and Ninu, they wear an apron, often of blue stuff, tattoo the face so heavily with broad lines and dots as to give them at a little distance the appearance of being blackened, and wear nearly all their hair, the front part cut short over the forehead, the back twisted into a knot fastened by a large pin of buffalo horn. The women of all the tribes tattoo slightly on the body and from the knee to the ankle, and at Kanching have three broad lines on the lower lip and chin. The men, except at Kangching, wear a belt of a long spiral cane wound round them so tightly, that the waist was sometimes compress[ed] to twenty inches, a habit perhaps the result of the spare and poor diet they put up with notwithstanding which, however, they are strong and active and excel in tree-climbing. No tr[ee]

is too tall to go up, and if too thick to clasp, it is still to be climbed either with notches cut with their ever-handy "dao," or by a bamboo pegged against the stem. The women wear no belt; to the men it gives a decidedly smart look, and with the gay helmets they wear, a party of young warriors has a most picturesque appearance.

There are minor differences of dress and arms among the eastern tribes, and their language differs, but of this I made no notes, leaving it to Lieutenant Holcombe, who, had he lived, would have furnished a very thorough account of them. There were two points, however, on which he made particular enquiries: the attack on the Gileki outpost in 1867, and the routes to Burmah, and from what he said to me, I believe he came to the conclusion that the Tablung, and probably Kongan men were the perpetrators of the first. His enquiries as to the routes to Burmah, though not conclusive, as all his informants (some of whom seemed jealous of our knowing anything about it, and some ignorant) did not give precisely the same information, seemed to point the following as the route *par excellence*, and the survey, as far as it went, confirms it, namely, to enter the hills by the Towkok river, ascend to Changnoi by Changsa, and cross to Lungva, from whence, in three marches southward, over a distance equal to that from the Assam plains, a broad navigable river could be reached. Men from Lungva had seen the river, but the route was little used, as the tribes are inimical to strangers, who stand but a poor chance of keeping either their property or their heads. This abominable practice of taking heads, which is always carried on in a treacherous and usually cowardly way, and in which no distinction of age or sex is made, though doubtless of use in keeping down the population, must always, if allowed, prevent communication and commerce among the tribes; but they would, I believe, themselves prefer its being put down.

There is a peculiarity of these eastern tribes which cannot fail of being remarked by a visitor to their villages, as it is usually called attention to by the nose as well as the eye—their mode of disposal of their dead. These are placed at the entrances to their villages. At Tablung and the villages near it the body covered with cloth and matting is laid in a canoe-shaped coffin ornamented with red and black paint and placed on the lower branches of a tree. More eastward the coffin is of mat and supported on a small bamboo frame; is covered by a narrow roof often with one end produced into a long, tapered beak, and sometimes ornamented with wooden figures or cloth, the arms and belongings of the deceased or imitations of them, being hung on posts near it. What is more remarkable, however, is that the whole of the corpse is not in these coffins. The head is invariably removed after death. It is twisted off after decomposition has sufficiently advanced (to cut it off would be a supreme insult to both the dead and living relations), and is then disposed of elsewhere. About Tablung it is placed in a cylindrical vase of stone, and then (so they told us) cast into the most out-of-the-way part of the forest which was to prevent its ever being used as a trophy by an enemy. About Joboka and eastward it is placed (evidently previously cleaned) on a little platform outside the gate and ornamented with beads and brass ornaments.

I regret that unfortunate circumstances prevented my collecting full notes regarding these, as yet, little known people. Incomplete notes supplemented by fancy are worse than useless, but future observers will, I do not doubt, report on them more fully and better than I could have done. I append a copy of my letter reporting the attack on the Camp at Nianu.

Report by CAPTAIN W. F. BADGLEY, *in charge No.* 6, *Topographical Survey, to the Surveyor General of India,—No.* $\frac{X}{6}$A, *dated Jaipur, 7th February* 1875, *on the treacherous attack made by the Nagas.*

I have the honor to inform you that on Monday, the 1st February, we arrived at Ninu (an Abor village four marches from the plains). I was detained as usual by survey work on the road, and did not pass through the village till some time after Lieutenant Holcombe and the rest of the camp. The people seemed sulky, but Lieutenant Holcombe said they were frightened, and did not come out of their houses at all when he came through. In the evening some of the headmen brought a small present of rice, fowls, and roots. They were told not to be afraid, to bring more in the morning, and that the whole village was to come and see us. About sunrise next morning there were a number of Nagas in camp. Sitting in my tent I heard one of the headmen say to Lieutenant Holcombe: "The Raja (village headman) is there, but is afraid of the gun." Lieutenant Holcombe took the rifle from the sentry and gave it to the Naga, who then began to laugh and dance with the gun on his left shoulder, flashing his "dao" in his right hand. Lieutenant Holcombe then turned apparently to draw the sentry's bayonet, when one of the young Nagas felled him with a blow from behind on the side of the head. There was a yell raised all through the camp. I sprang up to draw my pistol hanging to the back pole of the tent, as several of them rushed in. Firing into them, I made my way out behind (my tent providentially being made to open at both ends), and was followed by two of them, whose blows I avoided as well as I could, firing meanwhile, when at the moment I fired the fourth shot I tripped over a stump and fell. When I got on my feet again the men had disappeared, and a wail was rising from the camp instead of the cries and shouts of a moment before. Running to where Lieutenant Holcombe lay, I found him with two cross cuts on the right side of the head exposing the brain, the sentry near him with his head hanging by a strip of skin. I ran on to the Sepoys' lines, where I found a few men firing at the retreating Nagas, and getting a rifle did what I could in revenge, which I think

nothing should satisfy for the work of that one minute of treachery, which cost us the lives of eighty men, and such a fine and kind-hearted young officer, than the extermination of the whole tribe of those who were engaged in it. I did not know till it was all over that I had not escaped scot-free, so little do sharp cuts pain at first, but I found that I had a cut on each arm and each leg, the worst on the inside of the right thigh which I expect will keep me quiet for some time to come.

My escape I can only suppose to have been through having killed the leading man attacking me with my last pistol-shot, when his second, seeing me fall and thinking I was done for, carried him off according to Naga custom. I encouraged my men; the camp was searched for wounded, arms and ammunitions; each person was told to take a little rice with him; the unwounded coolies were told off to carry the wounded and such things as it was important to save, and I called on the men to advance with me against the village. But they had been too much shaken and refused, and entreated me to lead them in the opposite direction. The Havildar, a noisy Hindustani, would do nothing to assist me in controlling them, and as whatever was to be done must be done quickly, I was obliged, which I shall always regret, to choose to retire, though now on consideration I think that that was the wisest course.

We seemed a mere handful, overladen with spare ammunition and encumbered with wounded and coolies, and the arguments against attacking the place, that more than half the guns had been taken, that we were nearly all wounded, and that the village would have been specially prepared for defence, were not to be answered. There was a spur to the west leading down to the Disang, above where we crossed it on our march from Sanua to Ninu, which was for the most part cleared for cultivation, and I saw my way to getting by a pretty open route up to and past Sanua. The Nagas followed and surrounded us, but we killed some and drove them off, and dispersed a last party who were making a rush at us, when we reached the wide bed of the Disang, after which we saw no more of them, which I think proves my suspicion that an ambush was prepared for us on the direct path to be correct.

The march along the winding stony river was most slow and toilsome, and we did not get to the Sanua spur till nightfall. Two of the wounded had died on the way. We cut our path for some way through the jungle to where the spur was clear, and after following the cultivation path some way, turned to the left to pass under Sanua: all this took up much time. The jungle was thick, and the side of the hill very steep and of loose slippery shale, and when the morning star rose, I saw that it would be impossible to pass unobserved, so gave the party an hour's sleep. At dawn we took up a good position near the village, and were soon seen from all sides. The Sanua men swarmed down, but I warned them, through a Naga with me, not to come near, and they gave way as we went on. They tried to persuade me to pass through the village, even going through the pantonmime of executing their headmen to induce me to do so. Passing round the village we found at our old camp a khalasi and three coolies of the party who had brought up a post. Here I had intended to have halted and waited for relief, sending off the wounded, but fortunately one of the three coolies was strong enough to carry me, which was most fortunate, as my wounds had become most painful and stiff, and had given me fever and a swelling in the groin, so that I could not have walked further. So after resting from 8 to 2, we marched and encamped near Bor-Bánsang. On the 4th we passed through Bor-Bánsang and Bormuthun (where we got food for the first time); continuing through the night we reached Borwasali on the afternoon of the 5th, and arrived at Jaipur next day.

Here the wounded were attended to by Dr. McKay of the 44th from Dibrugarh. One of my khalasis died on the night of the 6th, and several others, sepoys, carriers, and a servant are, I am grieved to say, beyond recovery. I append a list of the party as it went in and as it returned:—

	No.	Killed.	Wounded.	Unwounded.
	1st February.	2nd February.	7th February.	7th February.
Officers	2	1	1	0
Jemadar, 44th Regiment	1	1	0	0
Havildars „	2	1	0	1
Naiks „	2	0	2	0
Bugler „	1	1	0	0
Sepoys „	36	7	9	20
Havildars, Police	1	1	0	0
Sepoys, „	11	7	0	4
Native Doctor	1	1	0	0
Baboo	1	0	1	0
Weighman	1	0	0	1
Survey Khalasis	8	4	2	2
Khasia Coolies	79	37	25	17
Goorkh „	26	4	3	19
Naga „	16	12	2	2
Duanies	4	2	2	0
Servants	5	1	4	0
Total	197	80	51	66

This shows the state on the 7th February. The attack was a preconcerted plan of the Sanua and Ninu people, who were assisted by men from Noka (a Ninu village), as I heard when returning from Nion. My escape without attack from Sanua I attribute to my having said that I intended to halt at the camp near for several days. I hear that Sanua had sent to a fifth village close by, who had agreed to help in destroying us, and they probably consider my having marched the same afternoon a stratagem. They soon discovered that we had gone, and some of them followed us shouting. I hope that the punishment of these people will soon be taken up, but it can only be done thoroughly, I think, in one way. To burn their villages will be nothing to them in comparison to their having taken 75 heads and 30 guns and ammunition and other spoil. They would leave their villages on the advance of a force and not one would be killed. A hundred men should occupy Ninu or Sanua for two months, a hundred more in parties of twenty-five should escort provisions from Borwasali, forcing the Nagas of the other village to provide the carriage (for which they should be paid), and a price should be offered for every head brought in. Mr. Chennell can, if permitted, accompany the force sent in and continue my work. I am sending a copy of this letter to the Secretary to the Chief Commissioner, Assam.

Extract from the Narrative Report of LIEUTENANT R. G. WOODTHORPE, R. E., *Assistant Superintendent, No. 6 Topographical Party, Naga Hills Expeditionary Survey.*

We arrived at the Ghât near Negheri Ting on the afternoon of the 31st November, and as in order to reach the mainland two large unfordable creeks had to be crossed, and but a limited number of boats being obtainable (these having been kindly sent to help us by a planter), it was dark before all the coolies had been crossed over the first. The road thence lay through very tall and tangled grass jungle, and was a mere track; it was therefore useless for the coolies to attempt it in the dark, and camp was formed on the bank, and next day at noon every one reached Negheri Ting, and on the 2nd December went on to Golaghat, where I found a guard of the Naga Hills police awaiting my arrival. I halted for two days collecting supplies, &c., and making all necessary arrangements for a start. The husked rice sold in the bazar being obtainable only at very high rates, I sent out to the villages around for unhusked rice and had it pounded out, and thus was enabled to let my men have it at a rate of Rs. 2-8 a maund. On the 4th Mr. McCay left me for Samaguting, as it was no use taking him with me, and he could be more usefully employed in renewing the signals on Kadiuba H. S. and Phegi H. S. On the 5th I started for Jamuguri, where we picked up the Kotoki (guide and interpreter), and the next day entered and camped in the midst of the broad belt of thick forest jungle lying between the hills and cultivated portions of the plains. Another day's march through the unvaryingly monotonous and gloomy forest along a path whose obscurity baffled even our guide occasionally brought us to the foot of the hills, and early next morning we arrived at Khabonggaon, so called by the Assamese, and Yembarasa by the Nagas, and proceeded along the ridge through Bhandari to Heligaon, encamping beneath the latter village. I was the first European who had visited these villages since Brodie was there, now many years ago, and his camping grounds were pointed out to me by the headman of Bhandari who accompanied me that day, sitting near me when I was at work and talking to his friends (for my special benefit) of the presents he had received from Brodie's party. "Besides cloths, sola topees, &c.," he said "one Sahib gave me Rs. 100; another filled my two hands joined as I held them out; as for this Sahib he has not promised me anything yet, but for his name's sake, he cannot give less than Brodie." He was therefore disappointed the next morning when I told him that I did not consider that my mere visit to his village gave him any claim on me for presents, and that unless he assisted me in some substantial manner, he would get nothing. He then left. He had previously endeavoured to persuade me to return again at once to the plains, saying of the other villages I proposed to visit—"Oh, they are Abori Biboris, if they see white cloth houses" (my water-proof sheet and Khalasi's shuldari) "they will come down and cut you all up."

At the risk of repeating what has often before been stated, but as often apparently unheeded, I must insist that there is no tribe known among the Nagas as Abor. This is an Assamese word implying "strangers," *i. e.*, men who do not go down into the plains to trade. This word is applied by the Assamese indiscriminately to all hill-men on either side of the Brahmaputra. The dwellers in the lower hills immediately bordering the plains all speak Assamese to some extent and have picked up this term, "Bibori," being an intensive of their own addition. When they wish to deter any one from going to a village they wish to keep him out of, they are sure to say—"The men there are Abors." Sometimes the very man who says so, and expresses his dread of the Abors, is the headman of the village he so characterises. To talk, therefore, of Abors and Bor Abors as separate and powerful tribes is to talk simple nonsense. The Daphla expeditionists expressed surprise at finding no apparent difference between the Abor Daphlas and the other Daphlas, but it is easy to understand the motives of the latter) the presenting the former as Abors of whom they were in dread. But to return.

found that Heligaon would be the furthest village in that direction I could visit then, it my best chance of doing what I wished, *viz.*, to reach Samaguting by continuing along r range of hills, was to return to Khabong and thence along the ridge, working west.

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This I did, and arrived at Phitagaon on the 11th December. Sonarigaon, through which we passed that day, was the largest village we had seen on that range, and occupied a very strong position, with very steep approaches on all sides; a very conspicuous feature being the long lines of granaries extending down the slopes, between which the paths passed up to the village. On the way to Phitagaon an amusing incident occurred. One evening I encamped below Rongagaon; the headman of the village came down after dark to see me. I was standing up by the fire when he arrived, and seeing my chair on the other side, he calmly drew it towards him to sit on, preparatory to opening the conversation. A Khasia standing by dexterously and promptly drew the chair away as the Naga Chief was about to place himself on it, and he sat down on the ground more suddenly than agreeably. He remarked that Brodie had never treated a "Rajah" like that, but the result was that he gave me a good supply of rice, fowls, &c., the next day. Very good, though small, oranges and sweet limes are abundant in all these villages, and the Nagas were exceedingly liberal with them to all of us.

My camp remained for three days at Phitagaon, while I visited Khorogaon, Lungkung, and Moilang, in the hope of finding some path across the Doiang, by which I might reach Mewhima and Nidzuma on the way to Samaguting. This route would have enabled me to fill in the gap that then existed in Sheet 83. I was unable to find any way across, and with our limited supplies, I did not like to endeavour to cut my way through the dense jungle and long grass. I therefore returned to Jamaguri. On my way I was walking ahead of my men along a narrow path, when I observed a small clearing to the right with a few ashes and an old bamboo cup; thinking "some Naga has cooked his food here lately," I was passing on, when a portion of the path and the whole of the artful clearing suddenly gave way, and I found myself on my head and shoulders amid a mass of *debris* at the bottom of a deer pit 8 feet deep, and wider at the bottom than the top, which was about 4 feet in diameter: some of my men soon came up, and lowering their puggris and kumurbunds hauled me out. Beyond a slight shaking, I had sustained no injury; I was less fortunate, though, three days later when I was crossing an old bridge nearly three marches from Samaguting, a portion of which snapped under my weight, and falling I sprained my ankle so severely that it was the beginning of February before I thoroughly recovered the use of my foot.

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On the 25th December, Captain Butler, Lieutenant Austin and I left Samaguting, and marching daily came up with Captain LaTouche at Tesephima on the 29th, and halting there a day to make a few necessary arrangements, we all moved into Nongsechong on the 1st January 1875. It was doubtful for some little time whether we should be peacefully received, the gates were shut and the villagers behind them in battle array; after a little parleying, however, they admitted us. The next day we halted there to send back our coolies for some baggage which had been left about half way by Naga coolies who had bolted on hearing that Nongsechong might fight. I was able to do a great deal of work in and around the village. On the 3rd we marched on to Wokha, where we had been warned to expect a very hostile reception. We arrived at noon and were quietly received, though the villagers for the most part preserved the sullen demeanour we had noticed last year, and afforded us no assistance in building huts, &c. One old fellow, the headman of Akuk, a village across the Doiang, expressed great friendship for us, but cautioned us against offending Wokha. On Captain Butler remarking that Wokha had better not offend us, he was much surprised that with our small force we could take that tone exclaiming—"What! would you fight with Wokha? then would you soon be forgotten on the earth." No actively hostile demonstrations were made against us that day beyond throwing a few stones at some coolies who went to cut bamboos close to the village, which was a large one containing 437 houses, arranged on either side of a long irregular street occupying about three-fourths of a mile in length of a very narrow ridge running down from the hill, Thebzothu, on its western side, the slopes of which are clothed with fine forest trees right down to the village. North of the village the ground falls steeply into a series of deep ravines which give rise to a broad stream flowing north into the Doiang. South of the village the ground is broken up into long, broad spurs and undulating slopes. Our camp was pitched on this side on a small grassy plateau watered by a little stream, and separated from the village by a steep rise of about 200 feet. Mr. McCay joined us on the evening of the 3rd January.

Early next morning Captains Butler and LaTouche accompanied Mr. McCay and myself to the hill above, a distance of about 3 miles and an ascent of about 1,500 feet. All our Khasia coolies went up with us, the Kukis being left to collect materials for the godowns, &c., which it was proposed to erect there. In the middle of the village on the big tree hung a head which had been taken only a few days previously from a neighbouring village, and an obliging Naga explained by pantomime to some of my Khasias the method of decapitation practised at Wokha. About 1½ P. M., Captains Butler and LaTouche started for camp, leaving us to finish our cutting and put up our mark, and half an hour later an Angami "dobashia" (interpreter) arrived breathless with a hurried note from Captain Butler asking me to go down at once with all my party to the camp, as he has just heard from Lieutenant Austin that one of our Kuki coolies had been murdered near the camp by some Nagas. Though unwillingly, as work was near completion, I at once gave the order to return, and my Khasias, suspecting something was wrong, took the precaution of arming themselves with long bamboo sticks which they cut and sharpened as they went down, and under the influence of the excite my carriers ran the whole way down with me. I had originally started in a light dooly

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it as this was found inconvenient in narrow and steep paths, I had a "Thapa," call it, made. It is constructed from a big bamboo which is split and opened out nnel-shaped basket about 4 feet high, and about 1½ from the ground. A seat is ve this, half the bamboo is cut away, the rest being left to form a back; a foot ded. One man can carry this on his back, a strap passing under the seat and ead; the occupant facing to the rear. It is astonishing how easily and safely ry any one in this way, and I soon acquired as great confidence in my carriers ny own feet in the most dangerous places. As we passed through the village it there was only one woman visible, and the men were sitting sullenly about

in camp we found that the headless corpse of the Kuki had been brought in s was being investigated. The facts were as follows. The Kukis had all gone guard to collect grass, &c., as I have before mentioned; while doing so one man d from his fellows a little way, when two young Wokha Nagas who had followed ed to him to go with them, and they would show him a good place for cutting th the usual fearlessness of a Kuki, he at once went with them into the long con- gle, and as he stooped to cut an armful, one of them dealt him a blow from rly severing his head at once, the other then completed the work, and burying arefully in a marked spot they made off. When the coolies were about to return ey missed their comrade, and instituting a search found his trunk lying as it had aptain Butler summoned the headmen of the village before him, but they at first come, and we heard that all the women and children and household goods were oved from the village—an ominous sign. Later on, however, three Chiefs and two speaking Nagas from Sanigaon came down, bringing in two fowls as presents. Captain course declined to accept them, saying that till matters had been satisfactorily o interchange of presents could take place, adding that he should be satisfied with short of the surrender of the two murderers and the head of their victim. On his they were a little disturbed, and sent off the two men to call other elders to the e; these men did not return, and having waited till dusk, the three Chiefs were allowed , with the understanding that a decided answer must be given next morning.

out 6½ P. M., we sat down to dinner, and about 7 o'clock we were started by some llowed by shouts of "Naga, Naga." We rushed out, but the night was very dark e where the camp fires shed their fitful glare over a small space around them, nothing be seen, though it was evident that the jungle surrounding us on three sides was the savages whom we expected to burst into our camp every minute. They had com- the attack by throwing large stones at the sentries, two of whom were rather severely , and were preparing to follow up with their spears when the prompt reply by fire-arms d them. Nagas always seem to think that tactics which are successful among themselves rove equally so against us; they were therefore probably not a little surprised that at st alarm we did not lose our heads and rush blindly into the jungles, where, of course, would have got the better of us. Captain Butler at once ignited a blue light round every one rallied, and a line of sepoys was drawn round the camp; Captain Butler with in LaTouche and Lieutenant Austin taking the rest of their troops with them proceeded village and fired the first houses; these, which were within 80 yards of our camp, at lighted it up and all the jungles round, and there was no further danger of not seeing ush of Nagas across the small bit of open which we were every moment expecting as bushes beyond it resounded with their war cries. My lame foot prevented my moving, I therefore remained in camp with Mr. McCay, watching the spreading flames and rolling ds of smoke above us, against which the trees covering the village ridge stood out dark clearly defined to the smallest twig. Shots fired frequently told us of the advance of our through the village, and the Nagas evidently thought it better to try and make a stand than remain watching the camp, for soon the war cries ceased in the jungles, only to doubled in the village just above us, while large pieces of rock were detached and rolled n in the hopes of injuring some of us; this they did not succeed in, as a slight hollow lay ween us and the foot of the slope into which the rocks rolled and lay. The firing con- ued for about an hour and a half when the flames had reached the furthest extremity of village, and then the sepoys returned. We did not expect the Nagas to attack us again at night, nor did they. In the morning eighteen bodies were counted about the village. Our ss, of course, was *nil*, though a constable had rather a narrow escape. A Naga bursting t of a house as the constable passed it, threw a spear at him and disappeared down the *khud*" (precipice). The spear struck one man in the chest, but being thrown hurriedly only licted a slight wound. During the day all the jungle was cleared away round the camp, and w houses near the centre of the village which had been purposely spared from the fire were closed in a strong stockade, and all the coolies, magazine and spare baggage removed there. By this means they were all placed in safety and our little camp below being left unencumbered, was easily defensible. The jungle, moreover, being cleared from the slope, paths were opened up between the camp and the stockade, and anything shouted from either place was heard without difficulty at the other.

On the 6th, two Wokha Chiefs came into camp to sue for peace; the conditions already dictated to them were repeated, and they promised compliance with them in three days.

Probably the young murderers objected to be tamely given up without another
got a large party of their friends to take the same view of the case. For, as
learned, at a big council which followed this visit of the Chiefs to us, it was
make a bold and united effort to avenge Wokha and drive us out of the co
was further resolved that this could only be done by each of the neighbou
furnishing as large a contingent as possible for this attacking force. Accor
2½ P. M. on the 10th, a shout from the stockade warned us that Nagas were se
at the same moment a deep simultaneous war cry from some 400 or 500 men t
nearness of our foes. The cry was followed up by a rush down the village on to
and towards the camp; the reception they met at both places made them retire a
they had advanced, and in a few minutes skirmishing parties followed them. Fro
we could see a small portion of the path beyond the village running round a l
and we watched the Nagas gradually emerging from the jungles below, and collec
path move slowly off; presently they came more quickly, and at last flew past, a
knew the skirmishers were not far behind. The Nagas were followed up in all dir
some little time, and ten of them paid the penalty of their boldness. We no
curiosity that most of them had covered their shields with strips of plantain bark w
them glisten most brightly; some of the shields picked up in the jungle and paang-
had been thrown down in the retreat were simply strips of this bark on a bamboo fright
I expressed my surprise at this to one of my Synteng coolies, and he said at once, ". me
"think the bullets are fire, and that if they pass through any substance full of moith
"fire is quenched and the bullet becomes harmless. In the Khasia and Jaintia war, wand
"build stockades with plantain stems in this belief." The failure of the attack on ong
convinced them of the futility of any further opposition, and on the 13th one of old
murderers was brought in. He was taken to point out the scene of the murder, and hen
where the head had been buried. The head was exhumed and brought into camp and
great joy of the Kukis, who had been vainly entreating Captain Butler to allow nd
appropriate the head of some one of the slain Nagas in exchange for that of their own
which they began to despair of recovering. Deputations from the surrounding villages ht
to visit us daily, bringing presents and ratifying their professions of friendship with as
After the attack on the 10th, Captain Butler had written off to Golaghat for reinforcer
as he had not enough men to leave a guard with Captain LaTouche sufficiently str
the then complicated state of affairs to ensure the safety of dâks, &c., the constables
panying a dâk to Tesephima having been attacked near Nongsechong on one occasion
reinforcements were a long time coming up, but as the horizon was clearing, we dete
not to wait for them, but to start as soon as possible after the second murderer was brou
I took advantage of the improved state of things to send a couple of khalasis with a
guard to Lakhuti to erect a mark there. Mr. McCay and myself in the meantime
revisited Thehzothu on two occasions and finished our clearing and what observations we
then get. The weather generally was unfavorable all the time we halted, mist and
driving across the hills almost daily; sometimes when it was dry we had a sharp fr
night, and the thermometer often went down to 33° and 54° in the night. On the 15t
second murderer was brought into camp. He, like the other, at once admitted his guil
pointed out the same spot as the scene of their crime. He was astonished at finding tha
head was not there, exclaiming that some wild animal had discovered and carried it off.
these men stated that they were instigated to the crime by the headmen of Wokha,
wished to precipitate matters, as they found we could not be made to initiate hostilities.
this time our coolies had not been idle, but had daily been employed in husking rice, w
was stored in a godown in the stockade; other houses had also been built, and everything
could leave behind was placed in them, in order to give us as many coolies as possible
carrying rice.

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The damp and cold affected our party somewhat, and one of the buglers and Capt
Butler's Madrassi cook succumbed to the effects. The loss of the latter was a serious one
us. Rice and fowls formed the principal articles of food with us, and a good cook is requi
to vary the monotony of such a diet by ingenious little culinary arts. We had been fari
better than usual in camp since the burning of Wokha, as the village was wealthy in cov
goats, fowls and pigs, and numbers were caught and killed as they prowled about. Our tar
Nagas and coolies were always on the look-out for any movement in the low jungle near th
camp which indicated the presence of pigs or goats, and these were at once hunted down
amid much encouragement from the lookers-on in camp, who, though they were too lazy t
join the chase, were not afterwards found unwilling to share the spoils.

On the 20th January we sent off all the coolies and baggage we could spare direct
Lakhuti, the headman of which had received orders to build huts for us, and marched ou
selves to Changse, very glad indeed to be once more on the move after our long period of i
action, and crossing the Doiang on the 21st arrived at Nunkum the next day about noon.
This is a fine large village, the first of the Hattigoria villages we had seen, and we were very
favorably impressed by the inhabitants who received us in a very friendly spirit. They visited
our camp in the afternoon, and appeared to think our camp fires had been lighted expressly
for them; crowding round and turning their backs to the warmth, they held up the little scraps
of cloth which with them do duty for coat-tails in the most civilised manner. I shall leave a
description of their houses, &c., for another part of the report. In the afternoon Mr. McKay

and I visited a small bare peak not far from our camp, and put up a signal there, and the next morning going there at dawn we got all our work done satisfactorily, and joined Captain Butler at Nungatong, a village four miles from Nunkum. On the 24th we crossed the Chebi River and halted at Allibar about midnight. We were aroused by a shot; this astonished us, as the villagers had received us well. The sentry who had fired said he had seen several Nagas in war dress flitting about in front of him in the moonlight, and as they took no notice of his challenge he had fired. Nothing further happened, and the villagers who came down in the morning told us the Nagas seen were men from the interior, who were returning to their village from an intended trading excursion, which had been cut short by the news that their village was to be attacked during their absence; they therefore were hastening back. On the 25th we crossed over to the outer ridge, camping at the village of Chánki on a beautiful grassy spur overlooking the valley and hills away to the east. It was, however, rather an exposed position, making great-coats and big fires necessary in the evening. The next day's march to Mekúlá was a most fatiguing one, though only about 9 miles in length. The path ran along the top of a very narrow ridge, following all its natural features, now ascending through long grass interlaced overhead about 4 feet from the ground, which annoyed and hindered our coolies greatly, now descending steeply over wet and slippery moss-grown rock, where one false step would have sent us over the precipices into unknown depths of arrie jungle below. Again, the path meandered on through tangled breaks of low thorn bus our which obscured it and tore our legs, while, to crown all, the path was thickly studded wpom- "panjis" for two-thirds of the way, necessitating continual checks to pull them up, and notwithle- standing every precaution, many of our number were wounded by them. Outside Mekola on either side of the path were very nasty pits about 5 feet deep and 3½ feet square, and bristling with "panjis" 3 feet long. These had been dug in the long grass and covered over, but their positions were perceptible to the suspicious eye and we unmasked them all. It was late when we arrived at the village, but the villagers (we were once more among Lhotas) came down and assisted us, and our camp was soon pitched. The next day we marched on to Lakhuti, where we found huts built and our coolies arrived. The reinforcements from the detachment of the 44th at Golaghat had arrived at Wokha, we heard, and as Lieutenant Austin had been very unwell from continual attacks of low fever which he could not shake off, and as we were moreover going into the low jungle-clad valley of the Disoi River through which we should have to wade a good deal, Captain Butler thought it would be advisable that Lieutenant Austin should return to Wokha to recover and rejoin us afterwards, when we returned to that place from our trip up the Patkai. This officer accordingly left us on the 28th, taking his men with him, and we halted at Lakhuti till the detachment of the 44th joined us on the 30th; in the meantime we had not been idle; we had taken observations from Lakhuti Peak and completed the plane-tabling of all the adjoining country, connecting it with the work I had already done in December.

We proceeded on the 30th January to Borágáon, and the next day to Jampang, passing through Lungitung. From Jampang we looked down the valley of the Disoi, a broad, flat valley, bounded by the high ranges on the east, and a long low range to the west, bordering the plains. This low range and the whole of the valley which in the full sun-light looked almost a dead level, was densely wooded, unenlivened with a single patch of cultivation, and no paths whatever existed through it; our only road therefore was the river itself. We left Jampang on the morning of the 2nd February and descended to the valley. The path was choked up in many places with fallen bamboos, and being very steep and slippery, our coolies were some time getting down, sliding about here and there, dropping their loads or catching them in the overarching bamboos. At the bottom we found ourselves in the Sengda, a pretty shady little stream, running beneath the overhanging bamboos and between tall, dark rocks covered with dripping moss and ferns. All these small streams in the lower hills are very deceptive; in some places they are only two or three silver threads running among the smooth stones and boulders, barely covering our ankles, broad sweeps of dry sand and pebbles occurring at every bend; a little further they suddenly deepen and widen till they are knee-deep and many feet broad with every appearance of having had a long course; a few hundred yards further still and they have shrunk again to their original dimensions. Two people crossing only such a stream at two different places would give apparently entirely contradictory accounts of its size and probable previous length of course.

After two or three hours walk down stream, we came to a junction with another, and thence the two flow on together through hot, open reaches of long grass, or shady sweeps between tall, dark trees till they meet the Rongdu flowing from the west. A long narrow tongue of sand and grass at the confluence offered good camping ground, and there we halted for the night. The next morning while the chilly mist was still low in the valley, clad in the scantiest raiment, we stepped into the still more chilly water, and after a mile of wading we found ourselves in the Disoi river, from which we had hitherto been separated by a long span from Jampang. The Disoi is a broad and tolerably deep stream, taking us above the knee throughout the day's march. When we stopped about noon for breakfast, the Nagas, who were hunting about, discovered two very fine specimens of the Iguana (water lizard); one was 6 feet 2 inches, and the other 5 feet 7 inches in length. They were black on the back with markings of yellow, and the whole of the underpart of their bodies, legs, &c., was of a most brilliant yellow. We noticed a large number of ticks on them, which were also black, with yellow markings, and were hardly distinguishable from the spots on the lizards' backs. They

were skinned and stuffed when we arrived in camp. Their flesh is much prized by the Nagas; it was beautifully clean-looking and white, like veal, with large rolls of clean fat. Our interpreters carried the whole off with lively anticipations of a delicious repast.

The next morning as we were leaving our camp on the river, a large party of Nagas, male and female, appeared suddenly round the bend of the stream above us; they seemed rather startled at first, but were speedily reassured and gave us accounts of their proceedings; they had been on a trading excursion to Jorhat, and were on their way back to their village Nunkum; we ascended the hill to the small village of Lungmi Khaba, and having visited Japu, crossed the valley to Chotemsen. The ascent from the Scopani river to Chotemsen was very long and steep, the road in many places being cut or built up into steps. From Chotemsen we went on next day (5th February) to Múnchíng, a short march, enabling us to put up a mark on and observe from a very good point half-way, marked on the Great Trigonometrical Survey charts as L2. On the 6th, passing through Búragáon or Dibúá, we crossed the valley of the Tirú, and after another steep and very hot ascent through bare dry fields, the glare from which was very distressing, we found ourselves late in the afternoon at Assiringia. The Nagas themselves looked upon that as rather a pull-up, and some I passed takir ; a rest asked me in Assamese: "Do you call this a hill or not?" These men were some large trading party from a village in the interior called Lungchung. They were very .ious that we should go to their village, the headman saying to Captain Butler,—"We are our way to Jorhat, but if you will pay us a visit we will return with you at once." Captain Butler replied that we hoped to be at their village in about ten days, but at present we were obliged to go on to Kánching. They then left us saying they should have time to get to Jorhat and back before we should be at Lúngchúng. Unfortunately circumstances which had then occurred in the Eastern Naga Hills, but of which we were still ignorant, prevented our paying them this promised visit. We halted at Assiringia on the 7th to enable me to visit the villages of Cháng-cháng and Lakhu, and complete the survey of that range towards Japu. We marched on to Kámpúngiá on the 8th; the day was very foggy, and we did very little work. Our next march was to Deká Haimong, and as we were running short of supplies, two villages we had lately visited having been unable to give as much rice as we required, Captain Butler determined not to remain at Kámpúngia, but to go on to Deka Haimong, whence he could send down to Amgúri tea garden for rice to fill up all our spare bags, a proceeding all the more necessary, as you had told us that in the country we were about to visit, no rice was grown, the Nagas there subsisting principally on "katchus" (a species of yam).

I found that three young planters from Amguri had just arrived to spend a day in camp with us; we were very pleased to see them, and not less so, as they brought up a large supply of beer, potatoes, cabbages, and other vegetables for us, all of which were absolute luxuries to us, and a pleasing change on the monotony of "kutchus", the only kind of vegetable we can rely on getting in these hills. We should have been a very happy party had they not also brought up the news of the sad disaster to the other survey party, of which only vague accounts had then reached Amgúri, the only thing certain being that poor Holcombe was killed. No one knew where the attack had been made, nor what had become of you. On the 11th I visited the mark which Mr. McCay had put up, and in the afternoon went to Bárú Haimong. On the 12th Captain Butler having arranged the day before for dâks from Amgúrí, started for Sibságar to find out further particulars of the massacre and to offer the services of our party if required to assist your party. He returned again on the 13th, but the same evening's dâk brought letters from the Chief Commissioner, the contents of which made Captain Butler anxious to see him if possible, and on the 14th he again started for Sibságar, remaining there till the 17th. Mr. McCay and myself had taken all our observations and finished all the plane-tabling we could get in the neighbourhood by that date. Captain Butler brought with him instructions to close our survey work and join the punitive expedition about to proceed against the Eastern Nagas.

In the evening our coolies celebrated the order to march by a grand dance before our camp fire. The Khasias first set the example; two or three of the youngest personated females, arranging their clothes in admirable imitation of the Khasia women's dress, and demurely casting down their eyes began the dance *à la femme*. The motion is very slow, the body and arms being kept perfectly steady, and the feet seeming to ripple about; a dozen men danced round these ladies with a much more energetic movement of arms and legs, waving cloths in the air and at intervals bursting into a few wild snatches of song. While this was going on, we heard the notes of a small drum accompanied by low deep singing, rather chaunting, gradually approaching, and I recognized these sounds as the prelude to a Kúki dance, the Lushais having once favoured us with an entertainment. The Kúkis to the number of about 150 came slowly, but irresistibly onwards, swamping two unfortunate Khasias, who from performers suddenly found themselves deposed to spectators. Only three Kukis engaged in the dance, all the rest standing round, beating the drums (which they had borrowed from the villagers with whom our coolies had become extremely friendly) and keeping up a continuous and slightly monotonous but singularly impressive chant the whole time. The performers were supposed to be two women and one man; the latter danced face to face with one of the women, while the other kept close behind him, following his every movement apparently with the object of not being seen by him. Whether—she was supposed to be his wife—jealously watching his flirtations with the other *danseuse*, or his mother interested in the success of her

son's courtship, I did not discover. After some time the music and dancing became quicker, and at length amid shouts which were interpreted to mean "let them be united" the performance came to a close. The night was very fine with a bright moon, and the scene was a most picturesque one, the moon-light and fire-light struggling together on the crowd of figures, representations of many tribes and races in the foreground, the quiet village with its tall "morangs" standing up above them sharply defined against the clear sky. The Kúkis drummed themselves back again to their huts just within the stockade, and soon all was still, save when at intervals during the night the village watchers sounded the big drum. They say this is beaten occasionally in case any enemy is approaching to attack the village. On hearing the drum the foe remarks: "They are on the alert there, it's no use going on any further to-night," and returns to his own village.

On the 18th February we marched out of Deká Haimong to Náogáon, and the next day arrived at Kanching and visited your mark there in the afternoon, getting a few observations. The next morning, having explored the range west from Kanching for about 4 miles, I returned and descended to Gelekie tea garden; here I met Mr. McCay, who had been to take an angle at the Kánching H. S., which we had not been able to observe the night before, and after being hospitably entertained by the gentleman in charge of the gardens, we went on together to Názerá where we found Captain Butler. The next day we continued our march and arrived at Borúarchati on the 24th February. The kind assistance of all the planters along our route, who each and all helped us in many possible ways, alone enabled our coolies to accomplish the long and trying marches in so short a time, the road in many places being ankle-deep in mud.

Arrived at Burúarchati we found that the troops would not be there before the 1st March. Major Tulloch with a detachment of the 44th Regt. had been there some time, and huts and lines had been built in a large open rice-field which even then was sloppy in many places and moist in all. I received letters from you, telling me that you had obtained permission for Mr. Chennell to accompany the troops, and that he would join me when the troops marched in, bringing with him the plane-tables, &c., necessary to carry on the survey of the Eastern Naga Hills. Captain Butler went into Dibrúgarh on the 25th and returned on the 28th, and hearing from him that he had not seen Mr. Chennell with the troops, I walked into Jaipúr, at which place the latter were to arrive that day to find out where he was and make arrangements for his following me into the hills. Captain Butler was going on to Bor Mútan ahead of the troops, and I was anxious to join him there as soon as possible, as there was much to be done in that immediate neighbourhood. Arrived at Jaipúr I found, to my relief, that Mr. Chennell had overtaken the troops and was there. The Chief Commissioner's orders were that the survey party could go on only if our coolies were not required by the military, in which case we were to remain in the plains making over our Khasias to the troops. At first permission to go into the hills had only been accorded in any case to Mr. Chennell and myself, but there was nothing for Mr. McCay to do elsewhere, as all survey work had been stopped, and I could not obtain permission for him even to survey the small gap near Samaguting. While at Jaipúr I had an opportunity of talking all these matters over with Colonel Nuttall, whom I found in command, and I was very glad to hear that I should be able to keep as many coolies as I required for myself. Mr. Chennell and Mr. McCay, for whom I also obtained permission to accompany us, and I gave him a board on the quarter-inch scale, as we did not know how far we might go in after the offending tribes, and it was just possible that we might be able to ascend some of the Patkai peaks of the Patkai.

I returned to Búrúarchati on the 1st, and on the 2nd we marched to Bor Mútan, where Colonel Nuttall and Major Heathcote, Assistant Quarter Master General, arrived the same day; the troops and Cooly Corps followed in various detachments, but unavoidable delays occurred in getting up the necessary amount of supplies, and we remained at Bor Mútan till the 13th March. The time, however, as far as the survey was concerned, was anything but wasted. We accompanied Captain Butler one day to Bor Bansang, and as the day was a very clear one, we did a good deal. On other days we visited two villages of Khúlan Mútan, Hora Mútan, Nokphan, &c., and put up a mark on one hill. I had hoped with this and one other station to have been able to connect your triangulation with that of Captain Samuells' of the previous season, but unfortunately you had been unable to observe a few necessary angles from Joboka, &c. Owing to the absence then of signals ahead, the orders against the survey leaving the line of march were so very strict, that we were unable to take these angles ourselves, and so we were obliged to leave the trigonometrical connection for a more convenient season.

On the 13th March, a very wet and cold day, we marched to Bor Bansang. Huts had been built for us by the villagers who evinced great friendliness, and on the following morning a large number assembled to see us start. It was very doubtful whether we should be opposed or not at Senua, which was to be our halting place that night, but the Bansang Chief went through an expressive pantomime, intimating that the Senua men would shoot us with guns, bows and arrows, that they would spear us and cut off our heads, but that he had no fear for our ultimate success, and saw us depart with a farewell flourish of his arms, which, being interpreted, meant "go in and win." We marched on and on through open fields and jungly ravines without seeing anything of our foe and passed the old survey camp, several huts in which were still standing, and on the hill to the left the mark put up by you was to our astonishment still

intact. About midday we arrived within hail of the village, and came suddenly upon a party of Nagas, who cried. "Is it pence?" to which the reply was a demand for the Chief of Senua to appear before Colonel Nuttall. This they promised he should do, and we halted. After some time, Sombang, the Vangam or Chief, appeared and came down to where we were. He was questioned about the massacre, and admitted that five men of Senua had been concerned, but contrary to his orders, in the tragedy at Ninu, and had brought back four guns, but no heads. He added that he had prevented a party of coolies with russad and dâks for the survey from going on to Ninu on the morning of the 2nd February, and had thus saved them from destruction. Colonel Nuttall and Captain Butler had from previous evidence decided that Senua had not as a village been concerned in the massacre, and that if we were not opposed here, the surrender of the five men and the four guns would be sufficient punishment. These terms were explained to the Chief, who promised to comply with them, and sent back two men who had come down with him to the village, he himself being detained. Senua is situated on a very strong and commanding position, the ground falling precipitously 300 or 400 feet on three sides. On the north and west, the ground below this fall is gently undulating, and here we were halted, and we could see that the approaches to the village had been strongly stockaded, and behind each defence large numbers of fully armed men were collected and especially on what might be called the citadel, where the Chief's large house stood, on the highest part of the village, a fine plateau of rock capable of a very strong defence being almost inaccessible on three sides and shelving away gradually to the fields on the fourth. We waited nearly for about an hour and a half, during which time the Chief shouted pathetic appeals to his men to do what he had promised and procure his release, but without avail, and so we received the order to advance on the village. Colonel Nuttall with the 44th and Naga Police advancing by the north, and Colonel Sherriff with the 42nd making a detour to the west, to take the village in flank in case of opposition. The former route was a very difficult one, two strong stockades having to be broken through and two nasty *panjied* ditches to be crossed, but at length we reached the village, the Nagas falling back to the high plateau before mentioned. Further parley ensued without any better result, and we finally took possession of the plateau, the villagers retreating to the jungles; Colonel Sherriff had got round quickly by a comparatively easy path and joined us on the plateau, many of the houses on which had a deserted appearance; probably the owners who had built temporary huts in the jungles, not knowing how things might go with their villages, had left them at the first intimation of the preparations at Baruarchatí. Camp was formed at once, some of the houses being told off for the sepoys and coolies, and others on the slope pulled down to prevent surprise from that side. Under the big tree in the centre of our camp we found six heads in a row of small baskets set upon bamboos. Adal Sing, your chuprassi, told us they were there when you passed through Senua, and a closer examination revealing tattood faces showed that they were Naga heads. We got a little work done this afternoon from a small hill near Senua, whence we could see all the implicated villages.

We halted at Senua on the 15th; it was showery and foggy all day. During the morning three guns were sent in by the villagers, and a man coming in with food for the Chief was recognised as one of the offenders and secured, and later on, the Borduarias and Námsángias (many of whom were accompanying us as guides, &c., captured Nokdon, or leader in the attack of the 2nd February) and another. Adal Sing on that day had escaped a blow aimed at his head in a most wonderful manner, the dáo slung off only a small patch of skin and with it the sacred tuft. When Nokdon was brought in, Adal Sing went up to him, showed him the scar on his head, then turning round shook his fist in Nokdon's face, and by an unmistakeable piece of pantomime expressed to Nokdon his hope that he would be hanged, then he returned with a satisfied air to his breakfast. Nokdon pointed out Lieutenant Holcombe's double-barrelled gun concealed in some grass hard by. The Senua Chief was granted his liberty during the day, with the understanding that he was to bring in the other men on our return to Senua, which place was to be held during our absence by Lieutenant Abbott with 80 men of the 42nd.

The 16th February dawned dark and wet, and as light increased there seemed little chance of any break in the steady down-pour for several hours at least. About 8 o'clock the troops marched out of the village to the Dili River, which we reached about 11 A. M. It was very much swollen, and the turbid waters were rushing angrily past the low, stony tongue on which we assembled, gazing despairingly at the torrent through which it was impossible to wade. Some rafts were moored on the other side, apparently having been used by Nagas to cross on in the early morning, and one of the head-constables volunteered to swim across and bring them back. He got over safely, but failed to steer the raft back through the fierce current, and had to abandon it and save himself by swimming. He was joined by several more volunteers, and other attempts were made unsuccessfully to get the rafts back. They tried next to fell a tree, which if it had fallen across the stream would have given us some foundation for a temporary causeway; but the task was too much for them with their small numbers and having only one hatchet with them. After they had worked for several hours, at the end of which the rain was coming down more pitilessly than ever, and the river having risen two feet since our arrival, Colonel Nuttall decided to return to Senua. The order was given to the six men on the other bank to return, and they got on to the remaining raft and prepared to obey. The raft came down with tremendous velocity, and as the men neared us, who were anxiously watching them, they threw themselves off and

struck out for the shore, which they all reached, except one poor fellow, who lost his head, or was disabled by striking something, for he turned back as if to regain the raft, and was swept away beyond chance of help notwithstanding all our endeavours to save him.

On the 17th the sun at length came out, and a large working-party was sent down to try and construct some sort of bridge across the stream. Sending Messrs. Chennell and McCay up to the Senua mark to observe and do what plane-tabling they could from there, I went down to the river with Lieutenant Macgregor, 44th, in charge of the working-parties, to assist him in making the bridge. We found that the river had fallen considerably, and about two hundred yards above the point where we had attempted to cross the day before were the remains of an old fishing weir: three large portions of it, one at either bank and one near the middle, still existed, and having stood the rush of the day before, afforded a good basis on which to work. I saw that the only possible bridge was a trestle one, and I explained my views to Korom Sing, the head-constable, and he said if I would leave it to him and the other constables (all of whom are by nature and habit very clever at this sort of work), he thought he could do it. Working-parties were at once told off to get the necessary materials, and the constables, and sometimes Nagas, set to work. The *modus operandi* was as follow. A very short distance in front of the pier, formed by the standing portion of the weir, a strong stake was driven to which two stout bamboos were lashed, the inner ends being firmly secured to the weir, the bamboos being run out horizontally and about 2 feet apart one above the other. These afforded supports to a man while driving another stake in advance of the first, the bamboos being lashed to this stake, and so on each stake being strengthened by other men working behind. A similar process was carried on about 6 feet higher up the river, and when these parallel lines were sufficiently advanced, they were connected by cross-pieces, and a rough roadway constructed, and about 4 P. M. we had got a slight frame-work across to the centre piece of the weir. At 4½, the working-parties were marched up again to Senna, a long and trying ascent; a small guard was left to protect the bridge during the night. A heavy storm came on at 9 P. M., and made us tremble for the work, but fortunately it did not last very long.

On the 18th March, a beautifully fine day, all the troops were once more marched down to the river, and on a flat-open bit of ground close to the bridge camp was formed, and as the river was still unfordable, working-parties were at once detailed to continue the bridge and strengthen that portion already made, and to collect materials, &c. Soon after our arrival the Nagas opened fire on us from the opposite side, fortunately without damage to us, and being promptly replied to were soon silenced and work proceeded. Every one worked well, being anxious to reach the opposite bank, whence Ninu was distant only a three hours' march, and by evening the bridge was "*un fait accompli*," and a picket was posted on the opposite bank, and early next morning the march on Ninu commenced. A small stream rising close to Ninu flowed into the Dili, just opposite our camp, dividing two long spurs, which forked at the village, a path running along the ridge of each. It had been decided that a column should advance by each of these spurs, taking care to arrive at the village together. The coolies followed under a strong escort, in order to leave this attacking force free. Colonel Nuttal with the 44th under Colonel Cory, and Captain Butler with his police took the eastern route; Colonel Sheriff with the 42nd taking the western route.

As we marched along under a burning sun, we saw large numbers of Nagas, in full war dress, coming down through the fields on our left, from Lonkai. We turned a corner, and found ourselves only half mile from Ninu, which the long grass had hitherto hidden from our sight. As we continued on our way, a column of smoke rose slowly from some houses in front of us; at first we thought that the enemy intended burning their own village, and not making any stand, but seeing that these houses were a few detached from the main village, which would have afforded shelter to our skirmishers covering the attacking party, on the very strong stockade which surrounded the village itself, we gave them credit for their military skill, and hoped they intended to make a good defence, which hope was strengthened by their calling out "come on; we are quite ready for you," and at once opening fire on us. We had caught glimpses of the 42nd approaching up the other spur; they arrived almost as soon as we did, and were received on their side by a body of Nagas stationed outside the stockade with a volley. When we, on our side, were close up to the stockade the firing ceased, and again an ominous cloud of smoke, followed at once by flames rose again, this time within the stockade, which the Nagas had now abandoned. Had they stood up a little more boldly and fired more carefully, we must have suffered severely, as our advance was necessarily made over open ground, up very steep approaches, very thickly planted with "panjees." We clambered over the stockade without delay, but the Nagas were quicker, and before half-a-dozen of us were over, the greater portion of the village was in flames, the Nagas dispersing in every direction. After the fierce heat of the sun, the change to the fiercer heat of the burning houses closely built was not a pleasant one, and we ran through the village as rapidly as possible, our pace being accelerated every now and then as some large house subsided suddenly, threatening to involve us in its fall, and covering us with a shower of fire brands, while the hot, pungent smoke blinded us. At last we were once more clear of the village, and could see the Nagas rapidly retreating along all the slopes in the direction of Nisa, a village four miles distant from Ninu.

The scenery was magnificent; a high, darkly-wooded range behind Ninu descends abruptly for about 1,500 feet, when it suddenly changes its precipices for beautiful open, undulating

country, well watered by a succession of clear, babbling streams, at the cool waters of which, in the deep shade of clumps of trees, dotted along their banks, magnificent "methna" quench their thirst; across the Dilli, into which these streams all flow, rise other lofty hills wooded along the ridges, but cultivated below on the more gentle slopes, over which the cloud-shadows are lazily moving, and on which numerous villages glitter brightly. To our left the high peaks of the Patkai range lose their outline in the hot and hazy atmosphere; it is a beautiful country and to-day basking in the still sunlight all is so calm and peaceful before us, it would seem almost impossible that treachery and murder could find a place here; but the black cloud already darkening the sky and changing the blue of the air to a murky brown; the roar of the flames and crashing of timbers behind us, and the thought of the scene of the massacre, which is still before us, remind us of the eternal truth that even in earth's fairest spots the fiercest passions of man may make their home.

Half a mile from the village, we came upon the dreadful spot where the bodies, now little more than skeletons, of our poor friend and his ill-fated companions were still lying in every direction, and our imaginations pictured the fearful incidents of that February morning. Here I joined Major Heathcote and Captain Butler, and with about sixty sepoys we at once followed up the retreating Nagas to Nisa, which they also fired, escaping into the deep ravines beyond, whither pursuit was useless. Colonels Nuttall and Cory with the 44th, Lieutenant Macgregor, Messrs. Chennell and McCay, also came on to Nisa, the rest of the troops under Colonel Sheriff remaining at Ninu. It was fortunate for us that a few houses had escaped the flames in Nisa, as most severe hail storms raged during the night, against which waterproof sheets would have been as great a protection as brown paper. In the morning all the gutters and ditches in and about the village were full of large hail stones, and when we climbed to the hill tops in the afternoon, we found them still covered to the depth of several inches, and some of the ravines were filled to a depth of two feet in many places. Small detached parties were out all that afternoon, from Nisa, scouring the jungles all round, climbing up and down in the dense forest which clothed the precipitous faces of the hills, and coming suddenly in the most unexpected places on Naga encampments, sometimes even catching the men engaged in cooking operations. The closeness of the trees and undergrowth saved them from any great loss, though occasionally a quick-eyed sepoy would bowl one over. In some of the huts we found little dogs sleeping calmly before the fires, and in the paths were bamboos of water hastily put down by those who had been carrying them. In one encampment the Nagas had not time to carry off one old woman, but left her in a hollow tree. From all which it will appear that the Nagas imagined themselves perfectly safe in these retreats to which they had removed their property, and never expected us there. While we were thus engaged at Nisa, Colonel Sheriff marched against and burnt Lonkai.

On the 21st the Nisa column started for Kamhua. We had a very long and steep descent to the river, and another long pull-up to Kamhua under a very hot sun. We arrived at the first village about 11; the Nagas, as usual, made a very faint show of resistance and we soon entered and burnt it. In the big tree we found a head recognised by the Khasias as one of their race. We proceeded on to the second village and burnt that also without opposition. These villages are well placed on a long spur from the Patkai, and from several knolls and fields I was able to fill in a good deal. We got back soon after dusk to Nisa. Dr. White at Ninu had been busy examining and classifying the heads, seventy-one in number, which were found in a long basket in the sacred grove in that village, and he came to the conclusion that all of them had been taken after the massacre from our unfortunate people. These heads and all the bones found on the site of the camp were collected and burnt and the ashes buried. On the 24th, I accompanied Captain Butler to Voka, a village close to Patkai, and I managed to complete our work up to that range in this direction. The Voka men received us in a very friendly manner indeed. On the 26th we all left Nisa and joined the others at Ninu. By this time Kaimoi had also been burned, Kamhua, Lonkai, &c., revisited, and all the jungles thoroughly scoured, and much of the stolen property recovered. In holes, in trees and such hiding places, we found gongs, sepoys' cooking-pots, waterproof sheets, medals, and even rupees and halves of currency notes, so thorough was the search. The guns were evidently objects of their most jealous care, for we never found one, though we came across small packets of ammunition once or twice. A large number of women and children were captured from time to time, but of course they were released, and though on the first occasion they expected instant death, one, a Nisa woman, requesting that she might be cut up on the site of her own house which she pointed out, yet the news that we respected women and children (though they probably looked on us as fools for doing so) soon spread in the jungles, and I believe the women came to regard a capture as a pleasing little excitement, affording them an opportunity of seeing what manner of men their captors were.

We remained at Ninu till the 31st, and while there I one day visited Khānu and squared up all my work there, the day being exceptionally fine. While we were at Ninu, several guns, including Captain Badgley's double barrelled rifle and some sepoys' property, were sent in from time to time,—the Nagas bringing them to an open spot on the road through some cultivation which was visible from the camp, and deposited them there, retreating precipitately as our men went forward to take possession. On the 31st March we all returned to Senua, and on the 1st April, Niaonu was attacked and burnt, and on the 2nd Mr. Chennell and I visited Niáosá about 4 miles beyond Niaonu and finished our work in that direction. We saw a large number of fully armed Nagas on a spur leading down from the village. We

shouted to them that ours was a friendly visit—to which they replied—"If you are friends do not come near us or our village, but go back at once." We told them that we must go to the village, but that no harm should be done to it or them. They expressed their satisfaction at this, but kept at a respectful distance the whole time. On the 3rd Messrs. Chennell, McCay and I marched into Bor Mútan, the troops halting one night at Bor Bansang; went into Bor Mutan on the 4th, and on the 7th the last detachment marched out of that camp. Captain Butler and my party halted at Halwagaon at the foot of the hills that night, going on to Borúárcháti the next day and leaving that place again on the 9th, and marching daily arrived at Dibrugarh on the 11th. Owing to the continuous and heavy rain which had fallen since the beginning of March, the roads between Borúárcháti and Dibrugarh were in a dreadful state, being ankle-deep in mud in the better parts, and in many nearly knee-deep. The coolies consequently had a hard time of it, and many falls resulted, the men and their loads undistinguishable from each other, coming into camp, walking mud heaps.

We joined you at Dibrugarh and leaving in the River Steamer *Oude* on the 15th, reached Negheri Ting on the 17th. Here Captain Butler left us and with him Mr. McCay, whom I had deputed to finish that small gap in Sheet 83, "which had so long and so inconveniently defied us." This, I am happy to say, he satisfactorily accomplished. On the 20th we reached Gauhati, arriving in Shillong on the 23rd.

I append some notes on the tribes and country visited by us. These have, in the main, appeared in Captain Butler's reports to the Chief Commissioner of Assam, already published.

Notes descriptive of the country and people in Western and Eastern Naga Hills, by Lieut. Woodthorpe, R. E., *dated 1st August* 1875.

Our own especial work this season, owing to our not getting beyond the outer ranges, did not take us into any very elevated country, the greatest height visited being Thebzodhu (6,600 feet). The average of the other ranges was about 3,800 feet. These ranges all run remarkably parallel to each other. The valleys are open and cultivated, while the tops of the ridges, as a rule, are very narrow and clothed with long grass jungle. The valley of the Disoi river is very low, flat and densely covered with large forest trees, and is separated by a very low, wooded and uninhabited range from the plains beyond. In former days this valley used to be visited by Assamese to work for gold in the river of the Disoi, but the quantity of gold obtained was not, I believe, sufficient to repay the labour of washing it. Many fine rubber trees grow on the banks of the river, some of which have been ruthlessly cut down for the sake of the rubber.

All the outer ranges of hills are of sandstone, the strata dipping at a very great angle, frequently nearly vertically, and the strike following the general direction of the ranges. In many of the villages the hard stratified rock crops up in a series of knife-like edges, making walking exceedingly difficult, and exciting wonder as to how the stability of the houses can be secured. The northern face of all these ranges is most precipitous, falling nearly perpendicularly for several hundred feet, and making the approach to the villages from that side very steep and difficult.

After leaving the Wokha men and the other Lhota Nagas who have already been described by me (*vide* my report of last year, dated Shillong, the 29th April 1874), we passed through and saw numbers of three tribes, *viz.*, Hattigorias, Dupdorias and Assiringias. The principal differences between these three are linguistic; but, though all are far superior to the Lhotas in physique, manner, bearing, and in the general well-to-do appearance of their villages, yet the Hattigorias bear off the palm in all these characteristics. Both the men and women, next to the Angamies, are the best looking, best built, and most pleasing of the Naga tribes I have yet seen. The women are especially remarkable for their good looks, many retaining them even in middle age. The dress of the three tribes is the same, consisting for the males of a small waist-cloth tied at the back end, being brought round between the legs and drawn up under the waist-belt, falls in front in a broad flap. These cloths are of various colours and patterns, from dark blue with white stripes, to white with variegated patterns of black, or black and crimson. The Dupdorias fix small stripes of brass in clusters down the edges of their flaps, apparently to give them additional weight. The broad dark blue or back flap adorned with cowries is also common among these tribes in full dress. The general decorations are the same as those described last year as being worn by the non-kilted tribes, such as the bearskin coronet, cotton wool bindings for the hair, and puffs for the ears, necklaces, &c. There is one common ornament worn suspended on the chest, which I think I have not described before; it is a long flat strip of wood about 15 inches long, narrow in the middle, but broadening slightly towards the ends, and covered with coloured canework, cowries or white seeds, and adorned with a fringe of long red-hair. Two broad red and blue sashes, also fringed with hair, support at the back the "dáo," and a small bucket for carrying "panjies." The spears are generally similar to those found at Primi. The "dáos" among the Hattgorias and Dupdorias are small handled, like the Angamies; but among the Assiringias are found an approach to the long, hair-tufted handles and broad blades common among the tribes of the Jaipur district. The shields are small, and either of canework, or else thin pieces of wood, a hide painted black with white circles and spots on their face, and occasionally decorated with plumes. The Assi-

ringias wear, in war dress, tall conical helmets, adorned with boar's tusks and two straight plumes of hair, one on each side, leaving the apex of the helmet bare. The clothes of these three tribes are many-coloured, and seem to be used indiscriminately, according to the taste of the wearer, rather than as denoting tribal distinctions. They are dark blue, with red and white stripes, or dark blue only, or red only, red and blue, &c., &c., and are frequently adorned by tufts of crimson and white hair, sewn in rows at intervals along the stripes of the cloth.

The women's dress consists of a small petticoat of dark blue, a cloth of the same colour being thrown over the shoulders. They wear large brass rings on each brow, supported by a string passing round the head. Sometimes these rings pass through the upper portion of the ear, but generally they simply hang on the temples. The lobe of the ear supports large thick, oval, or oblong-shaped pieces of a crystal obtained from the plains. The women all tattoo slightly, four lines are drawn on the chin, the outer ones being tattooed from the corners of the mouth; the front of the throat has a few crossed lines on it, three arrow-head shaped lines are tattooed on each breast running up to the shoulders, and a fine diamond pattern runs down the centre of the stomach. The calf of the leg from about three inches below the knee is also tattooed with diagonal lines, the space between the highest and the knee is filled up with a few vertical lines ending at the knee in arrow-heads or stars. The wrists are also frequently tattooed with stars and stripes. The women's necklaces are, as usual, beads or large pieces of shell strung on cotton thread.

The pipes smoked by both men and women are of the ordinary shape, though sometimes a small bamboo receptacle is fitted below the bowl to catch the tobacco-juice.

The villages, as a rule, occupy the most commanding points along the ridges, and the approaches to them are exceedingly pretty. Broad roads, bordered with grass and low shrubs, lead up through avenues of fine trees to the main entrance, which is generally very strongly guarded by two or three panjied ditches, running right across the ridge, and stockaded on the inner bank. The stockades are strongly built of a double line of posts, supporting a wall of interlaced bamboo, and are capable of offering a good resistance. The outermost ditch is generally about 200 or 300 yards, or even more, from the village, the second being situated between it and the one enclosing the village. The gate through the stockade of this last ditch into the village is cut out of one huge block, and is frequently four or five feet broad and about six feet high. A large gable roof is constructed over it, giving it a great resemblance to our own old lychgates at home. Look-outs are built commanding the entrance, and in some cases little huts are constructed in large trees outside the most advanced stockades on the main roads, communications being preserved with the interior by means of long ladders and causeways Passing through the gate into the village, we find ourselves before the "morang," or bachelors' house, a large and most peculiar-looking building, appearing to be all roof, which springs from a small back-gabled wall of bamboo about five feet high, and six or seven feet broad. The ridge rises rapidly from this to the front, till it attains a height from the ground of twenty-five or thirty feet, the eaves resting on the ground on either side. The front is closed in with a semicircular wall of thatch, a small door about four feet high giving admittance to the building, which, as this is generally the only opening, is necessarily somewhat dark. As the eye gets accustomed to the gloom, we find that the house is divided into two parts by a low wall formed of a log of wood, over which a thick bamboo mat is stretched. The half of the house has a matted floor, and is provided with a hearth, and planked sleeping places round it, and here the young men live; but the other half is unfloored, and is intended for the reception of casual visitors, who drop in for an hour or two only. We also make out that the principal uprights are carved with large figures of men, elephants, tigers and lizards, &c., roughly painted with the three colours common to the Naga and Garo tribes, *viz.*, black, white, and a reddish brown. Arranged round the walls are skulls of men and animals, and skilful imitations of them made by painting and cutting old gourds; these imitations are so well done that often at a little distance they pass for real skulls. The ridge of the "morang" projects a few feet in front, and is ornamented with small straw figures of men and tufts of straw placed at regular intervals. Outside each "morang" is a large platform of logs of wood, on which the young men and their friends sit and smoke through the day, and hard by is an open shed, in which stands the big drum, formed of a huge trunk hollowed out, and elaborately carved and painted in front, after the manner of the figurehead of a ship, and is furnished at the other end with a straight tail. The drum is raised from the ground, and rests on logs of wood; it is sounded by letting a heavy piece of wood fall against it, and by beating it with double headed clubs. In large villages there are two, and even three "morangs," with their drums in neighbouring sheds. The other houses in the villages are large and long, the front part resting on the ground, the back, as usual, being supported on bamboo piles, with platforms at the back and sides, on which many of the household duties are performed. There is a large open verandah in front, and the interior of the house is divided into two or three rooms. The Hattigoria houses are the largest and best built, and are arranged most regularly and closely adjacent on either side of long streets. The front gables project considerably, those of opposite houses nearly meeting over the roadway, calling to mind the appearance of a lane in some old European town, where the gabled upper stories of the houses overhang the footways. In front of the houses are rows of skulls; and in one or two of the front verandahs we notice rows of curiously carved and painted posts about three feet high. These we are told, are put up on the occasion of the owner of the house giving a big feast, and thereby proclaiming himself a man of substance.

The bodies of the dead are wrapped in mats and disposed on platforms, roofed over and fenced in, all the personal decorations and clothes of the deceased being arranged about the platform and fence. The ground around is sometimes "panjied" as a protection against the attacks of wild animals. These bodies are placed in groups along the road between the two outer stockades.

The Hattigorias, as road engineers, far surpass their neighbours. Their roads are constructed with due regard to the easiest gradient and are not carried up and down over every little hillock. The steeper parts are paved or stepped to prevent the rain washing channels in them, and in the gentler gradients cuts are made across the road at every change of inclination or direction to carry off the water down the hillside in the most scientific manner.

Altogether, I am very favourably impressed by these three tribes, and I shall be very glad if I am able on any future occasion to renew my acquaintance with, and extend my knowledge of them.

The area of the country passed through being necessarily limited, and our opportunities of observing the natives of the villages which our troops were sent to punish being few, I can only describe with any minuteness the men of the Mutan, Bor Bansang and Senua villages, premising, however, the men of Ninu and Nisa, judging from what we were able to note, do not seem to differ materially from them, and that they are all probably members of the same tribe. We were accompanied by a small detachment of Borduarias and Namsangias, of whose personal apperance and decorations I am therefore able to say something, though I had no opportunity of seeing their villages or country except from afar.

Men.

The men are of average height and nearly all well-made and well developed, and, as is the case among most hill tribes, their complexion comprises every shade of brown. These would be good looking as a rule very often, but for the tattooing on their faces which in some makes it appear perfectly black where the tattooing has been heavily done; in others the tattooing is blue, and then the bare portion of the face, especially in those of fair complexions, appears pink by contrast. The tattooing in the face, called in Naga language "ak," consist of four continuous lines carried across the forehead, round and underneath the eyes up to the nose, back over the cheeks and round the corners of the mouth to the chin; rows of spots follow the outside lines and two fine lines mark out the nose in a large diamond space. The Mutan and Senua men do not tattoo very much on the body, but their thighs are tattooed in several places with lines and spots, or diamond and egg-shaped patterns, the upper portion of the tattoo being continued round to the back.

The Namsangias and the Borduarias do not tattoo the face at all, but their shoulders, wrists, bodies and thighs are very much covered.

The men of Voka, Khanu, &c., in addition to the tattooing of the Senua men, frequently cover their chest with fine lines, either horizontal or zigzagged; all the men dress their hair apparently in the same fashion, *i. e.*, shaving that just above the ears, and taking the remainder back off the forehead and face, and tying it behind in a knot through which are passed curved strips of horn carrying waves of red and white or black hair. Some men have a small moustache, but very few show anything like a beard.

Men's dress.

The dress and decorations of all the men we saw were essentially the same, the only differences perceptible being in the style of ornamentation, differences due to the various tastes of individuals rather than to any attempt at distinction of clan or village. The helmet is conical in shape and made of plaited cane, either plain, or having patterns of colored straw worked over it. A large plume of black or red hair passes over the helmet from front to rear, and long horns carrying toucan feathers or tufts of hair spring from the sides; some helmets are covered with leopard or bear skin, and have a wreath of red or black hair round the base. Another head-dress is a circular band of colored cane and straw, ornamented with bits of a large shell and a fringe of hog's hair, which lies on the forehead. Their ear-ornaments are generally strings of beads pendant from a piece of shell, and terminating in long tufts of hair, which fall over the chest. They have a very pretty one made of alternate tufts of red, white, and black hair, radiating from a centre of yellow straw work, which is fixed in the lobe of the ear. The necklaces are beads, some of which, of a yellow opaque color, are highly valued by the Nagas. From the shoulders to the elbows the men encase their arms in many rings of red and yellow cane, very large at the shoulder, gradually decreasing to the elbow; these give an appearance of great breadth to their shoulders, an effect which is further heightened by the bands of black or yellow cane which are drawn very tightly round the waist, and this effect is still further increased by the lines drawn by the Borduarias from their breasts to their navels. One man had as many as nineteen turns round his waist, giving a total length of cane of over forty feet. It is amusing to see them winding this cane round them, and it is a matter of time to get it all properly twisted on. Large belts, very broad at the back, fastening in front, and made of plates of polished brass or of coloured cane and cowries, are also worn. A broad piece of blue cloth hangs from the waist, ornamented with red fringes and rows of white seeds; a portion of the cloth is taken up between the thighs and secured at the

back as an extra piece of decency by those who visit the plains most frequently. On the wrists are worn deep bracelets of cowries, and below the knee, strings of the same are also tightly tied. These Nagas are very skilful in devising little adornments from palm leaves, making coronets, wristbands and anklets of them. Those have a most picturesque appearance. A curious custom prevails at Voka, and I fancy also in the neighbouring villages; it is this, that till a young man is married, he goes perfectly naked, and he at once adopts a waistcloth when he takes a wife to himself. Every Naga carries about with him a small basket or bag for his food and pán, &c. In wet weather he has a cloak made of grass on a small string foundation. The large cloths worn in the cold weather are generally of Assamese silk; but at Khanu I saw a cloth of black and orange stripes, identical with those we saw last year in Thetchumi on the Lanier.

Women.

The women are short in stature generally, and their figures are remarkable rather for strength than beauty, to which very few have any pretensions. They tattoo a good deal on the shoulders, body and legs, but not on the face. The shoulders are tattooed with diamond patterns, three horizontal lines are taken across the body above the breast, between which eight lines go down to the waist narrowing gradually to a point; the navel is the centre of a Maltese cross; each arm, about five inches long, consists of three lines with a pointed finial. The leg tattoo is done with an admirable sense of fitness, that on the thighs consisting of close vertical lines and on the calves of horizontal lines, a small break occurring in each on the shin bone; this has the effect of increasing the apparent rotundity of the legs below the knees. The women wear their hair braided and tied in a knot at the back, or else gathered up and tied into a small bamboo tube covered with particoloured cloth or beads, the lower end decorated with a red fringe, or a long tuft of hair.

Womens' dress.

The dress of the women consists principally of a very small petticoat, two feet two inches long and six inches deep, ornamented occasionally with bells, beads and shells; this only comes a little more than half way round the body, leaving the right thigh bare,—it is attached at the ends and middle to a string passing round the waist. Sometimes a small cloth is worn round the shoulders. Many strings of beads fall low down over the breasts. Small fillets of coloured straw adorn their brows, and several massive white-metal rings are worn above the elbow. Their ear ornaments are principally small strings of beads passed through various holes in the ear.

Arms.

The arms of this tribe are the "dao," spear and crossbow. The first is a most formidable weapon, the blade is generally triangular; about eight inches long, straight at the back, and four inches wide at the top, narrowing gradually with a slightly convex edge towards the handle, which is two feet long and ornamented with tufts of coloured hair; sometimes, instead of being straight all the way up, the back of the blade swells out towards the top in a semi-circular projection—both forms are shown in figure 6. The spears are not by any means such handsome or formidable weapons as those used further west, and this is due, I fancy, to the fact that with the eastern tribes the "dao," and not the spear, is the principal weapon of offence. The spear-heads are small and resemble very similarly in shape and ornamental workings those found at Thetchumi and Primi; the shaft, though short and slender, is strongly made of bamboo and decorated with red and black hair in various fashions. The crossbow is exactly similar to that described by me last year in Captain Butler's report as being used by the Lhota Melomi and Primi Nagas. The shield is small, about four feet long by two feet wide, and made of buffalo-hide decorated along the upper edge with a fringe of red hair, and on the face with two or four tassels of grass. Every man carries with him on the war-path a large supply of panjies, which he plants in the road to cover his retreat. These are carried in a horn suspended at the back, or in a small basket to which is attached a long tail of bearskin; sometimes this panjie-holder is the skin of a bear's foot with the claws remaining, the skin sewn up to form a large bag, a little figure of a sitting man, dressed and painted after life, being affixed to the upper part. Some men wear a skin of defensive armour in the way of a leathern corset which overlaps on the chest, and is kept up by means of straps which pass over the shoulders. The Wokha men also wear a leather corset, but without shoulder-straps.

We found among these men a large number of gongs which they probably get indirectly from Burmah. They cast bells themselves very well in little clay moulds, the material being apparently a kind of gun-metal, and occasionally brass. A woman's walking staff is a long, thin, iron rod foliated at its upper end.

The country we passed through was fine and open except for the first march from Buruarchati in the plains, to Khulan, Mutan, the path lying through dense forest and following the course of sluggish streams with muddy bottoms. But on reaching Bor-Mutan the first extensive view of the country beyond is obtained. It is well watered by several large tributaries of the Delli or Disang river as it is called in the plains, and Tisa as it is called by the Nagas themselves, meaning the "large stream;" "Te" being the prefix of all river

names, and "Sa" an affix signifying large. It was the largest stream we had to cross, and to the strength and velocity of its current when angry we owe the loss of a good sepoy. Water was abundant along our route, specially beyond Ninu, where the undulating, park-like character of the slopes, backed up by tall, dark wooded cliffs, suggested itself as an admirable site for a station. Methna grazed about the grassy slopes in large numbers, and herds of hill buffaloes were seen at several villages; deer were seen here and there, and about Nisa, partridges flew up from the grass on either side of the path at every turn. Near most of the villages and in the deep ravines are seen tree-ferns, sago, and "toko pat" palms; the latter are carefully preserved, as they are most valuable for thatching purposes.

Villages.

The villages are not always well placed for defence against rifles, being commanded from some neighbouring height; but others, such as Bor-Bansang, Senua, Niao, &c., are exceedingly well placed, occupying the highest points of the ridges on which they stand and commanding all the approaches to them. The defences consist of double stockades made of interlaced bamboo and cane, and panjied ditches. The houses are generally scattered up and down without any attempt at order, and are half hidden among the trees, which are not as elsewhere cut down to clear a village site, such only being felled as interfere with the houses; these are built on the unlevelled ground, the floor being carried out to the rear on bamboo piles, the back verandah being frequently a great height above the ground. These are not railed round at all, and on my asking if the small children never fell off, the reply was "of course they do, many are killed in that way," in a tone conveying the impression that my informant looked upon it as an ingenious mode of giving effect to Malthusian theories. The house is divided into an entrance hall, as it were, where the owners' weapons hang, also skulls of animals taken in the chase, and beyond into several small apartments terminating with a large open verandah. Trays are suspended over the fire-places (of which there is generally one in each appartment) on which flesh, fish, vegetables and wood are dried. The walls of the houses are of bamboo matting, the roof being thatched with palm leaves or grass; the principal uprights project through the ridge some two or three feet, this portion being thatched also to keep the rain from running down the post into the house; this thatching is ingeniously worked into figures of men or animals very often. The reason given for this projection of the post is, that as the part below the ground decays, it can be cut off and the post lowered without damage to the house. The Vangam's, *i. e.*, headman's house is always very large, and built on the most level site in the village. It is generally about 200 feet long by 40 or 50 broad, and contains two large halls, one at either end, the intervening space being divided up into several apartments and store-rooms arranged on either side of a central passage. Each of the women's apartments has its own door of exit and verandah. On one side of the entrance hall stands the drum, a large tree hollowed out and carved roughly at either end; it is played upon with clubs shaped like large dumb-bells. A large number of men perform at once on the drum, and though each seems to hammer away entirely on his own account, the effect is harmonious and pleasing. They have several tunes as it were, each being ended by a shout from the leader, responded to by the rest, when a fresh one at once commences. Opposite the drum is the rice-pounder, of great length, giving occupation to nine operators. The other hall is kept as an audience hall, where the Chief receives his friends. It has a raised and matted floor, the rest of the building having as a floor the bare ground. This hall opens into a verandah. Every house is furnished with a few small stools on four short legs, and one or two large beds which, with their legs, and a slight attempt at a bolster, are each cut out of one log. Tables made of cane work, shaped like an inverted wine-glass, and about two and a half feet high, are used on which to place their food at meal times.* In each village are one or two morangs, or bachelors' houses, in which a drum is kept, and also the collection of heads taken in battle; these are placed in rows of about twenty-five each in a large sloping tray placed in the verandah, just within the shelter of the roof. At Bor-Mutan there were 219 bleached skulls arranged in this way.

* The principal posts in the "Vangam's" house and the "Morangs" are generally rudely carved with representations of men and animals.

These villages are remarkable for their sanitary arrangements, small raised houses in which calls of nature are obeyed being built in various parts of the village, and fenced round. Look-outs are built at all the gateways and in front of the morangs, and here watches are alway kept. These are also erected in the fields. At Kamhua I saw some watch houses in the fields surrounded by a double stockade enclosing a passage all round, and over the outer gateway a small platform was erected. Between Senua and Niao, by the road side was a small table raised about eight feet from the ground, approached on either side by a broad wooden ramp. We were told that here peace is concluded between those two villages after a war. The Chiefs walking up, each from his own side meet face to face on opposite sides of the table, and, exchanging "chungas" of wine, drink to each other, and thus declare that peace is made. On the road to Niao, also, was a curious mud figure of a man in bas relief, presenting a gong in the direction of Senua; this was supposed to show that the Niao men were willing to come to terms, if possible, with their enemies. Another mode of evincing a desire to turn away the wrath of an approaching enemy and induce him to open negotiations, is to tie up in his path a couple of goats, sometimes also a gong, with the symbolical palm leaf planted in the ground hard by.

Tombs.

The mode of disposing of the dead is the same in all these villages in its main point, *viz.*, wrapping up the corpses in cloths and mats and placing them on platforms under small roofs. The shape of these roofs differs in different villages slightly, but all are decorated with various colored cloths and streamers, and have at each end a tall figure of wood, dressed, painted and tattooed after the manner of the men of the village, and carrying imitation spears, "daos" and shields; gourds, baskets, &c., are suspended about the tomb. At Khanu the tombs were enclosed in small sheds with doors. Each shed contained several tombs of adults and children, being, in fact, regular family vaults. These tombs are all arranged on either side of the principal entrance to the villages. Cairns of stones are also erected, where the heads of the departed villagers, decorated with shells, beads, and bells, are collected, and earthern "ghurras" filled with the smaller bones, are ranged among them. Each head is decorated in a slightly different way from the others in order that they may be recognised by their surviving relatives.

TRANS-FRONTIER.

Extract from the Narrative Report of the Daphla Military Expeditionary Survey, with the description of the country, its geology, &c., by MAJOR H. H. GODWIN-AUSTEN, B. S. C., F. R. G. S., F. Z. S., &c., *Deputy Superintendent in charge,—Season* 1874-75.

Having received your telegram from India that I had been appointed to the charge of the Expeditionary Survey Party, letter No. 1447, dated 24th August 1874, from Surveyor General, to the Secretary to Government of India, Department of Revenue, Agriculture and Commerce, I left England on the 1st October 1874, and arrived in Calcutta on the 26th of same month. Employed there until the 14th November, making preparations for the approaching work, getting plane-tables projected, &c. Lieutenant Harman, R. E., was forwarding preliminary arrangements at Shillong, and Mr. Ogle, after some delay, was enabled to collect some 32 Khasi coolies and come down with them to Gauhati, where he and Mr. Robert joined me on the 24th November. At Tezpúr, on the 27th, while the steamer was taking in cargo, the Great Trigonometrical Survey Station of Sildubi was visited, the plane-table compasses set, and some observations taken to the distant Daphla peaks, many of which were fixed on plane-table from P. T. stations at Koliabar, Bisnath, Dunsiri-múkh, and Dikrang-múkh, of the Assam Valley Triangulation Great Trigonometrical Survey as we proceeded up the river, and the river steamer *Burmah* stopped for cargo, &c., the weather being particularly clear.

Left Dunsiri-múkh in the little steamer E No. 1 for Dikrang-múkh on the 1st December, and on the 2nd marched for Narainpur and reported our arrival to Brigadier-General Stafford, C. B., Commanding the Expeditionary Force. Made immediate arrangements, in conjunction with Colonel Graham, the Chief Political Officer, to proceed to peak 5*a* of the Great Trigonometrical Survey, situated on the first and outer range, while Mr. Ogle was to proceed to peak 1 on the west. These two peaks were our first advanced stations for extension from the base Nikori Chapri, T. S., to Rodonga, T. S. A case of cholera (a Goorkha chuprassie) which proved fatal on the night of the 4th, delayed these arrangements, as the Chief Medical Officer, Dr. Ross, considered it advisable that we should leave the camp at Narainpur and keep the party isolated on the Golpur Road; camp was accordingly moved the same day to Radhapokri, about two miles off. No more cases occurring, on the 7th I marched (taking 20 Khamtis) for peak 5*a*, and encamped beyond Borpathar in the forest on the bank of the Darpang stream. On the 8th we reached the base of the hills where the point was situated, but owing to the dense forest, did not succeed in reaching a good site for the station until the 9th; on the 10th the clearing by the Khamtis and Khasis was sufficiently advanced to observe to the heliotropes at the Great Trigonometrical Stations on the Brahmaputra, and on the 11th I marched back to Borpathar, and was joined that day in the evening by Lieutenant Harman, R. E. On the 12th I returned to Narainpur to look after the head-quarter camp and made a final disposition of the party. Lieutenant Harman had not received my letter at Dunsiri-múkh, with orders to observe at Nikori Chapri and Rodonga before coming on, so I had to depute Mr. W. Robert to this duty. Observed also this day at the new Trigonometrical Station at Narainpur and returned to Borpathar in the evening.

Mr. Ogle had proceeded to his station during this time, but owing to the precipices on all sides of peak No. 1, or Gorusutia, he was unable to reach the summit, although he and Captain Michel of the 16th Native Infantry did all they could to do so; he therefore selected another peak about ¾th mile to the east, which served well as a station of extension (for an account of this western portion of the Daphla Hills, see Mr. Ogle's Narrative Report appended). On the 13th December our party, consisting of Lieutenant Harman, Mr. Lister and myself, marched towards Borpani to overtake the General and the force, which had got so far on its way; and that day, plane-tabling as we went along, we passed Harmutti and bivouacked in the jungle about 4 miles short of Borpani, reaching it the next morning before the force had started. After lightening loads here and fixing the position of the place, we followed the force on to Harjuli.

On the 15th started with Captains Heathcote and Palmer and Dr. Ross for the top of the ridge separating us from the valley of the Dikrang; the ascent led up a steep spur for some 2,660 feet. By cutting an opening in the forest, I obtained a good view up the valley, and saw the first Daphla clearings on the spurs of the north bank of the Dikrang. Time being of consequence, I commenced clearing the highest point on the ridge here, while the force was crossing over to No. 6 camp, with the help of working parties of the 44th and 16th Native Infantry. From this station, "Tanir Lampa," I laid the foundation of the future work. On the 19th we marched from Harjuli to camp 6, where we remained until the 31st December. During this time all the plane-tabling that could be done was got through, when the force visited Pekfi's village on the 23rd, &c. On the 24th, accompanied by Lieutenant Harman, I ascended to peak 2(*b*), Tanir H. S., which I had selected for a trigonometrical station, and cleared it on Christmas-day sufficiently well to plane-table from; erected the station mark and returned to camp. The remainder of the month was too wet and cloudy to do much, but I was enabled to examine the geological sections exposed in the ravines near camp No. 6. Obtained a guard of 12 sepoys of the 16th Native Infantry for Mr. Ogle and gave him the country to the south-west to survey on the ½ inch scale, and he started for Haseng's village on the 1st January. Moved with the force up the valley of the Dikrang on the 1st January, ascending to commanding clearings near the line of route to sketch the country, and we reached camp No. 9 under Nanang's village on the 2nd January. A slight attack of dysentery contracted in camp No. 6, and rainy weather, kept me unfortunately idle for four days. On the 8th Nanang's village was visited by the General. Captain Peet having reported that the Daphlas on the Ranga were willing to receive an officer on a visit to their villages, I deputed Lieutenant Harman to this duty, and he left for Narainpur to consult and make arrangements with Captain Peet on the 7th; this work I shall allude to under the head of the individual work of the assistants, and Lieutenant Harman's report I append.

As nearly all political matters with the Daphlas were now settled, I obtained the General's sanction to proceed towards Misa Parbat, with a guard of 25 men of the 42nd and 43rd Regiments, A. N. I., and on the 10th started early and, crossing the Dikrang about two miles up the valley, reached a point on the ridge about 4,540 feet, close in under the last and very steep slope of Peak Torúpútú (2*a* of the Great Trigonometrical Survey). On the 11th and 12th rain and cloud prevented further progress, but the 13th looking finer we started for the direction of Misa Parbat. It was an unfortunate day; rain set in before we had reached the summit of Torúpútú, but in hopes of its clearing up, I pushed on beyond it; the rain soon changed to snow as we got up above 7,000 feet, and when I stopped to pitch camp, the wind and driving snow completely did up the poorly-clad Khasi coolies, quite unused to such weather, and I had at last to return, leaving the supplies and most of our property behind, and with the greatest difficulty drove them back to the old camp below, many of them not getting down there until 8 P. M.

The Sikh Havildar and three sepoys of the 42nd Assam Light Infantry behaved very well and kept the coolies going, lending their great-coats to those who were suffering most from the cold. For six days, up to the 19th January, the weather was abominable; rain and sleet fell continuously. The 20th proving finer, I made another ascent of Torúpútú, and as so much time had been already lost, decided on clearing it for the extension of the triangulation instead of Misa Parbat, which would have taken us another day to reach; besides, I was daily expecting to be summoned back to camp, for I then knew anything like a good exploration of the country ahead was not at all contemplated or recommended by either the General Commanding or the Civil Officer accompanying the force. The clearing of Toruputu was commenced on the 20th and continued on the 21st, 22nd and 23rd; the forest was principally of oak and rhododendron, the former of gigantic girth, one taking four Sappers a whole day to bring down. On the 21st I received help from the camp below, Lieutenant Home, R. E. being sent up with a detachment of his Sappers, and they did excellent work. On the 22nd the weather broke and on the 23rd I was enabled to observe most of the angles. Cloud and rain set in again from the 24th to 27th, but on the 29th, after a bright star-light night, we started before day-light and reached the peak about half an hour after sun-rise, and I was enabled to observe all the snowy peaks visible on the far north-east.

In accomplishing this I owe much to Lieutenant Home, R. E., who kindly recorded for me the whole day, and the last angles to the trigonometrical stations on the south, which were very early in the day obscured by cloud, were just completed before dark. The days lost waiting were fully compensated for in the large area of country commanded from this point. On the 30th I returned to camp No. 9. The General had left for camp No. 6 on the 27th, and I found strict orders had been given for my return, and that no guard was to proceed with me more than half a day's journey from Nanang's village. As the country had been sketched far beyond this distance, I marched back on the 31st January for camp No. 6.

As it was most important to observe from another station the peaks and snows observed from Torúpútú H. S., I represented the matter to General Stafford and was granted an escort under Captain Macgregor of the 44th Sylhet Native Infantry, to proceed to the Great Trigonometrical Survey Peak No. 24, "Shengorh" from which I knew the country on the Ranga and far north would be visible. On the 2nd February all was ready for the start. Captain Macgregor (then with the detachment of his regiment occupying Pekfi's village) obtained the

guides, for these the Civil Officer had not considered it advisable to demand himself from Pekfis the headman. We marched through Shikhi that day and bivouacked on the opposite side of the Shu valley, above the last clearing, finding good water there. The next day was lost, for the guides, either from pretended ignorance of where we wanted to go, or design, took us wrong; this I found out in time, and with the aid of the sketching on the plane-table, we found our own way to the main spur again, and at a point no great distance from its highest portion, so that by 9 o'clock the next morning, the 4th February, we reached a position I determined at once to clear, as from it, through gaps in the forest, the snowy range could be seen.

Before the hill could be cleared sufficiently to observe from, bad luck again attended the work; rain set in on the 7th February, and lasted almost without ceasing until the 11th. This was the date I had received orders to leave the peak, work finished or not, but the day with a turn of luck was, most fortunately, gloriously clear, and all angles were observed, thus completing our series of triangles up to this point and securing many peaks to the north. It was a close run: another 24 hours of cloudy weather, and all our previous time and labour of the past month would have been lost. It was during this period that the last captive not having been produced by political expedients, the General had determined to march for the village of Dilling on the Ranga side. On receiving the news, I despatched Mr. Ogle at once to follow the force and get a sketch of the country. Although he came up with the rear-guard, then within 300 feet below Peak 29 eastern, which the force was that day crossing on its way back, he there received a note to return.

Returned to Pekfi's village on the 12th by the evening, and the next day passed through camp No. 6, ascended to Tanir Lampa H. S., and observed in the afternoon the angles remaining at the station. On the 14th, Tanir H. S. was revisited, and the same completion of the horizontal and vertical angles gone through, and all the work here then being over, we descended to Harjuli, bivouacking in the Sibjuli, two miles beyond that camp. On the 15th Borpani was reached, and Harmutti on the 16th, where I waited to see General Stafford, who arrived on the 18th. On the 19th made a short excursion into a portion of the outer range to west of Harmutti, and on the 20th returned to Narainpore, where I halted for orders from the Chief Commissioner and yourself until the 2nd March. But it was already too late to take up work in North Lakhimpore, of which district the Assistant Commissioner had only just taken charge, and could not accompany the survey party; at the same time no guards were available, owing to the unfortunate and treacherous attack on the survey party under Captain Badgley in the Eastern Naga Hills.

I resolved, therefore, to finish the work for the season by visiting the base of the western Daphla Hills, taking them up from Mr. Ogle's station near Gorusuttia. From the main road to Tezpore, which lies about 10 miles from the hills, the weather being clear, we were enabled to sketch much, as far as Rangsali; from there I marched, accompanied by Messrs. Ogle and Robert, *viâ* Behali tea garden to the gorge of the Burroi, and on the 12th ascended peaks 9 and 10 of the Great Trigonometrical Survey, situated on the outer sandstone range, and about 3,000 feet in height. A fine view was obtained of the Burroi valley at the back, up to the Misa Parbat range, and the position of five Daphla villages ascertained; this squared up the topography well on the south-west side. On the 15th I returned to Rangsali and marched towards Tezpore. The weather now became extremely hazy; there was no hope of penetrating into the hills on the westward towards the Burroi as intervening between the boundary of the Darrang District and the high peaks, from which we could only have sketched the interior country, is a broad belt of low forest-clad hills, too wide to penetrate without a guard, and in face of the orders I had received. Camp was therefore moved to Tezpore on the 21st, where we waited for a steamer down the river until the 30th March, arriving at Gowhatty the same day by the evening. Marched again on the 1st April for Shillong, which was reached on the 4th.

Triangulation.

The triangulation emanated from the base Nikori Chapri T. S., and Rodonga T. S. of the Assam Valley Triangulation; the instruments used were 6 and 7-inch theodolites by Troughton and Simms. I adopted the method of regular triangulation in preference to that recommended by Colonel J. T. Walker, Superintendent, Trigonometrical Survey, in letter of instructions to Lieutenant Harman, R. E., No. 18—1050, dated 14th September 1874, paragraph 19, a useful method which we might also have adopted had we proceeded far into the country, but is not well suited for inconspicuous, badly-defined points on the outer hills where the highest tree in the forest has often been observed a mark not identifiable when the hill is visited; its highest part may be many yards from the observed object. My principal reason for carrying a minor system of triangulation from the base of the Great Trigonometrical series was the fact that the whole country is so densely covered with forest, it becomes necessary, in order to plane-table with accuracy, to clear entirely summits of the highest points here and there; when this is accomplished, it entails but very little extra labor and time to set up a theodolite and observe to the stations and peaks around, and to build a good solid mark for future back observations at forward stations. This method in the long run secures in such country the maximum area of topography, with a minimum number of plane-table stations. During the months of November and December, the atmosphere for days at a time is beauti-

fully clear, and the marks are easily distinguishable on the first range at distances of 25-30 miles. We, however, had to place heliotropes at the base stations in the plains. The best description of mark to erect is a pyramidal one of three spars about 18 feet long, the apex centred over the station mark, and well kept together by cross-pieces lashed on the three sides, the whole of the upper part to within 5 feet of the ground being then covered in with bamboo-matting with the white inner side placed outwards; this matting is easily constructed on the spot, bamboo of various species growing at all altitudes up to 9,000 feet. Such a mark can be made out even in extremely hazy weather at considerable distances, for in certain lights the white bamboo-matting is sure to show up from time to time. The country triangulated embraces a large part of Degree Sheet No. XXVIII between the parallels of 27° and 28°, and meridians of 93° and 94°, the last station of observation being 42 miles from the base in direct line. Seventeen minor secondary triangles were observed, and about 50 points fixed, covering an area of 2,300 square miles.

Topography.

"The topography was all executed on the scale of 2 miles=1 inch and 4 miles=1 inch; it comprises portions of Sheets Nos. 166, 167, 168, and 169; towards the north this becomes mere reconnoissance; the run of the main ridges and streams could only be laid down with villages seen, but without the minor detail of roads, &c., but even this amount of data is invaluable when an expedition has to penetrate a mountainous country. The half-inch survey is of the same degree of accuracy as former work by this party in similar inaccessible ground. The total area is 1,705 square miles. On 8 miles=1 inch scale, a good general sketch of the hill ranges on the west in the Akha country near $\frac{\text{Latitude } 27}{\text{Longitude } 93}$ was obtained when leaving the field and marching through the country towards Tezpur in March.

Connection of minor triangulation with that of the Great Trigonometrical Survey.

"I cannot conclude this section of my report without referring to the work of Mr. W. G. Beverley, Assistant Superintendant, Great Trigonometrical Survey, who, from the series on the Brahmaputra, fixed such a multitude of points in the outer ranges as far as they were visible; their accuracy is very great; few peaks indeed escaped the field of his theodolite; only four were found out of position, and those are marked as doubtful. Three trigonometrical points proved of great use to us, and extension of triangulation would have been quite unnecessary had we been alone confined to the area they cover.

Cost.

"The total cost of the survey amounts to Rs. 22,010-10-5, or Rs. 12-14-6 per square mile of topography; this is high, but breaking ground in a new area of country entails a high rate at first, which the large out-turn afterwards secured reduces very considerably when the work is continued to end of the season.

Extension of the work hereafter.

"On the west, with the points fixed by Mr. Beverley alone, the whole of sheets Nos. 167 and 173 can be completed on the 2 miles=1 inch scale, and this would include all the villages, Daphla and Akha, to whom the Government pay "posa," and whose residences in the hills we should certainly be acquainted with. * * *

"All the tract on the east near the Ranga; and up to the Subunsiri Miris might be mapped with a little tact and proper precautionary measures. * * * * The triangulation this year commenced might also be carried for several triangles further to the north and east, so as to secure from the high range about 9,000 feet running north-east (on which are the peaks 26, 27, 30, &c.), of the Great Trigonometrical Survey points, in the country beyond, and lay down the run of the snowy range up to Latitude 28°-45', Longitude 94°-30'. From the above range a very large area might be mapped. Sufficient points are now computed in Degree Sheet No. XXVIII to finish sections Nos. 168 and 185, and eastern half of No. 166, or about 1,300 square miles and up to the snowy range on the quarter-inch scale. If the plan of operations adopted this season were carried some day or other to the north into the hills near Sadya upon Longitude 95°, we should soon knock a hole in the enormous unknown region that lies beyond our frontier, and this, no doubt, time and gradual change in our relations with the various tribes will bring about. Every geographer must long to see the day when broad tracts of triangulation and topography may thus cover the Eastern Himalaya not only on longitude 95°, but between 92°-30' and 93°, where the route to Towang lies, long known as the best of all others into the Thibetan countries from Assam.

Individual work of Assistants. Lieutenant Harman R. E.

"This officer was deputed to the party and joined me at Borpathar on the 11th December. He proceeded to camp No. 6, where he took a share in the clearing of Peak Tanir, and commenced a sketch of the country on the quarter-inch scale. After our arrival in camp No. 9, Captain Peet, Assistant Commissioner, North Lukhimpur, having written up to say that the Daphlas on the Ranga were willing to receive a European officer in their villages, I despatched Lieutenant Harman at once to that side *viâ* the plains, and he entered the Ranga valley from Salonibori outpost, from which he took a guard of twelve sepoys of the 44th Sylhet Light Infantry. I attach his narrative report. His stay in the hills was very limited, owing to the coolies who were to follow him with supplies not coming on in time, but he was enabled to fix the position of several Daphla villages, the position and

size of which were till then unknown, and with our combined rays on plane-table to place on the map the Ranga and all its principal tributaries. Lieutenant Harman was most zealous and energetic, never sparing himself to forward the work he was engaged on.

Mr. M. J. Ogle.

"Knowing the value of this surveyor on operations of this nature, I applied for his services on my return to India, and you were kind enough to depute him from the Khasi and Garô boundary survey work he was about to take up, and which was postponed. Mr. Ogle first proceeded to clear the first western flank station on the outer range, having been baffled in making the ascent of No. 1 Peak, or Gorusuttia. He then took up the survey of the Pomah and Borpani Dhúns, and accompanied by a guard of ten men of the 16th Native Infantry visited Hasang's village in the latter; thence he proceeded to the Dikrang Dun, and succeeded in securing an area of 525 square miles on the half-inch scale with his usual care and accuracy, the whole of the ground being covered with dense forest. He also observed angles at Dihiri Parbat, and accompanied me to the Shengorh ridge, but left when the force advanced to Dilling, as I have previously recorded. Mr. Ogle is a most dependable assistant, most zealous in all he takes up, and I trust his exertions on the expedition may meet with the reward of further promotion in the Department. I append his Narrative Report.

Mr. W. Robert.

"As I before mentioned, Lieutenant Harman having missed the letter of instructions sent to meet him at Dunsiri-múkh, to Mr. Robert at the last moment, devolved the task of bringing up the triangulation from the Great Trigonometrical base to the first stations selected on the outermost range. He proceeded to Rodonga and Nikori Chapri stations, repaired the towers and opened the rays which had grown over, and although his first season of independent triangulation, he carried on the work entrusted to him with ability and success, and thus relieved me of much anxiety regarding the connection with the Great Trigonometrical operations. Mr. Robert would subsequently have taken up plane-tabling on the half-inch scale between the Dikrang and Súbunsiri, but the retirement of the force put a stop to this undertaking. Mr. Robert carried out his work exceedingly well; he shews a great aptitude for fixing distant points, and I also beg to bring him to your favorable notice for promotion.

Mr. Lister.

"The Superintendent of the Botanical Gardens, Calcutta, having recommended that the opportunity afforded of exploring the Daphla Hills might be taken every advantage of to secure a collection of plants, seeds, and dried specimens, Mr. Lister, an assistant under Dr. King, was attached to the party, and I had great pleasure in giving him all the assistance I was able. Mr. Lister accompanied me to all the peaks and worked very assiduously, and I trust has brought together a good collection.

Climate. „

"The month of December was beautifully clear and fine nearly up to the end, when cloud and rain set in, and with a few bright days now and then, it continued stormy until nearly the end of January. The clouds conveying all this moisture drove up from the south-west as I found on Torúputu, showing that at this time of the year a very high counter-current to the north-east monsoon travels up the Bay and over Lower Bengal, descending and impinging on the Eastern Himalayas. In the damp valley of the Dikrang the temperature in the early morning used often to fall to 33°, but on the ridges at 4,000 feet the temperature during the day was delightful. In the outer Dhúns, as about Borpani, heavy dew fell at night sufficient to cause a continual heavy drip from the forest trees. This moist stratum, however, does not rise high, and in the Sibjuli and Harjuli we were clear of it. A good deal of snow fell in January on all peaks over 7,000 feet, but few of the ranges on the north rise above 10,000 feet, such as the C. C. 2 range. Colonel Graham in his report doubts "if the further peaks could have been reached;" this is opposed to all experience. When the Hon'ble Ashley Eden's mission was proceeding into Bhutan at the same season of the year, three passes were crossed, the Tégong-La, Chi-La, and Bielá, 11,800, 12,492, and 11,164 feet, respectively, and I remained for three days on the Tégong-La, deep snow covering the ground.

Health of party.

"The party enjoyed very good health; only one fatal case of cholera occurred at Narainpur, evidently contracted on the passage by steamer from Gowhatty. A few cases of dysentery occurred, from which a Khasi coolie died, after we got into camp No. 6, which, owing to the high forest that towered all around, received no sun for hours of the day, and was very low and damp. The food supplied was excellent and abundant, and the party was in this respect working under better circumstances than is usual when in the field.

Physical features.

"Looking from the plains, the Daphla Hills are seen to present three well marked ridges, a low outer and a high inner reaching 8,000 feet at "Misa Parbat" or "Yoludi" of the Daphlas, with another intermediate, and often not a well-marked one. In notes on the geology I shall show that the connection of these features, which is continuous for miles east and west, are the result and due to original deposition. The outer range, owing to the softer nature of its composition, has suffered most from denudation, has a very irregular outline, and is much cut up by ravines. Some of the points stand high and pointed, and amongst the most conspicuous is "Gorusutia," the "cow's hump," 3,279 feet, while at other parts, as at the Dubia Pass,

the ridge is under 1,000 feet. The high back range has a mean height of 7,800, and has the undulating flat outline of granitoid masses. Behind the Misa Parbat range is another having the same character, rising to 10,000 feet, but on another lateral axis of elevation, only a small portion of its high flat outline is visible from the plains. A description from my journal of the inner ranges from Toruputu Peak, 7,322 feet, will, I hope, give some idea of their general character.

The most striking feature looking over the mountain area from this peak is the very great distance into the interior that can be overlooked, few ridges rising above the mean of 6,000 feet. The hill features are on a grand scale, the ridges flat-topped, rounded, and their spurs spreading out towards the Dikrang valley, while they have a very uniform height for long distances. In latitude 27°28′ longitude, 95°25′ is a high mass with a few fine trees cutting the sky line and mixing with the other forest trees for about 500 feet below the crest. This is called Lolupu by the Daphlas (C 2 of the Great Trigonometrical Survey). It is the highest eastern extremity of a north-west to south-east mid-range, apparently given off from the mass of snowy peaks north of, and so well seen from, Tezpur, known by us as Peaks X. Y. Z., the highest 23,268 feet; this mass was seen to great perfection from Toruputu. On the southern flanks of the Lolupu range many tributaries of the Barowlie take their rise, as also the Bordikrai. At peak C 2 it bifurcates, one ridge separating the Dikrang from the Ranga, the northern that river from the Suban-siri.

The next high mass north of the Dikrang culminates at peak 29 western, 7,880 feet, giving off high spurs densely clothed with forest, and falling steeply and abruptly into the river. On these last spurs up to a height of 3,700 feet are all the clearings of the Daphlas. Looking east-north-east down the Dikrang is the conspicuous conical peak "Dorkorputu" (or 2 M eastern), situated on one of the above spurs, and at its south-east end lies Pakfi's village and "jhooms" (clearings) just where a large tributary from the north, the Shu, comes in. On the upper Ranga could be seen the clearings of Jakey, and north of that valley a fine bold range bounds it, with one fine high point about 9,251 feet, which stands as D (a) in the Angle Book. No range higher than 10,000 feet is to be seen on the far north-east for 50 miles, and the Snowy Range is seen up to that point of the compass, and at least 100 miles distant, and must be close over the bend of the Dihong. An outer range of sharp, flanking hills towards the east-north-east rise to peaks of 9,700 feet, with a broad extent of lower tertiary hills between the foot of their spurs and the plains north and north-west of Yaling; all is uninhabited, being too high for cultivation.

From the peak of Shengorh 6,706 feet, where I obtained another magnificent panorama of the northern mountains, nearly the whole area of the Ranga valley is seen; jhooming has been carried on to a great extent, and a large expanse of country on the left bank is quite cleared of forest and now clothed with grass, woods only remaining in the depths of the ravines; this part of the hills does not rise above 4,500 feet and has an undulating surface. The drainage area* of the Ranga is greater than the Dikrang, and near lat. 27° 25′, longitude 93° 45′ it branches upward into two large tributaries, one from the north, the other from the westward. This last has its sources under the peaks C 1 and C 2 "Lolúpú," while the former comes down from a high ridge of about 8,500 feet, having an east-north-east strike. Near the junction of these two streams there is much clearing, and a large village could be seen on the left bank at the end of a spur given off from a low, isolated hummocky hill down in the valley. The spurs immediately under and to the north run down to the Ranga and are all densely wooded. The Pitay stream receives all the small ravines and joins it above Tada's village. A great extent of the Snowy Range was seen up to north-by-east, a fine mass D 1 was the highest, flat at the top with a small knob at the eastern end where it falls suddenly. It has a long, straight wall of bare black cliff just below the top, showing strong against the rest of its snow-covered face.

Beyond the water-shed of the Ranga, and intermediate between it and the main Snowy Range, a flat-topped intermediate one was visible, about 12,000 feet high, very steep on its southern face, and running with the east-north-east strike of the mountains.

Rivers.

The principal rivers that drain into the plains on which Daphla tribes are located are the Ranga, the Dikrang, the Burroi, and the Bargang; of these the Dikrang is a fine clear stream in the cold weather and easily navigable in small dug-outs from Harmutti to the junction of the Borpani, although the rapids have here become troublesome and delay the passage up. Above the junction of the Borpani it fairly enters the hills and has deep pools and long still reaches with occasional heavy rapids. It breaks through the the sandstone ridge in a deep gorge about 10 miles north-east of Borpani stockade, and taking a sharp bend back to the west-south-west we thus come on it again near Pekfi's after crossing the Tanir Lampah ridge.

Here it had all the characterstics of a mountain river, the rapids long and formidable, in very few places fordable with safety to a great number of men even when at its lowest. Its breadth was about 60 to 30 yards. Large masses of rock fill the bed in places, the slopes on either side are very steep, while the alluvial deposits which I shall refer to terminate in cliffs of considerable height. These slopes covered with a vegetation of canes, bamboos, pandani, tree-ferns, plantains, &c., overtowered by gigantic forest trees covered with crepers of every size; a tropical vegetation only to be seen in such deep damp valleys, renders the views on bends of the river most striking, even after the eye has become tired with the monotony of eternal forest in

* 710 square miles and 540 square miles, respectively.

every direction. All these rivers abound in fish, several species of the larger cyprinidæ (known generally as "Mahasir"), and a rod should never be forgotten by the traveller who may visit them.

The Burroi.

Is a considerable river taking all the southern drainage of the Misa Parbat ridge up to 92° 20′ on the west from the watershed of the Borpani. Its principal feeders are the Páptím and the Poma, and these, uniting north of the outer sandstone ridge near 93° 30′, break through it in a very picturesque gorge up which the path into the hills leads; this during the cold season keeps to the bed of the river, constantly crossing and re-crossing it, the fords being deep. On the upper portion of the Papum, the valley is contracted, the spurs on either sides terminating abruptly on it. The principal village is Gambugam on the right bank, standing on a commanding point at the end of one of these spurs just on the edge of the steep descent into the valley.

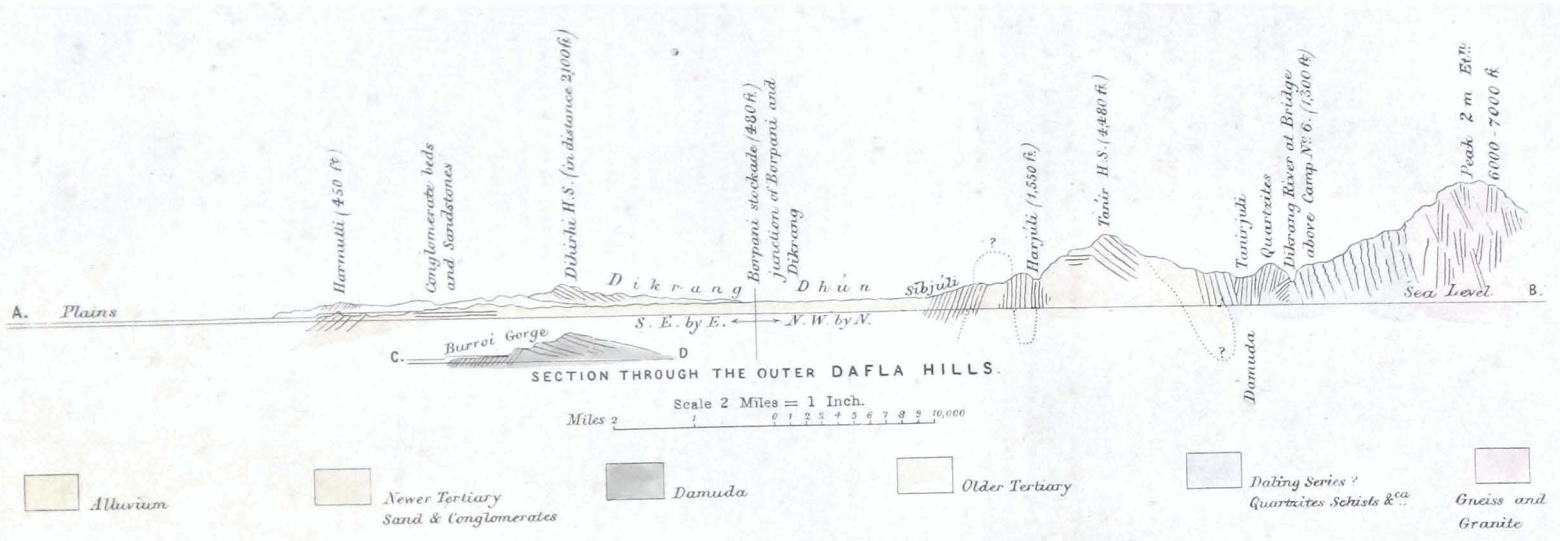
The Daphlas of the Upper Ranga use this line of route on their way to the plains by a pass west of peak 2C. The Ranga and Borpani are alluded to in the Narrative Reports of Lieutenant Harman, R. E., and Mr. M. J. Ogle.

List of Villages in Daphla Hills.

Names of Villages.	Clan.	Headman.	No. of houses.	Remarks.
Shikhi	Tanaulia ...	Pekfi	20	Left bank of Dikrang.
Páchitah	Tahbolia ...	Kápang	5	Ditto.
Doripú	Tachingolia ...	Túdak	7	Ditto.
Noju	?	Nángáng	18	Ditto.
Yáling	?	Tákú	9	Ditto.
Gotúpú	?	Harsú	8	Ditto.
Dápú	Bartolia ...	Túkáng	8	Right bank of Dikrang.
Birú		Toibúra	9	Ditto.
Petch pekh ...	Táolia ...	Háching	10	Ditto.
?		Nánáng's (new) ...	20	Ditto.
?		Légi	20	Ditto.
?		Tani	5	Ditto.
?		Sulung	10	Ditto.
Mokur	?	?	20	Ditto.
Umpúng	...	Boya Gam	8	In the Shu valley north of Dikrang.
		Total in Dikrang Valley...	177	
Outer Daphlas.				
Dapo	...	Háseng	2	On watershed between the Borpani and the Poma Rivers.
Mopop	...	Tákhang	3	
Bachu	...	Háseng	6	
?	...	Tazeng	6	
		Total number of houses...	17	
		Gambúgam	80	Right bank of the Burroi River.
		Chengogam		Do. do.
		Jarungam		Left bank do.
		Poyagam		Do. do.
		Taplengam		Do. do.
		Total ...	80	
		In the valley.		
		Tádá	150	
		Tágum	50	
		Tákha	150	
		Tápli	55	
		Sú	30	
		Piji	20	
Dilling			90	
Sera ? or Cherong ...			80	
		Total ...	625	
		Pili	10	Very small.
Chengreng ...		...	40	Name obtained from *one* Dapla only.
Chenghong ...		...	80	Do. do.
		Tákay	60	
		Rikom	60	
Apa Tánang ...		Tánú Raja	150	
			400	I am inclined to think this estimate high.
		Total No. of Houses ...	1,299	

Say 1,300 × 7=9,100 population.

Note.—Colonel Graham, I think, over-estimates the average number of souls per "Cháng"; he puts it at 12, but the large "Changs" are few in number in every village, and a number of small houses are only inhabited by one family; it is fair to take seven as the average all round.


Harmutti (450 ft.)
Conglomerate beds and Sandstones
Dikarki H.S. (in distance 2100 ft.)
Dikrang
Borpani stockade (480 ft.) Junction of Borpani and Dikrang
Dhún
Sibjuli
Harpuli (1,550 ft.)
Tanir H.S. (4480 ft.)
Tanirjuli Quartzites
Dikrang River at Bridge above Camp No. 6. (1,500 ft.)
Peak 2 m. E.ly 6000 - 7000 ft.
Sea Level
A. Plains
B.
S. E. by E. ← → N. W. by N.
C.
Burroi Gorge
D
Damuda
SECTION THROUGH THE OUTER DAFLA HILLS.
Scale 2 Miles = 1 Inch.
Miles 2 1 0 1 2 3 4 5 6 7 8 9 10,000
Alluvium
Newer Tertiary Sand & Conglomerates
Damuda
Older Tertiary
Dafing Series? Quartzites Schists &ca.
Gneiss and Granite

Geology.

From the Brahmaputra near Bishnath and Dhunsiri-Mukh, the outer range of the tertiary sandstones is well seen, the steep scarps showing white against the dense forest with which they are covered. I first entered this outer range by a route up the bed of the Darpang stream, a tributary of the Pichola, when proceeding to clear Dihiri Parbat H. S. After leaving Borpathar the road leads over the plain in a west-north-west direction, and after five miles, the shallow bed of the Darpong is followed up, and leads directly by a narrow gorge into the hills; these rise suddenly from the level plain of present detritus, no outlying beds of later age being seen here. The strata dip about 20° north-west, and consists of thick bedded fine sandstones with strings of water-worn pebbles here and there, but no conglomerate was seen; it weathers on the higher ridges into spheroidal masses indented with small holes in a precisely similar manner to the upper sandstones of the Burrial range. The most conspicuous beds are of a very pale grey color with black grains. Pieces of lignite are common, found in situ and lying in the beds of the water-courses; although I anxiously searched I saw no other fossil remains. The ravines are bounded by very steep sides, and are dark and gloomy. Looking from Dihiri Parbat westward, the fringing range of the sandstone is well seen rising at Gorúsútia or Peak No. 1 of the Great Trigonometrical Survey into a sharp, scarped point 3,319 feet, but it is reduced here and there on the line of strike to 1,000 feet. They present the same features all along of a steep, cliffy slope towards the plains, dipping 20° 25′ north-north-west, or towards the main mass of the mountains on the north, from which they are separated by a broad valley or "dun" drained by the Poma; this 'dun' is much cut up by numerous ravines and low ridges all buried in dense forest.

To the eastward three miles from Dihiri Parbat, the sandstone ridge is much subdued with a change in the strike of the whole mountain mass and a broad forest-clad plateau much intersected by ravines, and about 200 feet above the plains extends as far as the gorge of the Dikrang at Harmutti. On this side the Borpani and Dikrang in their south-west and north-east course represent and take up the continuation of the Poma Dun. At Harmutti is seen another quite recent deposit in an alluvial plateau of sand, clay and boulders, on which land for the tea gardens has been taken up. It corresponds to similar terraces in the Western Bhútan Dúars as those on the Jholdaka, &c., but is nowhere more than 30 to 40 feet above the river bed; it is found fringing the older rock slopes for some distance up the valley and also to the eastward. It lies against a broad extent of very low, intricate hills which from here to far east are a conspicuous feature. The very hurried examination I was able to make of these beds near Harmutti showed them to be ferruginous colored sandstones and thick conglomerate beds resting on fine blue-grey sandy beds dipping 5° to south-eastward. No lignite was seen in situ, but rolled pieces were common in the bed of the stream, evidently brought down some distance.

At Harmutti similar beds dip 15° south-east; they appear to me to represent the newest beds of this tertiary series, extending here out into the plains beyond the strike of the first, or Dihiri Parbat line of elevation, which is taken up east of the Dikrang by a low ridge that bounds the river on the south-east as far as the great bend it takes above the Borpani junction and where it breaks through the inner sandstone range. Leaving the stockade at this junction "Doi-Mukh," the winding bed of the Sibjuli is followed, and at 1½ miles is joined by the Niosi, a much larger stream. In the bed of this last the gravels are found to be a great mixture of gneiss, clay shales, and dark colored sandstones of a different series of rocks mixed with a few tertiary sandstones, showing that it cuts through, as I afterwards found, the whole series of stratified rocks up to the metamorphics. I found here several pieces of silicified wood quite 8 inches in diameter, with a section like bamboos.

The first exposed section about four miles up the Sibjuli presented the tertiary sandstones with a high dip 75° south-east-by-south; they are here very dark, hard, thick-bedded, with a slight violet tint, and no pebbles of a different character to the outer or Dihiri group of beds. At the low pass over into the Harjuli they are thin-bedded, softer, and perpendicular. Passing on northward (on the south-east spur) from Tanir Peak, the sandstones are horizontal and evidently roll over; at the peak they are 35° north-west, which is the dip all along the crest of this second ridge. Crossing it, and proceeding down the spur to the Dikrang at the few places where the sandstone is uncovered, the dip has become high to the north-westward. But it was down in the Dikrang that the most interesting section was obtained. On following up the first and eastern stream on the right bank of that river near camp No. 6, below the village of Shikhi, the first trace of an older series of rocks was found about a quarter of a mile up the bed, where a dark, hard, heavy standstone occurs perpendicular with a north-east, south-west strike. The soft tertiary sandstones immediately succeed, having a local dip east-by-south 75°; they are much crushed, very thick-bedded, and micaceous, with scattered small pebbles, and appear the equivalents of the sandstones of Dihiri. Proceeding up the bed of the next stream, the largest, and which draining from the northern face of Tanir ridge I shall, to distinguish it, call the Tanirjuli, we first come on the tertiary sandstone nearly perpendicular, strike south-west, north-east. A very few yards further on are clay shales, dip high 70° north-west; these are very dark and carbonaceous. Some 50 yards further up the stream the dip was reversed to 75° east-south-east with considerable crushing, and here occurred a thick seam of black carbonaceous shale from 5 to 6 feet thick interstratified with dark, close-grained sandstones; this seam can be traced along the strike north-north-east, south-south-west, for 200 yards as it crosses the bed of the winding

stream three times. It is rather a crushed splintery coal than a shale, and no doubt would prove better below the surface, for where now exposed it is either in, or just out of, the water, and to see it at all, one has to wade up the bed of the stream, the jungle being too thick on the bank to get about in.

It was interesting to come upon these rocks in this position, as they are, I think, the representatives of the Damuda series lately examined and worked out along the base of the Darjeeling and W. Bhutan mountains by Mr. F. R. Mallet, of the Geological Survey,* and first noticed by Dr. W. Hooker, in 1849, near Punkabari. The coal seam has exactly the flaky structure described by Mr. Mallet. The crushing it has been subjected to has apparently altered its original and probable even thickness, both the upper and lower surfaces being waved irregularly so that it never retains the same thickness for many yards together along the strike. I could not find time to follow the ravine up further, but at the head of the valley a full section of these beds would be found along the low ridge that connects the Tanir Lampa ridge with that from Misa Parbat. The boulders and gravel in the bed of the stream consisted principally of (1), the hard sandstone of a pale blue slaty color, the darkest pieces often speckled with minute grains of quartz? Damuda?; (2), a few of the soft tertiary sandstones, but these apparently soon get ground away; (3), a very hard lighter colored rock of the Damuda series; (4) some hard conglomerate, and (5), a few of gneiss from the ridge on the northern side of the valley on which is the little hamlet of Dápú. I am inclined to think there is unconformability between this Damuda series and the sandstones, but the crushing is great, and renders it very difficult to clearly make out, exposed sections are so very few. There cannot, however, be a greater thickness of the Damudas here than 1,000 feet in the area intervening between the sandstones and the quartzite and gneiss. Overlying the denuded out-crop of the Damuda rocks in this lateral valley, is a mass of sandy clay and large sub-angular rocks (some 15 feet long) derived from the harder strata and quartzitic sandstones, &c.; this and the dense forest combined, affords a geologist few opportunities of seeing much. This Tanir Júli marks the junction of the stratified rocks and the metamorphic series for some distance by its wide open valley, its breadth corresponding with the out-crop of the whole Damuda series; the valley of the Dikrang takes up the extension of the same for a long distance to the north-east, and its very probable extension westward is marked in the map by successive ravines excavated along the base of the gneissic rocks. Having once found the thick, carbonaceous seam†, it was very easy to follow it up. It crosses the Dikrang in a north-east direction, and shows on the left bank near the Daphla cane suspension bridge, beyond which it leaves the river and is covered with alluvial deposits. Down the Dikrang from this spot a set of beds of very hard, compact sandstones, perpendicular and showing metamorphism are exposed along its course, and about half a mile down the junction of the unaltered soft tertiary sandstones with them is capitally displayed on the right bank with a high southerly dip, and although having the same strike, gave me a still stronger impression of their unconformability.

To the Damudas succeed quartzitic beds, some very white, but I nowhere found an actual contact. On the road to the bridge built by the force above camp No. 6, a dark green rock is conspicuous by its very trappean appearance; at the bridge a very white quartzite underlies it, dipping 55° south-east. These metamorphic rocks have a regular strike south-west to north-east nowhere better seen than from Toruputu Trigonometrical station, that peak—with these of Dorkorputu and Shengorh—all lying on the main axis of elevation in a true line bearing north-east, and continued across the Ranga by the Peaks 28 western, M &c. They seem to pass by degrees into micaceous schists and hornblendic gneiss, which I noticed three miles above the bridge, and thence into true granite with large feldsparic crystals very similar to that of the North Khasi Hills at Kollong rock, &c. The peaks of Misa Parbat and Shengorh are of this granite. Near camp 9 under Nanang's village, the gneiss was very talcose occurring in pieces of an inch square or so. The quartzites, mica schists, &c., probably represent here Mallet's "Daling Series."

The Burroi Gorge.

At the first deep pool where the tertiary sandstones are first seen on the left bank is an interesting section, they are dipping about 50° towards the plains, the denuded surface is smooth and undulating, and here not more than 8 to 10 feet above the water-level (April); but proceeding up the river about a quarter of a mile to the next large pool, the same section is seen again, but the upper surface of denuded sandstones is there quite 15 to 20 feet above the river, showing a considerable slope of the old earth-surface up towards the hills. Upon this rests a very recent series of iron colored sands and gravels quite 60 to 70 feet thick, nearly horizontal, but the very slight incline is towards the southward; they abut against the older rocks as these soon commence to rise into well marked spurs from the outer range. These comparatively recent deposits are no doubt the same as those composing the plateau at Bihali eight miles out into the plain, towards the Brahmaputra and Bisnath plain. About 300 yards below the first deep pool, where our camp was pitched near the head of the next rapid, the last of the tertiary rocks is exposed in the bed of the river, showing through the boulder stones and about a foot out of water; it there dips 70° south, apparently falling over into a sharp uniclinal. This feature, I have shown in Section C.-D. under the larger one A. B. from Harmutti to the Tani bridge, as it probably extends along the whole base of the hills, but covered by the

* Memoirs of the Geological Survey of India, vol. XI., part 2.

† This coal would have to be worked up into an artificial fuel, *vide* Mr. Mallet's Report p. 60.

more recent alluvial deposits. To the west of the Burroi, the sandstone range has a general dip north-eastward, but a very conspicuous longitudinal roll occurs at the second large ravine west of the main gorge, the strata immediately east of this ravine dip 50° west, while in the main gorge of the Burroi they have a general easterly underlie, but are a good deal crushed with high dips. To the east the beds again assume regular dips of 30° to 40° northerly, the whole series gradually ascending towards Gorusutia, which lies on a main longitudinal or cross axis of elevation. Looking at the hills 20 miles to the west of the Burroi the dip of the lowest outer range appeared 20° southerly, and being low, produces a long, wide, even slope towards the plains.

River Terraces of recent age.

Near the junction of the Tanir Júli with the Dikrang, a higher and a lower terrace is a well-marked feature, composed of sand, clay and large transported blocks more or less rounded. The lowest is well seen on the left bank about 20 feet above the river bed at camp 6, and the highest between that and the bridge about one mile up stream. Their deposition took place, no doubt, during the period of glacial extension throughout the Himalayan range, and they would naturally have accummulated more at the junctions of large lateral valleys than elsewhere. The remains of these deposits are to be traced at intervals up the valley, notably at Pachitab, but in the valley below Nanang's, above the valley of the Niumtay, I observed no traces of the high level terrace. To contemporary beds on the outskirts of the hills, I have previously alluded to, and the present rivers from the hills are now producing at a lower level similar accummulation. An interesting and instructive example of how the mountain streams after leaving the hills change their course from east to west is displayed on the Darpang. Looking from the Dihiri range over the dense forest through which the many streams find their tortuous way, it can be seen that the Darpang at one time flowed with a much more direct southerly course. Quite recently, owing to the accumulation of silt round fallen trees, it has turned off into the forest due east, and a large patch upon its new course has been destroyed by the excess of moisture about the roots. The trees stand up dead and bare, only a few orchids still struggling to live on them, while the sand has silted up 6 or 8 feet above the old level of the ground they formerly grew on. It is a curious picture of desolation and as in time these trees will rot and fall, to incumber the ground and raise its level, the stream will again strike for itself another course and alter the whole drainage for miles below.

The Bishwanath Plain.

I first came on this remarkable portion of the country on the road between Rangvóali and Burigaon just after crossing the Bergang, which has a wide sandy bed, but with a volume of water not more than half that of the Burroi. The rise is sudden out of the "Kadir" (alluvial) land of the former river, and of about 20 to 25 feet, succeeded at from 200 to 300 yards by another of, perhaps, 3 feet, but though low, it is very persistent and distinct. The surface is perfectly flat, covered with a thin growth of grass, the few highest stalks of which may be about 6 or 7 feet high, but it is a short grass for Assam. In some parts, patches of forest growth, a few acres in extent, are dotted about here and there, their limits very defined and generally round or oval in shape. The plateau ends abruptly on its southern side, towards the Brahmaputra, but its edge is irregular in outline, having been scooped into by the river in its wanderings from side to side. Traces of the old former channel occur in the re-entering angles, in long crescentic pieces of water fringed with marsh and high reeds and grasses, that extend mile on mile to the present Brahmaputra. The view when on this high plateau, especially from the back of an elephant, is very striking, its dead level surface stretches away for miles, the line of horizon only broken here and there by a solitary tree, or by the embankment of an ancient tank, for the day has been when all this area was thickly studded with thriving villages. The low scarps of the dry nullah east of Burigang rest-house near Digul Beel, shew that there the plateau is sandy, and small rounded pebbles, mostly of quartz, occur quite near the top of the section. However, on the Sadaro nullah, away from the influence of the ancient Borgang, red clay predominates, as well as in the scarp to the west of Partabghur, where the plain of Bishwanath ends. The thickness of the alluvial here is much greater, but only apparently so. The Giladheri nullah has cut into the alluvial and flows at its very base; and instead of the usual gradation of fall from terrace to terrace, the whole thickness is seen at once, and is here some 40 feet. The high level is seen from here to extend round on the north and north-west by the tea gardens of Diplonga and Dikro, and west an isolated high patch of alluvium occurs at the tea garden of Korsontola, and gradually falls by steps at long intervals into the present level of cultivated land on the left bank of the Baroli.

A series of accurate levels taken over this country defining the extent of these terraces would be most interesting. Round the low granite knobs at Tezpur analogous alluvial deposits are seen, and at other places all the way down the valley. It could only have been formed under very peculiar conditions of an enormous water-supply from the mountains, in still water, and with an horizon higher towards the delta. Gradual subsidence there to the extent of a few feet, and change of climate, would soon model such outliers of alluvial, probably coeval with the extension of the Himalayan glaciers, the fine mud and sand from which would form just such clays and sands as the plateaus are composed of. It is probable that when these deposits were in process of formation, the granite barrier at Gowalpara had not undergone so much denudation. At the base of the clay at Tezpur, a strong

gravel bed may be seen, no doubt a part of the work performed by the Boriali in its earlier days of greater strength and volume, which is not sufficient now to carry gravel so far; at the ferry on the main road to Narainpur, a point nearer the hills, the bed is of sand alone.

Population, &c.

The villages in the Dikrang Valley are all small, some exceedingly so; a certain proportion of the "changs" are large, but that the inhabitants are not numerous is shewn by the limited extent of the "jhooming" in the neighbourhood of them. I give a list of the villages with the number of houses taken from the Field Books. In the Ranga Valley, 14 villages were seen by Lieutenant Harman and myself, and are entered on the map; a few are only approximately laid down as only one ray to them was obtained, but their position is not more than half a mile out. Whether these Daphlas are called Abor-Daphlas or Daphla Abors is, perhaps, inmaterial, but we should be at least consistent if we use either one or the other of these terms, neither of which I consider correct, and they are certainly puzzling to the reader, particularly when in the report by Colonel Graham, he calls both Pekfis and Nanangs, Abors (p. 24). The fact is they are all Daphlas; we hear of Nanang giving his daughters in marriage to the people on the Ranga side, while Daphlas now living in the plains are of the same clans as those now living on the Dikrang, &c.

If it be necessary in writing or speaking of these people to discriminate between them, the terms "Dikrang-Dahpla" Ranga-Daphla are at once lucid, as they give the particular habitat; even the terms Diling Abor and Sulung Abor in above report are superfluous; we might as well use the term Shillong Khasi or Cherra Khâsi. The term or word Abor already causes much confusion in the ethnology of Assam by its indiscriminate use both north and south of the Brahmaputra, even some Naga tribes having received this name, and we may soon hear of Abor Nagas and Naga Abors. There is no attempt shewn in selecting village sites to place or dispose them for defence, the houses being generally scattered about more with regard to the convenience of the site, shewing that they live in far greater security than is enjoyed by most of the Naga and Kuki tribes; in fact the Daphla does not possess the naturally warlike disposition of those people. It is always very difficult to obtain a correct estimate of a population especially as with the Daphlas so many families occupy houses in the "jhooms," but they have been rather exaggerated. I have never seen any large number of able-bodied men together; there is a very great difference in the size of the long "changs," and in some villages there are many small houses, occupied by a single family, at an average of five per house. I have taken an average of seven in my estimate. I much question whether the Dikrang Daphlas could turn out 500 fighting men; on the Ranga, however, the villages are certainly larger, shown by the much greater extent of "jhoomed" land and pemanent terrace cultivation, and the number of houses is brought up to over a thousand; to those villages we did not visit, 60 to 70 houses has been the number assigned, and is I think a high figure; they might possibly turn out 1,000 fighting men.

There is but little difference between any of these Daphlas; those in the plains are certainly darker; the characteristic wicker helmet is worn by most of them; whether residing in the plains or on the Ranga valley; their dress, arms and mode of carrying them is the same. As a race they are certainly short, but they are well formed as a rule, and their short thighs present a fine muscular development. Being generally nude on the side from the hip down, this muscular appearance is more apparent than is the case with many more robust hill tribes, such as the Bhutia and Lepcha. Some of the young men have decidedly pleasant faces, but on the other hand many have a disagreeable expression, not improved by their rough, wrinkled, weather-worn faces. They are about as disagreeable a people to have any dealings with that I know, and their natural cupidity has been fostered by the system with which they have been treated. Almost invariably the first sentence uttered, for any sort of salutation is seldom vouchsafed, is a demand for liquor, or for something in one's tent or on one's table. One fellow actually walked up to my tent door at Burigang and ventured to demand the quantity and quality of his liquor, which was "ek bottle brandy," and seemed much surprised when he was summarily ejected. * * * It is an excellent rule never to give a savage any thing when he asks for it; to give him very little when you do, and then only when he has either given good information or assistance, or worked for the present in some way or other. Those Daphlas who have left the hills and are located in the plains appeared to me to be very useless, unprofitable settlers.

A description from life of a typical Daphla is as follows—Head round in form, face broad, forehead large, square and broad. The distance from eyebrow to eye is large, the eyelid smooth and heavy, contracting the eye to a narrow, lengthened form; the profile with nose is straight and perpendicular, the nose flat, the ala of nose rather large but nostril small. Mouth well formed; lips moderately full, cheek-bones high and wide apart, cheeks full and smooth in the young. The rim of the ear is not mutilated as in many tribes by being cut or pierced, the lobe only is extended (but not to an extreme extent) to about one inch, in which is worn a metal ear-cylinder, or oftener one of wood or bamboo. The eyebrow is oblique, hair scanty. No hair on cheeks or chin; some have a few scattered moustachial hairs, occasionally an individual is seen with a small quantity of hair on the chin and lip, but other characteristics are generally present to show that there has been a mixture of Assamese blood. The hair is straight, but I noticed two individuals where there was a strong tendency to curl; that on the

sinciput is kept long, brought together and tied up with yellow threads, plaited and then wound in the manner of the figure of 8, about a long brass or wooden pin "Dumkor," stuck horizontally across this top-knot "pudum;" when of brass the "Dumkor" is often 15 inches long. Many of them (and it is seen oftener in the villages north of the Dikrang) tie into the frontal knot of hair a bunch of black feathers, which appeared to be the long black head and neck hackles of the male Florican "Sypheotides Bengalensis;" these droop over the forehead and form by no means an unattractive head-dress. Some headmen wear a head-dress somewhat like our "chimney pot" without a brim and open at the top, made of some thin white metal, perhaps silver, having a rude pattern stamped on it, and some feathers sticking up out of the inside. Young boys generally wear their hair long and unplaited. The most characteristic head-dress is the wicker work helmet, strongly and closely plaited with cane, like a skull-cap fitting close to the head, and with the back portion of the rim expanded slightly at the back. From the top a few long tail feathers, stript of the web nearly to the point, hang down behind; they are generally those of the Blue Magpie, "Urociosa Maginrostris," and those of the long tailed Drongos, "Edolids paradiseus" and "Bringa remifer." I have seen this helmet ornamented with the skin taken off the head of a leopard stretched tightly over it; they are as a rule quite plain; the upper mandible of the hornbill is sometimes placed in front with the point directed backward, and the short horn of the "sarao" is also used in this way, and would be a great protection from a "dao" cut. Over the shoulders and back a cloth is worn tied cross-ways in front, and extending to the waist, another small piece passing round the loins and between the legs. Many wear a number of cane rings "ukh" round the waist, which drop down over the buttocks, these rings are of long fine slips of cane neatly bound round with fine flat slips of the same. Similar rings of cane are worn on the arms or legs, by some of the Naga tribes, and besides being an ornament, would effectually stop a blow from a dao, it not being an easy matter to cut clean through such a pliant ring.

The arms and legs are quite bare; a cotton ligature is often tied below the knee, just above the calf, and this is sometimes a narrow band of plaited cane; round the left wristi wound a thick string of hair, to protect that part from the bow-string. Many wear a tight body-piece of stout leather fastened at the centre in front with an iron hook. On the march every Daphla carries a small basket, "Nárá," on his back, holding everything he requires; these are neatly constructed of cane, and are square and flat in form, with the shoulder-strap and basket all in one. Another small basket generally hangs close in, under the left armpit, in which is kept a flint and steel, and such small articles. The "dao" of the Daphla is long and straight, very similar to the Bhutia knife, with a short handle and no crossguard, and I saw a few of Bhutia manufacture. The hilt of the Daphla knife is of wood, bound with cane. It is carried attached by a string passed over the head, and hangs across the left hip, the hilt high in front of the chest. The scabbard is a single flat piece of wood hollowed out to receive the blade, which is kept in its place by three bands of cane or metal, and is thus exposed to view. A small dagger is often carried stuck into the leather body-piece, in front of the breast, or suspended from a loop round the neck. Spears are not often seen, and those I saw were very long. The bow and a bamboo quiver of arrows complete the equipment, and these are carried above and parallel to the long knife. They are said to use cross-bows, but I never saw one. The arrows are of two kinds; those for birds are short, neatly made of hard bamboo, feathered with a small piece of bamboo leaf let into a slit at the head. Those for fighting are larger and tipped with barbed iron points. Necklaces of glass beads, red, blue and white, are worn by both sexes, often in profusion, and a few brass bangles. They are inveterate pipe smokers, many possessing metal ones of peculiar shape of their own manufacture and made of a white metal; the usual pipe is made of bamboo.

The women are not particularly striking either in appearance or costume; this consists of a single cloth brought round the waist crossing over in front and descending to just below the knees, and an upper cloth is tied diagonally across the breast and back; some women wear a long sort of shirt, with short sleeves and confined at the waist by a strap, ornamented with large round button-like discs of brass. Just above the ankles they wear a bandage of cane about three inches broad, and this being tightly plaited on, often gives the leg above it an unsightly, swollen appearance. They part their hair in the middle, take it back over the ears, tie it behind, and two plaits are brought thence forward over the head in front. A number of glass bead necklaces are worn, brass bangles, and the usual ear-cylinders of same size as those of the men. Compared with other hill tribes, the Daphlas are cleanly in their persons, and have their hair generally done up with care. Both sexes tattoo, but it is not obligatory or confined to the Daphla of the Ranga, more than to those on the Dikrang. In the men, two parallel lines run from the corners of the mouth to the ear; on the chin is a short perpendicular line, from the middle of the lower lip, with two lines diverging from it, like the point of an arrow ↑, above the mouth, on the centre of the upper lip, is a little cross +. In the women, the lines from the mouth to the ear are crossed by two zigzag lines, forming a narrow band. They are divided into clans, such as Tauaulia (Shikhi) Tachingaulia (Doripu) &c., who keep together, but intermarry. Nanang's daughters, I heard, had been given in marriage to Daphlas on the Ranga side, showing most conclusively that they are one and the same people.

They appeared a strong and healthy race; cases of goitre were occasionally seen, but not in an exaggerated form, and generally in female subjects. In their domestic condition they

were certainly well-off, well-fed and well-housed; they did not show much in the way of good attire, and this may have been intentional, and due to our presence in the country, for Lieutenant Harman, R. E., reported a very great difference in the appearance of their close neighbours on the Ranga, who were well and plentifully clothed, and who had also been subjected to the blockade.

54. Like all jungle races, they are expert fishermen, and snarers of animals and birds. Large fishing weirs of bamboo are thrown across the Dikrang from bank to bank meeting in an angle down stream: at this point a long through or shoot is constructed and covered in, having a slight slope upwards at the lower end; the water washes into this strong, and the fish at last in their struggles splash and kick themselves high and dry up to the closed end. Another and commoner method, found at almost every considerable rapid, is this—Tripod trestles of bamboo are set up near the lower part of a rapid, where the water is still in a foaming state; bamboos are then laid from one to the other, and the structure thus carried out into the stream, and sometimes quite across; to render it firm it is well weighted with boulder stones. From this long cylindrical or "extinguisher" shaped baskets tied to long bamboo or cane, ropes are let down stream for about 12 yards, and hang thus half immersed in the foaming water. Into these the fish, either running up or down stream, get washed. As many as 20 baskets are so laid side by side, and the number of fish taken is very considerable.* In the upper part of the Dikrang, the largest and most numerous fish was a dark colored species of Mahseerr "Barbus." They are clever in snaring wood partridges, "aboricola" and pheasants, and the Daphlas with me on Torúpútú brought in a number of the former, seldom a day passing without one or two being thus captured. They have an ingenious method of catching smaller birds with bird-lime smeared over a bamboo, bent into the form of the letter D at the top. In the centre of the down stroke of the letter, as it were, a large sphinx moth is attached to a short string, and free to fly about without touching the smeared portion. This being passed up among the branches of the trees, insect-eating birds flying at the moth, get captured.

Cultivation.

The whole of the cultivation on the Dikrang is that known as "joom," or the clearing and burning of the forest, and near Nán-áng's village much of the country has been thus cleared and again grown over, particularly the lower portion of the northern spurs from Misa Parbat. Nanang's village was formerly much larger, and Doripo and other small adjacent villages were all massed together, and even Pekfi's formed a part of it. Thirty years ago they were cultivating the above portion of the right bank. They separated about two years since (1875) about the time of the Amtollah raid, and the break up of the community may have had some connection with the event. They raise fine crops of rice and millet, still uncut in many "jooms" up to Christmas time. From the millet they make the usual fermented liquor of all these hill people, but do not apparently drink so much of it as some Nágá tribes. In lateral valleys, on the east side of the Ranga valley, the more level ground was under permanent rice cultivation, terraced and irrigated.

Houses.

The houses or "changs" of the principal families are large and well-built, of great length, from 40—60 feet, and raised off the ground about 5 or 6 feet. At the front end is an open platform, where the inmates sit out in fine weather. In these houses several related families reside together with the slaves; and Nanang's house was said to contain a population of 120 old and young. Many families, however, live by themselves in smaller houses, and this renders an estimate of the population very difficult; other smaller houses are for the cattle and grain, and thus, I think, the size of many villages, seen from a distance, has been often over-estimated. They possess "mithans," cows, goats, pigs and fowls, but not a very great number of either. The people who live beyond them on the north were said to possess sheep, lived in houses of earth and stone with flat roofs, evidently quite a Thibetan people.

The Dikrang is crossed in two places by rope bridges, the "Chenka" of the north-west Himalaya, but somewhat differently made; two strong canes are stretched from trees on either side, the canes being first taken over a bough, and thence to the ground. This last part is then lashed lightly in toward the tree, fetching up the rope across the river nearly horizontal. On this is suspended, by bamboo loops, a cradle in which the crosser sits and pulls himself along the cane with his arms. Swinging raft bridges are also used, similar to those in Sikkim and Bhutan; the raft is long, the bamboos connected together at the bow end by strong sticks driven through holes cut in them just behind a joint; here is fastened a large ring of cane running upon a strong single cane stretched loosely across the river. The water taking it, this raft is easily pulled from side to side by ropes, or hand over hand on the cane upon which it runs. A raft of this sort will carry four or five men with their loads, but it is slow work crossing a number of men by this means.

Languages.

A short vocabulary of the Daphla language, as spoken on the Dikrang, was made by Lieutenant C. R. Macgregor, 44th Sylhet Light Infantry, who has most kindly forwarded it to me for insertion with this report; so large a collection of words in the language has never

* They are not baited.

before, I believe, been recorded, and my best thanks are due to Lieutenant Macgregor for this valuable addition to our report. (See Vocabulary attached.)

DAPHLA VOCABULARY.

English.	*Daphla.*
A bear	Sútúm.
Deer (big)	*Sáchá.
Deer (little)	Súdum. / Sibi.
Porcupine	Sísí.
Cat	†Soncha.
Pig (tame)	Érik.
Pig (wild)	Saráo.
Mithun	Síba.
Goat	Sabin.
A bird	Pátú.
Tree	Siran.
Hill	Mordí.
Valley	Morté.
Road	Lamte.
Earth	Kede.
Water	Isi, Um—Khasi, Sing—Munipuri —Ding—Khasi.
Wood	Ising.
Rain	Yeddo.
Sunshine	Doyne.
Rice	Áping.
Salt	Álo.
Paddy	Úm.
Rice (uncooked)	Umbing.
House	Ugo.
Beat out (paddy)	Changpo.
A stick for beating out.	Fangi.
Wine	Upo, Yú—Muni.
Door	Árap.
Sword	Chige.
Waistband	Upé.
Beads	Tásin.
Ear-ring	Rangbin.
Bracelet	Koje; Khúji—Muni.
Anklets	Lenkú.
God	(N)egun.
God (of good)	Álu.
God (of evil)	Kúru.
Father	Ábo.
Mother	Ánu, same in Kúki.
Husband	Nágbo.
Wife	Dongne.
Brother (elder)	Tete.
Brother (younger)	Pái.
Little girl	Niga.
Dead man (killed)	Mempe.
Dead man (natural death).	Sído.
Mouth	Ágam—"Akám" Kúki.
Ear	Narang—Na—Kúki.
Chin	Chapla.
Teeth	Ápí; Ha—Kúki.
Hair (in front of head).	Padam.
Hair (on top of head).	Dúmí.
Eye	Enik.
Foot	Léchú.
Arm	Lápo.
Hand	Lákchun.
Nail	Lákfin.
Nose	Nípún.
Knee	Lenbúng.
Ankle	Lengtu.
Thigh	Fápo.
Arm (broken)	Lagdam.
Skin	Súrpin.
Flesh	Súrdin.
Bone	Solam.
Blood	Oí; Eí—Muni.
Chest	Hábo.
Breasts	Ácho.
Hair (woman)	Dumplá.
Good	Álu.
Bad	Kúru.
Big	Porte.
Little	Michú.
Strong	Oiye? *vide* pretty.
Weak	Ojab.
Red	Lengchú.
Black	Koiá.
Blue	Ye.
Yellow	Minchit.
White	Pundhú.
Straight	Dinde.
Crooked	Kanje.
High	Au.
Low	Kochí.
Narrow	Bichú.
Broad	Fákta.
Near	Taiyan.
Far	Ádo.
Wet	Kache.
Dry	Sindo.
Middle	Bangto.
Quickly	Arib.
Slowly	Ású.
Many	Achimá.
Few	Ákin.
Pretty	Oiye? *vide* strong.
Ugly	Káru.
A little	Míchú.
Great deal	Korí.
Lame	Ladak.
Blind	Níglú.
Deaf	Rangbí.
To shut	Chaktumto.
„ open	Kurko.
„ call	Sabo.
„ give	Keke.
„ drink wine	Áchit dedno.
„ look	Máto.
„ ascend	Cháto.
„ kill	Páto.
„ fasten	Leto.
„ eat	Do-do.
„ sit down	Dongto.
„ get up	Darapto. / Gurapto.
„ lie down	Káto.
„ hide	Huso.
„ run	Fáto.
„ swim	Háturo.
„ call	Gokto.
„ play	Sonto.
„ jump	Purto.
„ fall	Geddo. / Dekto.

NUMERALS.

English.	*Daphla.*
One	Ákin.
Two	Ene.
Three	Ám.
Four	Ápe.
Five	Unyyo.
Six	Áke.
Seven	Kánú.
Eight	Penú.
Nine	Kniyn.
Ten	Ailú.
Eleven	Lákin.
Twelve	Laine.
Thirteen	Lám.
Fourteen	Lápe.
Fifteen	Lángo.
Sixteen	Láke.
Seventeen	Káno.
Eighteen	Punon.
Nineteen	Kaiyar.
Twenty	Aiyang.
Thirty	Chámang.
Forty	Chámple.
Fifty	Chángo.
Sixty	Chánke.
Seventy	Káne.
Eighty	Píne.
Ninety	Kaiya (?).
One-hundred	Irang.

All the Daphla words are written according to the Hunterian system, and should be pronounced accordingly.—C. R. MACGREGOR.

Natural History, &c.

In so close a country mammals are seldom seen, still more rarely shot. Four species of sevirus and a few bats were obtained, and I saw two species of monkey of the genus Rhesus, one large, seen generally in pairs, but I never managed to bag one. The elephant here ascends to a considerable elevation, and their traces were seen on the Shengorh ridge at 7,000 feet, up to which they are enabled to ascend by the easy ridges on the east running down towards the Ranga valley. On the outermost range, near the Burroi gorge, it was quite surprising to see the very steep and narrow ridges which they use in their wanderings. Of the Avi-fauna, I obtained a very fair number of species, which I have not yet had an opportunity of working out in detail, but this I hope to do ere long, and it will form an interesting additional list of birds from this north-east frontier. Several new forms occur.

* Colonel McCulloch tells me Sá is a general name for animal in Kúki, as "Sá Vom," a bear; "Sá-joo," a deer.

† Mengcha—Kúki.

The land Mollusca are numerous in the damp forest, and several new species were met with, especially of the operculated genera; these I hope to figure and describe. A small collection in other families was brought together and has been forwarded to Mr. J. Wood-Mason, Assistant Curator of the Indian Museum, Calcutta, to whom I was indebted for the services of a collector, and the sanction of the Government for the necessary carriage while on the expedition. The season of the year was much against the formation of a good collection, and we left the hills before the Lepidoptera and other insect forms appear in profusion, yet I trust when the whole collection is examined, it may yield some new and rare forms from this quarter of India.

Antiquities.

At Harmatti is to be seen the remains of one of the old forts so common all over Assam; it consists of a single brick-wall (now nowhere standing) enclosing a very large area, the sides about 400 yards in length, and a sort of inner square fort stood near the north-west angle. The position is a strong one, its two sides resting on the steep scarp of the alluvial terrace, the latter washed by a small stream. Near Hasseng's village Mr. Ogle noticed a similar fort, while another occurs in the Burroi gorge; they thus formed a chain of defences and were no doubt established to prevent the incursions of the hill tribes and keep them in subjection.

Concluding remarks.

In my preliminary Report D 37, dated Narainpur, 28th February 1875, I stated, "all that could possibly be done by us has been effected, and my only and lasting regret is, as I look back on the hills we have left, that we were not permitted to extend our work further towards the interior, or to the east and west."

Narrative Report of LIEUT. H. J. HARMAN, R. E., *Assistant Superintendent, Great Trigonometrical Survey, on Deputation, in charge Daphla Military Expeditionary Survey.*

I have the honor to give a narrative account of my trip up the Ranga Valley—that is, after I left your camp with the Daphla Field Force on January 7th, 1875.

2. Reached Salombari stockade near North Lakhimpur on the 14th January 1875, and by the evening of the 15th had picked up the 4 "Kotokis" (Government messengers) appointed to accompany me, and obtained sufficient coolies and supplies. That night Captain Williams, 44th Sylhet Light Infantry, in command of the stockade, received orders to detail 12 seyoys as my guard. This addition to my party proved embarrassing, for it is a task at any time to obtain coolies from about North Lakhimpur; few Assamese ever go into the hills, and I required many men to carry provisions for a reported 7 days' march to the nearest village, the sepoys' kit, box of ammunition, &c. On the afternoon of the 18th I made a start with 40 coolies, the Moonsiff of North Lakhimpur promising to send after me the food collected at the stockade when required.

3. *January 19th.*—Lost our way in the forest of the plains and took to roading up the sandy bed of the "Pans" river, here flowing with a fast current between steep banks; the width of water 40 feet and depth 1 to 2 feet. It passed through tracts of "tara" grass, trodden down in every direction by elephants, and receives several wet nullahs famed for turtle. A short distance beyond the Daphgarh (an old Assamese raised road with, in places, a pucka foundation of tiles), the river opens out to a width of 100 yards from bank to bank, and is called the Digal Daroli. Here were several Daphla sheds, and we sprung a number of spear traps for deer and springles for birds, set across the tracks leading to the river.

January 20th.—Entered the outlying low sandstone hills through a gorge, on the western side of which is a cliff (Hatimuta of the Daphlas) showing many layers of different colored sandstones, dipping at a low angle to the south; the topmost strata was hollowed out and filled with clear white sand. From this point the river is tortuous, and traverses low sandstone hills covered with the densest forests, in which are found many rubber trees. The river rises rapidly after its meeting with the small "Gordoloni," a stream with which my Sonari coolies were well acquainted, it being a favorite locality for gold-washing. At this junction is an isolated rock, its summit reached by a ladder; and on top of the rock is a Daphla hut and some bamboo frame-works: the latter formed by tying bamboos into tripods and filling in the bases with stones encased in matting. The adornments are strips shaved off the rods, tied into bunches, and tiny baskets are hung about, intended as receptacles for offerings of flesh and grain.

5. This is a great spot for the sacrifice of fowls by the Daphlas to "Yapum," their god of the chase. It is, perhaps, needless to remark that the fowls are subsequently eaten; the liver is the only portion considered necessary to offer up. Above the junction of the "Gordoloni" I found some plant remains by splitting some layers of a strata of clay that shows in the cliff. The strata of the cliff dip to the south; below the layer of hard clay specially referred to is white sandstone, and above the layer is a strata of sand, mud and small pieces of quartz (some angular, some rounded), and above this again is a strata of fine blue hard clay. Travelling on we came to the "Henko," which comes in from the west, and is equal in volume to the "Pans" at the point of junction. We followed up the "Henko" and encamped at the place where the "Bat Juli" (Juli or Jilli is a small hill stream) cuts through the left bank. In the bed of the "Henko" we found quantities of brown coal or lignite, and often saw protruding from the sides of the sandstone cliffs (the Henko flows in a chasm), the roots and portions of fossil trees, with about the exterior two inches in thickness, as hard as brittle coal of great lustre; the interior of brown petrified wood of an apparently dense structure (I did not note at the time whether the roots were in every instance upright and resting on shale beds, but in some cases I know that it was so).

6. This was the first clear day since I left Narainpur, but we were now so close under the big hills, that my plane-table was of but little use.

January 21st.—Ascended the "Bat" Juli a short distance, then crossed over a low ridge down into the "Lotia" Juli, and after marching up its course some way, we struck an excellent path leading up the hillside; an ascent of 500 feet took us on to the Kesuri-gauch-purbat, so called from the numerous "kesuri" trees—trees on which the "muga" silkworm will feed. Here was a Daphla shed, also a bundle of ready-made torches, which we afterwards found of use: at this place a path comes in from "Oabat" (in the plains), said to be practicable at all seasons. We continued up the ridge, and over many knolls (Jaboripita, Ratsal, Moru), on to the "Katusal" mountain, passing through magnificent forests containing "hollok," "pomah," "jatuli" (Assamese names) trees of great girth, used for "dugouts" (canoes), and the "hinguti," a tree of large size and of extreme hardness and toughness.

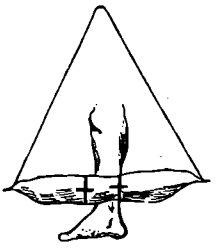
7. The coolies collected quantities of wild pan, and cut some "gondri," a sweet, fine-scented, moist, yellow wood, which they ate with the pan. From the Katusal the path goes to the "Tekara-guri-purbat" (the tekara is a small yellow fruit like an apricot), then along a flat broad ridge to the "Gala Pokri," a circular depression in the ridge top, full of water, 30 yards across, and on the border of which is a celebrated and immense rubber tree named by the Daphlas "pabila" and by the Abors "dob-abor;" it has never been tapped. From this there is a steep ascent up to the pass on the "Sikoti Dhura" (about 3,500 feet above the sea-level), and close to its summit is a well-known great banian tree, from the fruit of which the Daphlas prepare their best bird-lime. I often saw little boys trying to catch birds with bird-lime; they fixed to the end of a long pole a semicircle of bamboo, well smeared over, and in the middle of the semicircular space buzzed a large insect fastened with a hair round its body; the other end of the hair was tied on to the diameter of the frame. The urchins would sit behind a bush near a favorite tree and hold up the lure, so that the small birds might attack the insect.

8. From the "Sikoti Dhura" the path descends to the "Ranga" (Hunderi of the Daphlas). As yet I had not been able to fix my position, and having caught a glimpse of a Daphla village from the pass, I set my people to work to do a little cutting, but after expending a good deal of time and then not recognising any points, I gave up the attempt. During the descent I was at one time on ahead, and while waiting for my advance guard to come up, suddenly spied several Daphlas, went down to meet them, and on arrival of the "Kotokis" I was told they were "Tapli" (*gam*) and his sons out for a hunting trip. They were surprised at seeing soldiers, and it needed some persuasion before the "*gam*" (principal man of a village, and has very little authority, apparently) would accompany me: he disappeared during the night. On the path down I was shown a large rock of gneiss jutting out from the hillside and called the "Sitaimura mellaur." The Daphlas say that Mahadeo raised the rock up with his shoulders to serve as a shelter from the rain. Close by is a large heap of twigs, arrows, &c.; every Daphla passing by on his way to the plains contributes a something. To this act they ascribed a religious significance, but I suspect its purpose is merely to give warning that some one, or a certain person has gone to set traps. Up to the pass we had been travelling through sandstone formations, but as we went over the knoll "Lakati fillaur" on the downward path, we entered micaceous schists, &c., which, with gneiss, form the whole mass of the mountains 28 Western 28 Eastern. Midday of the 24th we got to the "Ranga," a fine torrent, of greater volume than the Dikrang, not fordable, and with an average width of water 60 yards. At this point its bed is at feet above sea-level.

9. Next morning, with my Kotokis, a Daphla and a couple of sepoys, I went off to Tada's village, 5 miles distant, and had a conference on an open bit of ground near the village. Tada is an aged, stout man; he came dressed in a yellow robe, and brought with him his boys and sú (*gam*), the other Daphlas standing around at a little distance. "Tada" was civil, and said "he was grieved I had found it necessary to bring sepoys and so many coolies, for how they were to be fed puzzled him; that he had not been out of his village for many years, but would come down the next day and bring all my things up."

10. He kept his promise, and I was foolishly prevailed on by him to send away some coolies (under an escort) as our supplies were running short. Near the village I found my hut built, but none for the men, so "Tada" had to exercise the little authority he has. The same evening "Tada" reported his people in a mutinous state; that they wanted payment for work done, &c,. Henceforth there was no managing the Daphlas; every coolie and every seer of rice was only obtained after a deal of trouble; not that the men ever showed signs of active obstructiveness, they simply did their best *not* to oblige or help us in any way; refused to believe in the harmless nature of my work, and were highly indignant if ever from necessity I cut down a shrub obstructing the view from my plane-table.

11. The morning of the 28th January "Tagum" (*gam*) came in with the men I had called upon him to supply, and we moved to his village, crossing the "Ranga" on a triangular bamboo raft ("supe"); it was propelled by a pole and capable of taking only one passenger at a time. Near the village is the usual halting place, and Daphlas invariably observe the etiquette of resting at these spots until some one comes from the village in answer to the shouting. On the path was a tree to the trunk of which, transfixed by many arrows, were the entrails of a "Mithun." At the opposite entrance to this village was an elaborate structure: a six foot stake of "simal" wood upright, and crossing it at an angle two other stakes, and in the fork thus formed rested a horizontal stick; at the crossing of the four sticks was fastened the hoof of a Mithan pierced with many arrows pointing towards the Abor country. The butts (holding the bamboo wings) were half broken through and bent upwards; from the top of the post was suspended a small punishment log such as I have often seen on the legs of their refractory children and men in disgrace; against the foot of the post rested a slab of stone bound about with matting and creepers, and there was a small tripod of bamboos neatly ornamented with cane-binding, arrows, shavings, &c. This structure marks the spot where a Mithun has been slain, but its exact object I could not learn.



12. While in Tágam's village, "Loma" (an Abor Chief), sent to me his son and daughter with a present of a fowl, some eggs and rice. The youth was fair, nice-looking and slim, well dressed after the Daphla style, and he carried a long spear; his sister was smart, wore a profusion of large heavy necklaces and carried the provision basket on her back by a plaited cane strap over the head and a relieving strap across the chest. The "Abors" *never* tattoo, the greater majority of Daphlas do so, but it is purely a matter of taste with them.

13. Tagum's men thought they had done all that could be expected of them. and did not see that it was their duty to take me away; however we went to "Tákhá's" village and passed through extensive cultivation at the foot of a hill on which is a large village (of 150 houses?) inhabited, it is said, almost entirely by women, and presided over by a Daphla woman, the wife of "Sera", an Abor Chief. On our way we met a crowd of Abors who begged that I should not go to this village. We went on for about 5 miles along the left bank of the largest streams, the "Kelo" and "Paing," through "jhooms," jungle of tall grass, bamboo, and patches of forest with cane, and in the valley at the foot of Tákhá's village I was surprised to see large fields terraced and irrigated for rice; the hillside above was also terraced. From the hill above "Túkhá's" village I was at length able to fix my position by the plane-table. As yet I had done a mere trifle of sketching on account of clouds, &c., but had kept a compass route of the marches with paced distances. We had now two nights of sharp frost followed by a couple of brilliant days, and the prospect over the Abor country was splendid. My aneroid puts "Tákhá's" village at 4,500 feet. I had an accident with my Boiling Point Thermometer.

14. While here, a detachment of 20 coolies (procured by the exertions of Captain Williams, who assisted me in many ways) came in from "Salonibari" with salt and rum; they had been 10 days on the road, had eaten up nearly all the provisions and twice lost their way, though how they managed it is strange, for the path was well blazed throughout, and every diverging track closed; this accession of strength tested our commissariat, which had been a difficult affair, and we had a grand job to squeeze a few days' supply out of the village: as a rule I used to give payment for the food drawn, but when I gave money the Dufflas cried for "salt," and when I had "salt" they would not be satisfied but yearned for "money" instead. In the village were two "Ouka Miris," visitors and very uncouth fellows; they said their village was only two days distant, and that their lands were flat. It was said that they irrigated, and grew wheat, but none of the Daphlas or "Kotokis" could I prevail upon to go there with me to see, and the thoughts of such a journey caused four of my coolies to run away; so as I had still a deal of Daphla country to visit, I gave up the project for a while and visited "Piji's" village, thence through "Tada's" to "Tapli" and to "Su"; the latter I reached early February 7th. I had only once seen a "Mithan" and that one was eating the mud of a "pung" (salt spring) on the path below "Tada's" village (the spring did not taste very salt to me), but in "Tapli's" village we found ten of them tied up, 3 were black, 2 white, the others pied; it was evidently stock-taking day of that batch. A few minutes after my arrival they were all driven away by men carrying long spears and twisted cane ropes; I should think that the number of head of "Mithun" to each village is large.

15. In "Tapli's" village was a man "in extremis," and two medicine-men (?) sat on the ground, repeating in a loud voice and with great rapidity a short sentence; they each held in one hand a fowl and in the other a knife, and at the proper moment simultaneously killed each man his fowl and put the liver in a bowl of water. They said that no prayers could avert death, but that this ceremony would lessen the pangs of dying; they had already massacred a dozen fowls and many more were tied up ready for sacrifice. These men did not seem to be held in particular veneration, for the Daphlas said things to them which made every one in the secret laugh; and if ever I questioned a Daphla about his religious affairs, he would say he did'nt trouble himself about such matters, but that the priestly men would do all that was necessary on payment. They have a god for most animals, and of most events. If I plucked a certain plant with a three fingered large leaf, common in these hills, the Daphlas would shudder and assure me "the Deota will seize you."

16. Now I wished to go down the Ranga Valley and trace its course to "Johing," but the Daphlas and my "Kotokis" would not hear of it; the Daphlas had often said it was a mere hunting track, difficult, not passable for a heavily laden man, certainly not for an Assamese, and so on. For several reasons I sent my people back to "Salonibari," and on February 9th started with some Daphlas who had volunteered for the consideration of Rs. 5 a piece, and that I should go alone. We had a terribly wet journey, and their description of the track was not so much exaggerated after all; there were lots of nasty little places where my dog had to be carried. The path cuts into the left bank of the Ranga at several points before it (the path) crosses the "Por" Juli, a large stream which flows in at the apex of the great bend, the "Ranga" takes to the south bursting through a fine gorge with landslips on either side.

17. It is here one again enters sandstone hills; the path goes over the boulders of the "Ranga" for some miles, occasionally making a long detour to get to the other side of a projecting rock. Soon after entering the low outlying ranges, the path leaves the river and traverses a "Dún," and ascends the ridge which is the source of the "Johing" river. We made slow progress through this "dún," for the path was over-grown with jungle and the line was kept by the Daphlas stringing themselves out to 20 paces interval and carefully searching for old cuts and signs. Crossing the ridge (about 1,500 feet) we followed the "Johing" river to its junction with the "Ranga" at "Johing" Tea Factory, reaching there on the afternoon of February 13th; here I found awaiting me orders for my return, and I got to Narainpur on February 19th. The whole journey had been through the densest forest and jungle and over low lying ground, so to speak; not once had I a chance of putting up my table, and all I could do was to keep an itinerary of my route with paced distances. Up the "Johing" and 3 miles from the factory a recent landslip has occurred and disclosed a salt spring, a little salty and soapy to the taste; the sand all around was churned into slush by the feet of animals.

18. The low ridge above the right bank of the "Paing" Jilli forms the boundary between the Duffla and Abor districts, the line crosses the Ranga and runs up a prominent spur to the ridge 29 En. 29 Wn. The Abor country beyond the low ridge is low, undulating grass slopes, and with little forest as far as the "Chengreng" chain which is clothed with forest. The Abor country of the right bank shows long, sloping, and wide rounded spurs running down from the ridge 29 En.; 29 Wn. and ending in cliffs above the Ranga; there is only dense forest in the valleys. Several large villages and many large clearings are visible from "Takha's" village. The Daphla District is in dense forest; all the villages (except "Tagmu's") are on the sharp spurs with intervening narrow and deep valleys which radiate from the ridge 28En. 28Wn. The "Ranga" flows through some small stretches of plain in which are the curious "Bogi Jamu" trees; some are of great height; the surface of the trunk is hard, smooth and white with a slight green tinge; they have a very thin bark, which they shed. A pony could travel by the "Salonibari" route to the Ranga, but would find the paths leading up to and from village to village difficult in places. The villages are well built and of the same type as those in the "Dikrang" valley; many of the houses are large, and "Silli's" house in "Takha's" village is 180 feet in length. Piji's village has 20 houses, Tatta and Su 30; "Tapli" and "Tagun" each 50; "Tada 60 and Takha 150. There is a vast amount of jhoomed land about and below the line of villages, which are all from 3,000 to 4,000 feet up, and on Tagum's side of the river are also great expanses of jhoom. The Ranga Valley Daphlas all belong to the Bodalia clan, except "Tagum" and "Tatta" (again in Su's village) who are of the "Nirikolia" clan.

19. These Daphlas are a great contrast to those on the Dikrang; they are light complexioned ("Tada's" boys are very fair), there are lots of pleasant faced, rosy-cheeked women of short stature but well built, well dressed (I rarely saw a shabby man); were easily amused, very merry, and manifested extreme curiosity about all my ways and things, but are obstinate as mules and prone to tell lies. I saw nothing of a defensive or warlike nature about, or in the villages, and the men seem to me to be men of peace. Their poisoned arrows (for game) are tipped with a piece of wood shaped like a heart, and just below it on the shaft is a lump of brown stuff studded with little yellow seeds; they get this from the Abors (it is monkshood—aconite?).

20. "Tada" had, as a constant attendant, a little Abor boy, who carried bamboo "chungas" of the liquor of the country for the "*gam*." On enquiry I found that this boy had to do duty for a certain time, and would then claim "Tada's" daughter in marriage. This liquor is in appearance like milk and water, it is palatable and mild, not unlike small beer, and is brewed from a small dark-brown grain (a millet); the Daphlas drink of it at every opportunity. I never saw a Daphla drink water. "Tada" has four wives and "Tagun" two; I do not know any other men who have more than one.

21. The Daphlas have few prejudices as to with whom they eat, or what they eat. I once saw a man toast a water rat and a mouse on a stick without flaying them; and one day after digging some grubs out of a decayed tree they were promptly devoured, and the men were overjoyed when I came upon some queer things with little black scales like beetles. They profess to hold the monkey and dog in abhorrence as articles of food. Twice a day do they cook their fine hill rice in bamboo chongas. Some houses have earthen pots, and Tada has a set of brass vessels. To wash the rice first before boiling they consider is a waste of its strength. Soon after midday they eat a meal of cold rice, a portion of the morning's cooking. They feed themselves, not by putting the rice into their mouths with the fingers, but by collecting it in the palm of the hand and passing the palm of the hand downward across the mouth; many of them have bone spoons, which they occasionally use. All, even little children, are inveterate smokers of the coarse hill tobacco; the black remains in a pipe after it has been smoked is swallowed with great relish.

22. In the Daphla district there is no salt; the "Ouka Miris" supply a dirty grey, bitter salt produced somehow by evaporation; the specimens I saw consisted of a cake of mud one-eigth of an inch thick, and on this was deposited $\frac{1}{8}$ inch salt; the lower surface of the mud was black with smoke.

23. The method of gathering rubber is to notch the tree all over at distances of about a foot apart, and as the rubber, which exudes in a thin stream, gets firm, it is detached from the bark by winding it up into a ball; in this form it is sold by weight to the "Kaingyas" of the plains; the rubber is often cunningly wrapped round a ball of mud. At about 4,000 feet and near Takha's village is a fine rubber tree.

24. They poison fish by pounding the bark of the "Ramal" tree on the stones where the water is flowing into the selected pool, the outlets of which are banked up; the poison spreads through the pool and acts rapidly they say. There are many fishing weirs on the "Ranga" some ingeniously built; the platform is usually suspended by long canes from the trees above the bank; the fish are caught in long funnel-shaped baskets baited with flesh and placed in the runs; we several times got small fish out of these baskets.

25. There are quantities of the "Tamin" the maddar plant, in these hills; they told me that the greater quantity is taken to the plains by the Abors. I saw some silk cocoons of large size, like those of the "Monga" silkworm.

26. The Daphlas do not dance, sing, or whistle; a noticeable peculiarity about the Daphla women is the sing-song way they talk; they speak slowly, the voice rises and falls half a dozen times and is pitched in as many keys during the utterance of a short sentence; the effect is very odd and pretty, and sounds like the tone of humble expostulation. Whenever a discussion took place, the women always had their say and were listened to attentively; every village brought to me its one or two old ladies, and their position in the community was explained by the "*gam*."

27. Most of the Daphlas can talk Assamese well, and my sepoy orderly made a capital interpreter. The "Ranga" valley Daphlas thought that they had not offended; they often declared that sickness was sure to follow in my track, and that after my departure the Abors would certainly cut them all up.

Extract from the Narrative Report by Mr. M. J. OGLE, *Surveyor.*

Having received instructions to select Gorusuttia peak for a trigonometrical station, and to survey as much of the country as possible from that point, and country lying between the outer range of the Daphla hills up to Misa Parbat range, I started from Narainpur on the 4th December and arrived at Gohpur on the evening of the 5th.

At this place I met Captain Michell, the officer commanding outposts along the line of road from Katnia to Hellan. His instructions were to provide an escort for my party and to accompany me if he thought it necessary; and after explaining to him the nature of the work I was to be engaged upon, he decided upon going. Accordingly, when Commissariat arrangements had been made, coolies collected and guides obtained, we started late on the following day with a guard of 6 men, which was afterwards supplemented by 4 more from the 42nd Assam Infantry, and arrived at Kukarjan tea garden, a distance of about 5 miles, at 3-30 p. m.

We encamped for the night on the Deja stream, and on the following day crossed the Meguine, and then came upon the Diphu river, along the bed of which we proceeded for two hours and halted for the night near its source; we arrived here late, many of the coolies not coming in till long after dark. On the 9th we ascended the outer range of hills and encamped on the ridge, there being an ample supply of water close to our camp. Gorusuttia peak still lay about 1½ miles to the westward; but the Daphla guides refused to proceed any further, declaring that it was impossible to get up to the peak; in fact these men were of very little service to us at all. Captain Michell and myself, however, kept along the main watershed line and were obliged to return to camp without getting near the hill, owing to darkness setting in, but I had seen enough of the eastern face of the peak to lead me to believe that it was inaccessible from that side, being a sheer wall of rock of over 2,500 feet at its highest point. I therefore next morning selected a hill above camp for the Trigonometrical station. The path was a dangerous one to walk along, lying in some places by the side of a deep landslip, and in others up the ridge, which was not more than a yard broad and in many places much less, steep precipices on both sides; fortunately there were numerous roots to cling on by. Late in the afternoon, although we had only traversed about 1½ miles, we arrived under Gorusuttia and found it was impossible to get up to it from that side, so we were obliged to abandon the attempt.

On the 11th Captain Michell left for Gohpur, and by the 14th the hill was cleared, all observations taken, and as much of the country as could be seen sketched, when I marched back for Gohpur and thence on to Narainpur, which place I reached on the 17th. I halted a day here to give the men rest and to get in supplies, after which I started for Dihiri, encamped at its base and ascended the peak next morning. On the second day I left for Harmatti and arrived there on the 23rd. The next day I plane-tabled up the bed of the Dikrang (as more of the hills could be seen from the river than by going along the road) up to the junction of the Borpani with it. On the 25th I marched through Harjuli camp, and across the Tanir range into camp No. 6 on the Dikrang.

Having been provided with a guard of ten men from the 16th Native Infantry, and twenty Nepalese coolies for the carriage of their baggage, provisions &c., I started on the 1st January with 10 days' rations for Haseng's village. The road at first led over a spur thrown off from Pokhopudu peak upon which the small village of Dapo is situated. Beyond this village for a distance of about 1½ miles the path was thickly studded with upright spikes of hard, seasoned bamboo some 3 inches long, called "panjies." Three of my men and one of the Daphla guides got "panjied" in the foot, in spite of the precaution I took of sending a couple of coolies ahead to clear them away.

These panjies were planted only along the crest of the hill, and after leaving it the path wound along the base of the ridge which connects Tanir H. S. with Pokhopudu peak, and crossing over a low dip midway between the two peaks we descended gradually into "a jhoom," from which clearing I was enabled to sketch in a great deal of country I had not seen before. The path then descends very precipitously for about a mile into the Murchijuli.

On the 3rd we ascended Dompu peak about 4,500 feet above sea-level, and after going down on the opposite side for 4 or 5 miles I was obliged to halt owing to night setting in, my Khasia coolies only arriving at 9 P. M. The whole of the guard and Nepalese coolies (with the exception of two orderlies that were with me) remained near the peak. The next day I pitched camp on the bank of the Popujuli under Hoseng's village.

The path just led up an easy ascent for 1½ miles when it reached the back of a long broad spur thrown off from Dompu peak. On this spur were the ruins of an old brick wall, only about from a foot in some places to two feet in others still standing. This wall flanked the spur in parts where it was easy of approach, and was broken off where it was steep and precipitous. Four or five stones also, with rude carvings, were seen on the path. This tract continued along the ridge until the Borpani was reached. Here this river runs with considerable violence in a southerly direction, dashing over rocks and boulder stones, till it takes a great bend to the eastward, when it flows smoothly along a sandy bed for a greater portion of the distance to its junction with the Dikrang, broken here and there by insignificant rapids. Crossing the Borpani the path led along a level bit of country, which was cut up by numerous small ravines; two large ones were crossed, after which there was an ascent and a dip down again into the bed of the Loijuli where we encamped for the night. From this point the track lay along the bed of the stream for some distance, and after leaving it then commenced a steady ascent for an hour when the summit of the ridge is reached. After again descending and then running along under the ridge, Takhang's village is approached.

We got here on the 6th, but Takhang was not at home; however, two of the people came out to meet me on hearing of my arrival. They were civil, and said that messengers had been sent after their Chief informing him of my arrival. The next morning he was down at camp with two other Daphlas and accompanied me as guide for the day. But I could get very little information out of these men. On asking them the road to a village (Tageng's, as it subsequently proved to be), one I had seen from Gorusuttia and lying about 3½ miles to the north of Takhang's, they declared positively there was no village in that direction and also that they were ignorant of the existence of any villages except Haseng's. It not being a matter of very great consequence to go there, and, besides, my supplies being limited, I did not

urge the subject. But it was of some importance to know that a village did exist there, as afterwards a party under Captain Palmer and Lieutenant Hume were sent to occupy it to facilitate the release of the last remaining captive. After completing all that could possibly be done, I retraced my steps to Haseng's, and thence down to Doi Mukh.

I proceeded on the 15th up the Dikrang. Rain had set in from the 5th, but fortunately there were occasional breaks here in the lower ranges which allowed of the work being carried on. Consequent upon this bad weather, progress was very slow, great difficulty was experienced in crossing and re-crossing the river owing to its swollen state; it had to be forded frequently, and could only be done at the rapids, the other portions being too deep. On the 18th we struck a Daphla path on the right bank, and taking advantage of it followed it up till the summit of the hill was reached, which was about 2 miles from camp below, and commenced clearing; on the 19th the hill was sufficiently cleared for plane-tabling. Having completed what could be seen from this point, I started again next day and got to near the great bend the Dikrang takes; cleared a low hill just above the river, and on the 22nd ascended a ridge to select another point. Two peaks close to each other were cleared on the 23rd, and on the following day another one, which enabled me to look over into the Ranga side, thus squaring the work up to Longitude 94°0′. On the 25th I marched back for Doi Mukh and arrived there on the 26th; two days were spent at that place in inking up my board. On the 29th I left for camp No. 6, reaching it on the 30th after doing a large amount of plane-table work from Tanir H. S.

In the meantime, I had received your further instructions, *viz.*, that after completing the country about the Borpani and Dikrang rivers, I was to apply to Major Heathcote, the Assistant Quarter Master General, to whom you had also written, to furnish me with a suitable guard to visit Peak 24 of the G. T. S., and to clear it for the purpose of a Trigonometrical station. On the 31st the General visited Pakfi's village and I took the opportunity of going up also and shewed him the peak.

We succeeded in doing some more sketching from the plains, and by visiting peak No. 10 of the G. T. S., filling in a considerable area drained by the Buroi river.

Rivers.

The principal rivers of the country in the narrative under report, are the Dikrang and Borpani. The former is a fine, clear stream flowing almost due east for a long distance of its course, when suddenly it takes a great bend to the south, or about 3 or 4 miles only, it then turns due west till it is met by this Borpani, when it again flows almost south. From the bend the country on either side is generally flat, in some places only spurs from the low sandstone ridges come upon the river and terminate in abrupt cliffs. This is the great hunting ground of Pakfi's men. Numberless deer traps and fishing weirs are to be met with. Otters abound, and mallards have been seen above No. 6 camp. This river has a considerable volume of water, and boats of 10 maunds burthen can be taken up as far as its great bend, but with difficulty, owing to the swiftness of the rapids. After that point is reached they are too strong, and the beds too bouldery, as the river becomes narrow when it gets into the hills.

The Borpani takes its rise in the Misa Parbat range, and after flowing due south for about half its course, takes a bend almost due east; for the first part of the distance it runs rapidly having altogether the appearance of a mountain torrent, the latter portion being a gentle, rippling stream having in some places a sandy bottom, and in others a rocky one, the rapids being inconsiderable. Like the Dikrang, the last part of it flows through level ground, being flanked from about a mile to two or three by low hills; small boats might also be taken up the Borpani as far as Haseng's, or probably a little further, but I think it would be a matter of difficulty, the river being broad (considering its short course) and consequently shallow.

TRANSIT OF VENUS.

Letter from CAPTAIN G. STRAHAN, R. E., *in charge Rajputana Survey, to Lieutenant-Colonel* J. F. TENNANT, R. E., F. R. S., *dated Roorki, 17th December* 1874.

I have the honor to forward herewith the following report on the observations of the transit of Venus as seen by me at Lahore.

2. On my arrival at that station my first care was to select a suitable place for erecting my instrument. I was fortunate in obtaining an excellent site within a few yards of the house in which I was living in the grounds of Doctor Calthrop of the Lahore Medical College, who was good enough to allow me to erect my pillars and observatory tent there.

The means of identifying the exact site and its connection with the Great Trigonometrical Survey are shown at some length in papers A and B attached to the original report. Three pillars were necessary, *viz.*, one for each of the following instruments,—the equatorial, the transit and the collimator.

They call for no special mention, being of the usual design. Three days were employed in building them, including the collecting of men and materials.

3. The instrument used for the observation of the transit was a 6-inch refractor by Simms, mounted on a rough equatorial stand which had been made up at Roorki workshops expressly for this purpose. There are no micrometers and no driving clock attached, which is not, however, to be much regretted, as I had no difficulty whatever in following the planet by means of a Hooke's joint turning an endless screw, gearing on the polar axis. Diaphragms of several different diameters were supplied, but I found no difficulty in using the full aperture of 6 inches.

4. The transit instrument is one belonging to the Great Trigonometrical Survey, 3 inches aperture and 30 inches focal length, Russian pattern. It is an exceedingly convenient instrument to work with, and with proper care gives very good results; but it has one serious defect, *viz.*, a complete instability of the position of the line of collimation dependent on temperature. This defect is no doubt to be traced in some way to the shifting of the metallic supports of the reflector owing to changes of temperature. This entails a constant reference to the collimator where any change is suspected, and it is perhaps hardly too much to say that the instrument would be useless without one owing to the uncertainty in this adjustment. Observations on the position of this line taken at intervals of 30 minutes throughout the day show pretty clearly its connection in some way with temperature. The equality of pivots has not been rigorously examined.

A theodolite by Cooke and Sons was used as a collimator on a pier about 7 feet to the south of the transit pillar, and also for the measurement of the angles required in connecting the observatory with the Great Trigonometrical Survey. Majanj station was the point I chiefly relied on for this, but on examination of the mound on which it had stood, no trace whatever of the old station could be found.

I, however, assumed the highest point of the mound to be correct and fixed by means of it and three other known points, a station which I have called Donaldtown station within a few hundred feet of the observatory with which it is connected by a traverse of two rays only. Not feeling quite satisfied with the accuracy of this, I fixed Donaldtown station by observations to three known points, and the results thus given agree with the previous ones within $\frac{2}{100}$ of a second in latitude and longitude, so that no doubt remains as to the accuracy of the computed position which is taken at—

$$\lambda = 31^\circ\ 33'\ 38''{\cdot}55$$
$$L = 74^\circ\ 22'\ 29''{\cdot}01 = 4\text{h. } 57\text{m. } 29{\cdot}93\text{s.}$$

In case its exact site should ever be again required for any purpose, I have attached a diagram showing its distance from the two corners of the house and the traverse from Donaldtown station.

5. The chronometers used were a sidereal one, No. 1509, by Arnold and Frodsham, and a solar one, No. 2566, by Dent; the latter remained indoors quite undisturbed and in as nearly an uniform temperature as possible, whilst the former was carried to and from the observatory as required. It was compared with the solar chronometer three times a day, *viz.*, at 8 A. M., when they were both wound up, and in the evening before commencing and after completing the night's observations. They were also compared on the day of the transit before and after the observations of contact.

6. I commenced observing transits on the 21st of November and continued without the exception of a single night until December 10th. I generally obtained 6 or 7 stars for time, and either one or two pairs of circumpolar stars for verification of azimuth. These have all been provisionally reduced and show a very uniform rate for the chronometer. There can be little doubt that the times recorded during the transit of Venus, when reduced by the application of the error and rate are true within a few hundreths of a second.

7. Some days previous to the transit, I had satisfied myself about the best position of the chronometer and note book for the observation, and from experiments on the various apertures and eye-pieces, came to the conclusion that the full aperture was by far the best and the most suitable eye-piece, one magnifying about 125 times, fitted with a diagonal glass to allow most of the sun's heat rays to escape.

8. Having satisfied myself upon these points, and knowing that my attention would not be distracted by having any measurements to make, I awaited the phenomenon without much anxiety. The weather on the morning of the 9th was all that could be wished. Ingress was not visible so far up-country as Lahore, and for about an hour after sunrise, the sun's limb and the planet were trembling a good deal, but as the sun got higher the definition became better till just about 15 minutes before contact the edges of the two bodies were as hardly and sharply defined as could be wished. Your telegram had prepared me for the absence of the black drop but not entirely for the appearances actually seen. As the planet moved towards the sun's limb, she appeared to push out the edge of the sun before her, the cause of which phenomenon became evident in a few seconds. The planet's edge was encircled by a ring of light nearly as bright as the sun's disc which prevented any contact, properly so called, from ever taking place at all. The moment I have assumed for internal contact is No. 2 in the sketch when the sun's edge, if unbroken by the ring of light, would just have grazed the limb of Venus. I have considerable confidence in the accuracy of this observation, as the limbs were beautifully steady and sharp and no distortion apparent.

There was no appearance whatever of a black drop or ligament. The following notes I copy *verbatim* from the record made at the time, but it must be borne in mind that a correction of +1 minute 15 seconds must be made to the recorded times for chronometer error. Slight darkness between the limbs at 16 hours 13 minutes 22 seconds, some uncertainty about the minute, seconds correct no black drop, the darkness enveloped more of the limbs without increasing in depth (of shade), no dark ligament occurred at all. After contact the limb of Venus outside distinctly visible owing to bright line of light round, enveloping $\frac{2}{3}$ of it, the part absent (nearly) being on east side.

At 16 hours 19 minutes the light was $\frac{3}{4}$ round the limb of Venus, confirmed by two spectators, cusps absolutely and perfectly sharp.

At 16 hours 23 minutes, the edge of light diminished to $\frac{1}{2}$ the circumference of the western limb.

The part of the planet outside the sun was palpably darker than the sky, dense black, the black ground being purplish. Its shape in no way distorted, magnified or diminished.

At 16 hours 26 minutes, the edge of light was fading.

At 16 hours 31 minutes 15 seconds, gone.

Traces occasionally seen again.

At 16 hours 34 minutes 5 seconds, edge again distinctly visible.

At 16 hours 37 minutes, it extended round $\frac{2}{3}$ of the circumference on the same part of the limb as before.

At 16 hours 38 minutes 15 seconds, visible as a glimpse only. External contact and total disappearance at 16 hours 41 minutes 9 seconds.

Aperture 6″; power 125.

An elaborate discussion of these observations would perhaps be out of place in this report, but I am nevertheless tempted to make a few remarks upon appearances so unexpected.

There can be little question that they point to the existence of an atmosphere to the planet, and there is certainly no *d priori* improbability in such a supposition. It is difficult to account for the position of the strongest part of the ring of light being unsymmetrically situated with regard to a line joining the centres of the sun and Venus, but this is established beyond all doubt; indeed, the most unpractised eye must have noted the circumstance. It will be observed that the brighest part of the ring is almost exactly on the preceding part of the disc, reckoning along the line of the planet's motion; but whether this is a mere coincidence or a significant fact, is not readily apparent.

The ring was visible up to the time of external contact, and from this a rough estimate of the refractive power of the planet's atmosphere may be made, inasmuch as the minimum deviation of a solar ray reaching the observer's eye after refraction when in the position of exterior contact must evidently be the apparent diameter of Venus as seen from the earth + her apparent diameter as seen from the sun. This deviation in the present case amounts to 1′ 27″.

During the transit I kept a careful look-out for a satellite of Venus without success, and also for any abnormal appearances in the planet's shape, but I never detected the slightest deviation from a clear, hard, circular edge.

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

Description of country triangulated in Jodhpore, Bikaner, and Shekawati.

The country through which the season's triangulation passed belongs to Jodhpur, Bikanes and Shekawati, and is of the same utterly uninteresting character as has fallen to the lot of this party for several years past. It is little better than a sandy desert, diversified only by groups of sand-hills at long intervals, covered with coarse sedgy grass and occasional babool trees. Notwithstanding the water being scarce and of bad quality, this country is moderately well peopled, but the inhabitants are dependent for their support chiefly on grain brought from the north and north-west towards Delhi, the only crops raised in the district being "bajra," if we except only a few small patches of barley in the immediate vicinity of the wells. Most of the land is in the hands of Jagirdars, who are for the most part addicted to the prevailing vices of Rajputana—opium-eating and drunkenness; they were, however, very civil, and assisted Lieutenant Leach to the best of their ability. The only trade appears to be in salt, of which considerable quantities are made from a salt marsh near Didwáná and in smaller quantities at Kuchámam. Camels are bred in great numbers, Soojangarh especially being noted for a superior breed of sawári camel, but the prices of even baggage animals is so high, that we still find it cheaper to bring them from the Meerut District, rather than hire them on the spot. It is impossible to obtain them here under Rs. 14 a month, whereas in the former district they are obtainable in any numbers at Rs. 9-8 or Rs. 10.

APPENDIX.

GEOGRAPHICAL, COMPILING AND DRAWING BRANCHES, SURVEYOR GENERAL'S OFFICE.

Statement showing the nature of the work performed, and the progress made from 1st January 1875 to 31st December 1875.

Maps, &c.	Scale.	Remarks and Progress.
	Miles. Inches.	
India—Standard in 6 sheets ...	32=1	New materials from the several surveys in progress inserted in the original sheets, Kelat, Afghanistan and countries beyond the North-West Frontier from the most authentic sources, compiled, reduced and added (outline only).
India—6 sheets ...	32=1	Blue print reproduction of the above standard compilation divided into six uniform sheets. Sheet 4 (Bengal) completed; sheets 1 (Punjab) and 5 (Madras) in progress, nearly completed. To be engraved.
India—No. 3, 4 Sheets ...	64=1	Reduced from the above standard engraving. Fresh additions made on dry proofs from recent surveys, Kelat, Afghanistan and countries beyond the North-West Frontier, reduced and added.
India—Military Sketch Map ...	128=1	Drawn to show the military divisions and districts, with list of the several stations occupied by the Indian Army of the three Presidencies of Bengal, Madras and Bombay to 1875.
Bengal—Eastern Frontier, 3 Sheets	4=1	Fresh additions made from recent surveys in Manipur and Lushai Hills. In progress.
Bengal—Eastern, 10 Sheets ...	8=1	Blanks filled up from recent surveys and revised throughout for a new edition to 1875.
Bengal—Western, 10 Sheets ...		
Bengal—Standard in 2 Sheets ...	16=1	Original (outline) compilation revised to 1875; standard projection made for plates with a view to engraving.
Assam—Standard, 8 Sheets ...	8=1	Provinces under the Chief Commissioner. Sheets 1, 2, 4 and 5 compiled and drawn in outline from the latest surveys, embracing parts of Bhutan, Goalpara, Kamrup, Nowgong, the Garo, Khasia and Jaintiah Hills and Sylhet to be lithographed. Sheets 3 and 8 projected.
Assam—for Administration Report	16=1	Compiled and drawn complete with hills from latest surveys to date. To be engraved.
Assam—Northern Frontier of ...	4=1	Major Godwin Austen's new work in the Daphla Hills; all tea gardens, grants, &c., inserted on original compilation for a new edition.
Sindh—the Province of ...	16=1	New lines of canals, roads, &c., inserted on original compilation, engraving.
Kelat—The Khanate of ...	16=1	Compiled and drawn from the best available information, in outline.
Naga Hills and surrounding country, for Political Agent.	4=1	The topographical and revenue surveys sheets, shewing all the country, limited on the west by a line drawn from Cachar to Gauhati, and on the north from Gauhati to Nowgong, and on to Sibsagar and Sudiya, reduced on a projection. In progress.
Bikaneer—Native State ...	4=1	Compiled and drawn from the best available materials for the Rajputana Gazetteer.
Bhopal—Native State ...	8=1	Compilation and drawing of—from recent surveys to date, in progress.
Delhir—City and cantonment, and adjoining country.	1=1	Drawn on blue print reductions of the Revenue Survey Sheets for the Camp of Exercise, 1875-76.
DISTRICT MAPS.		
Saharunpur District ...	8=1	Drawn for the Gazetteer of the North-Western Provinces, lithographed.
Aligarh ,, ...	8=1	
Mazaffarnagar ,, ...	8=1	
Bulandshahar ,, ...	8=1	
Eta ,, ...	8=1	
Etawah ,, ...	8=1	
Meerut ,, ...	8=1	
Baitul—District ...	4=1	Reduced from sheets of the Revenue Survey, outlines in progress.
Gya—District ...	4=1	Index to the 1-inch sheets of the Gya district prepared,

Sheets of the Atlas of India engraving in India.

Maps, &c.	Scale. Miles. Inches.	Remarks and Progress.
Sheets 12 F. P., 55 F. P., 90 N. W. „ 13 „ 36 „ 90 S. W. „ 18 „ 37 „ 91 N. W. „ 19 „ 76 „ 91 S. W. „ 20 „ 77 „ 92 N. W. „ 21 „ 78 „ 92 S. W. „ 22 „ 79 „ ... „ 23 „ 80 „ ... and 81 „ ... Total ... = 74 qrs.*		Computations completed for projection of the graticule on the coppers of 74* quarter plates. Projections marked on the coppers of 34 quarters, and points projected on the dry proofs of 2 N. W., 22 N. W., S. W., N. E., and S. E., 23 N. W., S. W., N. E., S. E., 36 S. E., 37 N. E., 66 F. P., and 90 N. W. Index to the sheets of the Indian Atlas, showing state of publication to 1875. A new one prepared for general use.
Sheet 17, Full Plate	4=1	Portion of Bhawulporo from Revenue Survey sheets, reduced and drawn on a dry proof to complete plate.
„ 23, N. W., S. W., qrs. ...	4=1	Part of Kattywar, compiled and drawn in outline. In progress.
„ 31, full plate	4=1	Part of Bhawulpore, reduced and drawn from the Revenue Survey sheets.
„ 34, N. W., S. W., qrs. ...	4=1	Parts of Rajputana Native States and Ajmere. Additional material to date compiled and drawn in outline from recent surveys.
„ 36, S. E., qr.	4=1	Parts of Central India Native States and Khandesh. Materials to date compiled and drawn in outline from recent surveys.
„ 37, N. E., qr.	4=1	
„ 52, S. W., N. W., qrs. ...	4=1	Parts of Central India Native States. Materials to date from recent surveys compiled and drawn in outline.
„ 53, N. E., S. E., qrs. ...		Parts of Bhopal Native State and Hoshungabad. Additional materials to date from recent surveys compiled and drawn complete with hills.
„ 66, full plate		Parts of Kumaon and Garhwal, compiled and drawn in outline to extent of materials received from the Superintendent, Great Trigonometrical Survey. In progress.

Maps, &c.	Remarks and Progress.
Sheet 72, N. W., qr.	Parts of Chindwara and Baitool, compiled and drawn in outline from the Revenue Survey sheets.
„ 93, S. E. and S. W., qrs. ...	Parts of Jeypore, Buster and Godavery talooks. Materials to date from recent surveys; compiled and drawn complete with hills.
„ 94, full plate	Blank portion on the north, *viz.*, part of the Godavery talooks and Vizagapatam Agency, compiled and drawn in outline from recent surveys on a dry proof to complete plate.
„ 113, „	Hazareebagh, compiled and drawn in outline on a dry proof to complete plate.
„ 119, „	Part of the Garo Hills, compiled and drawn complete with hills on a dry proof to complete plate.
„ 121, „	Sunderbuns portion, compiled and drawn complete on a dry print to complete plate.
„ 124, N. E., N. W., S. E., S. W. ...	Parts of Goalpara, Kamrup, Darrang and Nowgong, additions of new material on dry proofs from recent surveys compiled and drawn in outline. In progress.
„ 125, N. W., N E., qrs. ...	Parts of the Garo, Khasia and Jaintiah hills. Additional material to complete plates compiled and drawn complete with hills.
„ 130, N. W., S. W., S. E. ...	Parts of the Naga Hills, Nowgong, Sibsagar and Lakhimpur north-west, compiled and drawn in outline; south-west and south-east compiled and drawn complete with hills.
„ 131, N. W., S. W.	Parts of the Naga Hills and Manipur, compiled and drawn complete with hills from recent surveys to date.

Sheets of the Atlas of India engraving in England.

„ 54, full plate	Portions of Baitool and Nimar, compiled and drawn complete with hills on dry print to complete plate and proof; corrected and returned to England.
„ 71, N. E., S. E.	Small portions of Mandla added from recent surveys on dry proofs, waiting fresh materials. In progress.
„ 90, N. E., S. E.	Parts of Mandla compiled and drawn complete with hills on dry prints to complete plate, and proofs corrected and returned to England.
„ 91, N. E., S. E.	Parts of Belaspur and Raipur; additions to complete plates compiled and drawn complete with hills on dry prints, and proofs corrected and returned to England.

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

Maps, &c.	Scale.	Remarks and Progress.
Chota Nagpoor Division Survey.		
Sheets 5, 15, 17	1=1	Projected and fair drawn from the original field sections.
Ganjam and Orissa Survey.		
Sheets 7, 11, 20, 21, 23, 25, 38, 44, 47, 49, 60, 61, and 85 ...	1=1	Projected and fair drawn from the original field sections.
Sheets 22, 42, and 87	1=1	Projected and in progress in various stages.
„ 26, 27, 28 and 29 ...	2=1	Projected and fair drawn from the original field sections.
Rajputana Survey.		
Sheets 25, 26	1=1	New work in Ajmere added to the original standards.
Khasia, Garo and Naga Hills Survey.		
Sheets 43, 76, 77, 78, 80, 81, 83 ...	2=1	Projected and fair drawn from the original field sections.

MISCELLANEOUS MAPS, &c.

Tracings made of the Coast Line Sections A, B, C, D, E and F from Barabalang River to the Chilka Lake scale 1 mile = 1 inch, for Superintendent, Marine Surveys, with a Chart of Triangulation.

Chart of the River Hooghly	1=1	Extracted for Superintendent, Marine Surveys.
The Principality of Coorg surveyed in seasons 1815, 1816, 1817	1=1	Extracted from map of—for Under-Secretary to Government of Madras, Public Works Department.
The Provinces of Bedenore and Canara surveyed in seasons 1805, 1806, 1807	2=1	Extract taken for ditto.
Boundary between Karial, Bodosamar, and Patna, Central Provinces	1=1	Extracted from the original Plane Table Sections of the Ganjam and Orissa Survey, for the Deputy Commissioner of Sumbulpur.
Chart of Triangulation, Hydrabad Survey, seasons 1863-64	4=1	Trace made for the Officer in charge of Central Provinces and Vizagapatam Agency Survey.
Charts of the Triangulation of the Valley of Dindigul and the Vurraghery Hills, season 1821	4=1	A register of triangles in six sheets written, and an extract taken from chart of same for Superintendent of Madras Revenue Surveys.
Route from Katmandoo to Naiakote with adjoining streams	4=1	Drawn for H. B. Medlicott, Esq.
Index to the Sheets of Simla	3=1	Reduced and drawn for re-production.
Corrections and additions to original Topographical Survey Sheets; 65 Sheets examined and corrected.		
Corrections and additions to engraved Lithographed and Photozincographed Maps, various		Blanks filled up. Railways, boundaries, territorial names, headings, foot-notes, titles, &c. inserted, examined, and corrected in 3,119 Sheets.
Atlas Sheets and engraved maps colored		6,073 Sheets.
Lithographed and photozincographed maps and plans colored		13,746 „

(Sd.) J. F. BANESS,
Chief Draftsman.

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

APPENDIX.

Engraving Branch, Surveyor General's Office, Annual Progress Report, 1875.

Number of Atlas Sheets.	*Atlas Sheets finished and ready for publication.*	When finished.
2 N. E. ...	Completed and ready for publication	December 1875.
34 S. E. ...	Ditto ditto ditto	September ,,
52 N. E. ...	Ditto ditto ditto	,, ,,
93 N. E. ...	Ditto ditto ditto	November ,,
	Sheets of the Indian Atlas that have been in hand for additions, repairs and alterations.	
D. E. 26 ...	Hill work repaired throughout	May ,,
,, 40 ...	} Railways—Additions, &c.	
,, 41 ...		
,, 42 ...		
,, 43 ...		
,, 44 ...		
,, 55 ...	Writing recut	August ,,
,, 56 ...	Additions, title, &c.	,, ,,
,, 58 ...	Writing recut and hill-work repaired	December ,,
,, 61 ...	Ditto ditto	October ,,
,, 68 ..	Small corrections and additions	September ,,
,, 75 ...	Writing recut	November ,,
,, 77 ...	Ditto ditto	October ,,
,, 78 ...	Railways and additions...	June ,,
,, 80 ...	Writing recut	September ,,
,, 102 ...	Heavy corrections and additions	August ,,
,, 106 ...	Additions and alterations	September ,,
,, 111 ...	Writing recut and additional names engraved	April ,,
,, 112 ...	Ditto ditto	December ,,
,, 115 ...	Additions and alterations	May ,,
,, 116 ...	Ditto ditto	April ,,
	Atlas Sheets in hand up to December 1875.	
D. E. 17 ...	New survey of Bhawulpoor; outline done, writing in progress.	
,, 31 ...	Ditto ditto ditto ditto.	
,, 57 ...	Writing being recut; in progress.	
,, 59 ...	Writing recut; hills repairing in progress.	
,, 60 ...	Ditto ditto ditto.	
,, 67 ...	New portion of survey of District of Kheree; outline and writing done. corrections in progress.	
,, 72 ...	Writing being recut; in progress.	
,, 73 ...	Heavy additions; greater portion of outline and writing done, outline of last new drawing in progress.	
,, 76 ...	Repairing hills; plate put down for other work.	
,, 79 ...	Writing being recut; in progress.	
,, 88 ...	Outline and writing done, corrections in progress. This is an exceedingly heavy sheet.	
,, 94 ...	Heavy additions, new surveys, talooks of Budrachelum, Rakapili and Kumummett, Nizam's dominions; outline done, writing in progress.	
,, 103 ...	Canals and additions done, writing being recut; in progress.	
,, 107 ...	New portion of survey; parts taken out on plates, outline in progress.	
,, 108 ...	Additions, outline and writing done; Hills in progress.	
,, 113 ...	Plate cleaned for heavy portion of new Survey District of Hazarecbagh; outline done, writing just commenced.	
,, 119 ...	Outline and writing done of new Survey Mymensingh Hills; in progress.	
,, 120 ...	Slight additions and the writing recut.	
,, 121 ...	Outline and writing done; new survey of portions of the Sunderbuns; writing to old portion being recut.	
	Quarter Sheets.	
8 S. W. ...	Corrections done	May.
34 N. E. ...	Slight additions done	August.
34 N. W. ...	Outline and writing done as far as drawing; one-third done of the plate; in progress.	
34 S. W. ...	Outline done, writing one quarter completed; in progress.	
51 S. W. ...	Rivers recut; done	July.
52 N. W. ...	Outline finished as far as drawing; writing in progress.	
52 S. E. ...	Outline and writing done, full plate; hills in progress.	
52 S. W. ...	Outline done as far as drawing; writing in progress.	
53 N. E. ...	Outline and writing done; waiting orders.	
53 S. E. ...	Additions as far as drawing done.	
64 S. W. ...	Slight additions done.	
72 N. E. ...	Outline and writing done; hills and jungle in progress.	
72 N. W. ...	Ditto full plate; waiting orders.	

Number of Atlas Sheets.	*Atlas Sheets finished and ready for publication.*	When finished.
	Quarter Sheets—continued.	
72 S. E. ...	Slight additions, done.	
93 S. E. ...	Outline done; writing in progress.	
93 S. W. ...	Ditto ditto.	
105 N. W. ...	Additions done.	
105 S. W. ...	Outline and writing done, Full Plate; plate put down, waiting drawing for hills.	
124 N. E. ...	Outline done as far as drawing; writing in progress.	
124 N. W. ...	Outline of new portion of survey done; writing in progress.	
124 S. W. ...	Outline and writing done; hills in progress.	
124 S. E. ...	Outline, writing and jungle of new survey done; hills about to be commenced.	
125 N. W. ...	Outline and writing done; hills in progress; plate put down for other work.	
130 N. W. ...	Border cut plate projected; outline done as far as drawing; writing about to be commenced.	
130 S. E. ...	Ditto ditto ditto; outline and writing done as far as drawing; hills in progress.	
130 S. W. ...	Outline and writing done as far as drawing; hills in progress.	
131 N. W. ...	Outline and writing of new portion of survey done; hills about to be put in hand.	
131 S. W. ...	Outline and writing of new survey done as far as drawing; hills in progress.	
37 plates ...	Borders cut and quarter sheets projected, 12, 13, 22, 23, 35, 36, 37, 9 S. W. and 1 N. W., 91 N. W. and S. W., 92 N. W. and S. W., and 130 N. W. and N. E.	
	Miscellaneous Maps and other work finished and additions and corrections made.	
No. 3, Map of India ...	Four sheets engraved in the very best style, 64 miles = 1 inch; outline and drawing done; plates put down; waiting fresh orders ...	Published.
No. 2, India ...	Additions for 5th edition finished.	
Western Districts of the Dacca Division ...	Outline and writing finished.	
Map of Oudh ...	This plate is in hand for heavy alterations.	
Map of Sindh ...	Outline completed; writing in progress.	
Four Plates of Map Headings and Imprints...	Additions all done.	
2 small scales, 5 chains = 1 inch, for the Mathematical Instrument Department ...	Done.	
Index, Chart, Great Trigonometrical Survey of India ...	Additions done.	
Index to Atlas Sheets ...	Ditto ditto.	
Duplicate scale for Projection of Atlas Sheets ...	Done.	
Small scale of miles for Indian Atlas ...	Done.	
No. 1, Map of India ...	Writing recut; done.	
Scale for Marine Survey ...	Done.	
Outline Map of India, No. 2 size	Done.	
	Plan of the Town of Calcutta done as far as drawings.	
	Number of Plates in hand during the year 1875 133	

Copper-plate Printing.

Proofs	1,037
Transfers	534
Impressions or copies	12,333
TOTAL IMPRESSIONS ...	13,904

(Sd.) C. W. COARD,
Supdt., Engraving Branch.

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

Report by CAPTAIN J. WATERHOUSE, *Assistant Surveyor-General, in charge Photographic Branch, dated the 1st January* 1876.

1. AMOUNT OF WORK.—The amount of work performed between the 1st January and the 31st December 1875 may be briefly summarised as follows:—

1,956 original maps and other subjects have been received for reproduction; 1,264 transfers have been made to zinc, besides 27 to stone in the Lithographic Branch; 1,42,371 complete printed copies of maps have been struck off, besides 2,868 silver prints, 704 carbon prints of convicts, and 392 photocollotypes.

2. PROGRESS.—The year just closed has been marked by increased activity in all branches of the office, and though the outturn of printed maps, reckoned by the number of pulls and complete copies, is not quite so large as last year's, which was quite an abnormal one, owing to the demand for maps of the famine districts, it is very little less; but is far in advance of the outturn of 1873, and very satisfactory for the small number of presses employed. The increase in the number of originals and negatives has been in a great measure due to the additional work entailed by the reproduction of the sheets of the Cadastral Surveys of the North-West Provinces on the scale of 16 inches=1 mile, as will be explained hereafter.

3. A large amount of work has been done for the Quartermaster General's Department in connection with the Camp of Exercise at Delhi; and the great value of the photographic process has been fully exemplified by the way we were enabled to assist in the production of these maps from the latest and best materials of the recent Revenue Survey. As the 4-inch survey maps contained a vast amount of detail that would have been misleading and useless on a military map, blue prints of the sheets required were furnished to the Quartermaster General, who then re-drew them in black in a suitable style, and showing just the details he required. These drawings were then returned to us for reproduction on the 4-inch and 2-inch scales, the 4-inch being in 8 sheets, of which 520 copies on calico and 630 on paper were printed, and the 2-inch in 2 sheets, of which 1,220 copies on calico and 630 on paper were printed, the total number of prints being 12,900, besides 920 of two other special maps for the same department.

4. During the year, considerable progress has been made in the reproduction of the Marine charts, both for the Master Attendant's Office and for the Marine Survey Department, and these departments are thus enabled to issue the charts immediately after survey, with far greater accuracy, speed, and economy than could be secured by any other method.

5. There has been an increase in the silver printing on account of work connected with the Eclipse expedition to Camorta.

6. The carbon prints, which form a new feature in this year's work, are of the life convicts photographed previous to deportation to the Andamans, and are printed from negatives taken by a professional photographer for the Jail Department.

7. The small number of photocollotype prints turned out to complete the series of illustrations of the Caves of Cuttack, for Babu Rajendralala Mitra's Antiquities of Orissa, does not fairly represent the work actually done in this branch, which, I regret to say, has still been chiefly of an experimental nature, as explained below.

8. The following table will show the comparative outturn of the years 1874 and 1875:—

	1874.	1875.	Difference.	Difference in decimal square feet.	Remarks.
Originals	1,280	1,856	+ 576		
Negatives	1,933	3,339	+ 1,406		
	5203·36 d. s. f.	*9863·06 d. s. f.*	.....	+ *4659·70*	
Silver prints	1,324	2,868	+ 1,544		
	1610·06 d. s. f.	*2849·69 d. s. f.*	.....	+ *1239·63*	
Photo-transfers ...	1,926	3,300	+ 1,374		
	5276·21 d. s. f.	*9825·06 d. s. f.*	.....	+ *4548·85*	
Transfers to zinc or stone ...	812	1,291	+ 479		
Number of pulls	1,57,600	1,55,693	— 1,907		
,, of complete copies ...	1,53,242	1,42,371	— 10,871		
,, of impressions ...	...	1,71,800			
Photocollotype prints ...	1,495	392	— 1,103		
Carbon prints of life convicts ...	...	704			

9. EXPENSES OF WORKING.—The approximate expense of working the office during the year, inclusive of the Superintendent's salary, contingencies, and the cost of stores, &c., as far as known, has been Rs. 65,049-1-4.

10. The approximate sum to credit of the office is Rs. 83,361-4-6, so that there is a nominal profit of Rs. 18,312-3-2.

11. Personnel.—There have been no changes of importance in the staff of the office, and I am glad to again have to report on the excellent conduct and zeal of my principal assistants, Messrs. J. Mackenzie, B. Mackenzie, J. Watson, Sergeant Harrold, Corporal Marshall, and Syud Ishmael. The Native photographers and other assistants have also worked satisfactorily.

12. Processes.—*Papyrotype.*—Experiments were again tried for obtaining photo-transfers by Captain Abney's papyrotype method, alluded to in my report for last year, with the materials sent out from England; but as it was not found to give better results than could be obtained by the ordinary method, and was not so simple to manipulate for our large work, it has not been adopted.

13. *Photocollotype.*—As stated in paragraph 7, the working of this process has not been satisfactory, though Corporal Marshall has striven very hard to obtain successful results. I have also given considerable attention to the subject myself, with the view of finding a composition for the films that could be depended upon to give good results in half tones at all seasons of the year, and particularly to find a method of printing from a paper tissue, which could be insolated in the same way as an ordinary silver or carbon print and attached to a glass, zinc, or other metal plate when being printed from. Though the results thus obtained were uncertain in working, they appeared to promise well, and I still hope that a good and certain mode of working for this country may yet be found.

14. *Carbon printing.*—Under the orders of Government, experiments have been carried on in carbon printing by the autotype process with the object of making permanent prints of the photographs of convicts transported for life to the Andamans. During the hot weather some difficulty was experienced in working the process, and after the rains it was found that the pigmented gelatine tissue which had been kept here through the wet season had become quite insoluble and useless. The experiments were resumed with fresh tissue at the commencement of the cold weather, and, after a few trials, no difficulty whatever was found in working the process successfully with the autotype tissue, or with tissue prepared here, and it is probable that, with the experience and practice gained in the cold weather, the difficulties of working in the hot weather may be overcome by suitable precautions. By transferring the print to the enamellee paper used for collotype printing, instead of to the ordinary transfer tissue supplied by thd Autotype Company, the brilliancy and finish of these prints is greatly increased, and they are scarcely distinguishable from fine silver prints. This modification was suggested by Syud Ishmael, who has supervised the work. Having expended the small quantity of gelatine tissue obtained from England for experiment, we have succeeded in making very fair tissue here, which, though not so good as that manufactured in England, has enabled us to carry on the work by taking advantage of the cold season, and the power of thus being able to prepare our own tissue may also be useful on occasion. The autotype process is exceedingly simple, and is likely to be of great use in the office in replacing silver printing for many subjects where permanency is an object.

15. Cadastral maps of the North-West Provinces.—Orders having been received from the Government of India, sanctioning the reproduction in this office of the maps of the Cadastral Surveys of the North-West Provinces on the scale of 16 inches=1 mile, a small commencement of the work has been made, and 201 sheets have been reproduced during the year. Owing to the pressure of ordinary work on the limited resources of the office, the greater part of this work has been done as extra work at a cost of Rs. 2,617-15-3, which has been paid by the North-West Provinces. This commencement is only a small fraction of the number of sheets turned out annually by the four parties now working in the North-West Provinces, estimated at between 3,000 or 4,000. To enable us to deal with this enormous addition to the work of this office, a large increase of establishment and appliances has been lately sanctioned by the Government, and arrangements have been made for training the new establishment and getting through as much of the work as possible, pending the receipt of the additional apparatus and plant specially indented for from England.

16. Several trials have been made of a method of drawing the sheets of the Cadastral Surveys with the liquid lithographic ink prepared by Captain Abney, of the School of Military Engineering, Chatham. The sheets were drawn by the executive officers in recess quarters and sent down for transfer. It was hoped that by this method it might be possible to dispense altogether with photography, thus simplifying the work of reproducing these maps, and materially reducing the cost. Some preliminary trials in this office were quite successful, but in practice the results have not been altogether satisfactory, and further experience is still required before the system can be definitely introduced.

17. Handbook of Topographical Drawing for India.—In my last report I expressed the hope that the second part of this work might be finished during the year, but I greatly regret that it has not been found possible to make much progress, owing to the steady demands of current and more urgent work on our time and presses throughout the year. Six plates have, however, been printed off out of about thirty, and every effort will be made to complete the work as soon as opportunity permits. By the kindness of Colonel Walker, R. E., Superintendent of Great Trigonometrical Survey, I have been able to include some excellent specimens of the Topographical maps of the Great Trigonometrical Survey.

18. Introduction of the Metric system of Weights and Measures.—It has been found that the use of the ordinary English weights and measures causes considerable inconvenience in keeping the store accounts of chemicals, from the fact that chemicals are received in avoirdupois weight and expended in troy. I have, therefore, made an arrangement for introducing the French system from the commencement of the current year, so that chemicals received on indent from England in metric measure will be issued in the same way, thus avoiding all confusion and simplifying the accounts very much.

19. The Eclipse of April 6th.—Almost immediately after my return in January from photographing the Transit of Venus at Roorkee, intimation was received from the Government that my services would be required to take charge of the photographic operations connected with the observation of the total solar eclipse at Camorta in the Nicobar Islands. Preparatory work in spectrum photography, and in trying methods of preventing irradiation, besides the necessary arrangements for the expedition, occupied all the time I could spare from current work till the 10th March, when the expedition started. Unfortunately, we were prevented by heavy clouds from taking any photographs of the eclipse or other observations at the time of totality, and the expedition returned to Calcutta on the 18th April. Though the expedition failed in its object, some useful experience was gained, which may be of value on another occasion, and has been detailed in my report on the operations of the Indian party.

20. Experimental work.—The photographic work and reports connected with the Transit of Venus and the eclipse took up a good deal of my time during the first-half of the year, but since then I have commenced some experiments upon electrotyping engraved plates with a view to the production of electrotyped duplicates of the plates of maps in various stages. It is to be regretted that the calls of work more immediately connected with my own departments of the office, and the want of suitable assistance and appliances for carrying out the electrotyping process on a large scale prevented my carrying out my experiments fully, because the process would be of inestimable value in saving wear and tear of valuable original plates, and for providing copies of general standard maps in various stages of their progress without the trouble and expense of re-engraving them.

21. In connection with some photospectroscopic researches on coloured collodion films in which I have been engaged—first in connection with the eclipse observations, and afterwards with the object of finding a method of rendering collodion films more sensitive to the so-called non-actinic colours and thus enabling colored maps or drawings to be photographed with better results than at present—I have discovered a method of making reversed negatives which may, perhaps, be turned to useful account in the practice of the carbon and collotype processes. It is dependent on the well-known property of the red rays of the spectrum to reverse, or undo, the action of light already impressed upon a suitable sensitive surface, which, in this case, is a dry plate prepared with plain bromised collodion, and stained with an aniline blue dye. The plate is first exposed to diffused light for a moment, then placed in a pressure frame under an ordinary negative, and exposed for about 20 minutes to the full rays of the sun, passing through a sheet of ruby glass. On developing the plate with the ordinary alkaline developer, it will be found that the parts acted on by the light passing through the red glass are free from deposit in proportion to the translucency of the negative, while the parts entirely protected by the dark parts of the negative develop to full strength by virtue of the preliminary exposure to light.

Statement showing Cost of working the Photographic Branch of the Surveyor-General's Office from 1st January to 31st December 1875.

Dr.	Number of complete copies.	Rs.	A.	P.		Rs.	A.	P.
Topographical Survey Maps ...	25,770	23,175	9	0	Superintendent's salary from 1st January 1875 to 31st December 1875 ...	13,698	6	6
Revenue Survey Maps	29,390	30,507	2	1	Sanctioned establishment from ditto to ditto	21,091	4	3
Cadastral Survey of N. W. P. ...	10,050	5,025	0	0				
District Maps	2,415	2,642	8	6	House-rent from ditto to ditto ...	4,200	0	0
General Maps	1,376	1,610	9	6	Contingencies	3,030	4	6
City and Cantonment Plans ...	6,140	8,157	8	0	Chemicals and Stores received from England, as far as known ...	7,348	1	5
Miscellaneous Maps, &c.	60,120	5,181	12	8				
Anastatised	5,480	3,607	8	0	Chemicals received from Government Medical Store Department on emergent indents	236	8	6
Zincographed	1,630	227	13	6	Cost of Paper	15,444	8	2
Silver prints	2,868	2,745	13	3	Balance in favor of the Department ...	18,312	3	2
Photocollotypes	392	392	0	0				
Carbon Prints of Life Convicts ...	704	88	0	0				
Total ...	1,46,335	83,361	4	6	.	83,361	4	6

Abstract of work performed in the Photographic Branch of the Surveyor-General's Office from 1st January to 31st December 1875.

Maps photographed.	Number of sections or sheets.	Number of negatives or plates.	Prints. Collotypes.	Prints. Silver.	Prints. Transfer.	Transfer to zinc or stone.	Number of pulls.	Number of complete copies.	Remarks.
Topographical Maps ...	191	311	...	356	322	155	24,430	25,770	
Revenue Survey Maps ...	678	1,138	...	40	1,128	331	41,900	33,700	4,000 Anastatic. 310 Zincographs.
Cadastral Map, N. W. P. ...	486	1,144	...	...	1,198	508	19,450	10,050	
District Maps ...	4	14	...	...	14	9	4,705	2,665	250 Anastatic, 4 stone.
General Maps ...	20	71	...	3	78	25	2,756	2,066	480 Anastatic 210 Zincographs } 1 stone.
City and Cantonment Plans	36	119	...	...	101	37	9,020	6,140	2 stone.
Miscellaneous ...	441	542	392	2,469	459	179	51,619	61,980	20 stone.
Anastatic transfer ...	...	...	...	...	...	47	.....	.....	
Proofs	...	...	...	...	...	...	1,813	.....	
Total ...	1,856	3,339	392	2,868	3,300	1,291	1,55,693	1,42,371	

Calcutta : 1st *January* 1876.

(Sd.) J. WATERHOUSE, *Captain*,
Asst. Surveyor-General, in charge Photographic Branch.

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 :—

SUBJECTS.	1874.	1875.
New drawings executed on transfer paper	271	185
Ditto executed on stone	37	22
Color stones prepared	142	146
Subjects printed	602	472
Complete copies	2,14,153	1,93,449
Pulls	2,77,501	1,87,352
Sheets of forms, &c., for type...	2,100	2,171
Complete copies	1,95,876	1,98,986
Pulls	3,28,583	3,03,591

2. There is some falling off in the drawing and printing branches, which is partly to be accounted for by the fact that last year's outturn was unusually large, on account of the increase caused by the demand for maps of the famine districts, and partly that, owing to the completion of the barrack plans, and the abolition of the establishment kept up for that purpose, there has been less draftsmen's work and consequently less for the printers.

3. The cost of the establishment and contingencies amounted to Rs. 40,822-6, or Rs. 204-13 more than last year, which is accounted for by the increase of Rs. 50 per mensem on account of house-rent.

4. During the year good progress has been made in color-printing, particularly as applied to the coloring of the engraved sheets of the Atlas of India and other departmental publications. The demands from the Geological Survey and other Departments have not been quite so large as usual, and no new large or important colored maps have been undertaken. Two plates illustrating the "Fungus Disease of India," executed by Mr. Lepage for the Sanitary Commissioner's Report, are excellent specimens of chromo-lithography, and are said by competent judges to compare well with works of a similar kind executed in England.

5. Among the principal maps in hand during the year may be mentioned the new map of Simla, on the scale of 8 inches = 1 mile, reproduced in four sheets, with chalk hills, from the original Indian ink drawing by Captain G. Strahan. Of the four sheets, two have been completed with hills, and the hill drawing of the remaining two sheets is rapidly progressing, so that it may be hoped that the complete map will be ready for issue before the commencement of the hot season.

6. Messrs. Jevezy, Niven and Lepage continue their good service and zealous attention to their duties. The conduct and progress of the Native draftsmen and other assistants have been satisfactory.

Abstracts of the Drawings executed in the Surveyor-General's Office, Lithographic Branch, from 1st January to 31st December 1875.

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	Eastern Bengal, Sheet No. 8	Imperial ...	1	Re-drawn.
" "	Western Bengal, Sheets Nos. 14, 18, 19 and 20 ...	Ditto ...	4	
32 miles = 1 inch	North-Western Provinces	Ditto ...	1	
	Index to the Sheets of North-East Division, Central Provinces Topographical Survey	Foolscap ...	1	
	Index to the Sheets of Bhopal and Malwa Topographical Survey	Ditto ...	1	
	Index to the Sheets of Gwalior and Central India Topographical Survey	Super Royal ...	1	
	Index to the Sheets of Rajputana Topographical Survey	Ditto ...	1	
	Index to the Sheets of Khandesh and Bombay Native States' Topographical Survey	Foolscap ...	1	
8 miles = 1 inch	Index to the Sheets of District Chanda ...	Atlas ...	1	
			12	
	DISTRICTS.			
4 miles = 1 inch	District Maldah—corrections, boundaries, margin lines drawn	Super Royal ...	1	By plate transfer from engraved plates of the Atlas of India.
" "	District Moorshedabad	Atlas ...	1	
" "	" Cuttack	Ditto ...	1	
" "	" Bhaugulpore	Double Elephant...	1	
" "	" Patna	Imperial ...	1	
			5	

Abstract of Lithographic Drawings.—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	District Moorshedabad, Sheets Nos. 5, 8 and 10 ...	Double Royal ...	3	
" "	" Nowgong, Sheets Nos. 5, 6, 7, 9, 10 and 12	Ditto ...	6	
" "	" Chandu, Sheet No. 15, a portion drawn ...	Ditto ...	1	
" "	" Southal Pergunnahs, Sheets Nos. 1, 2, 4, 6, 14 and 16	Ditto ...	6	
4 inches = 1 mile	Hooghly River, Sheets Nos. 1, 2, 3, 4, 5 and 7 ...	Atlas ...	11	
" "	" No. 6	Antiquarian ...	1	
" "	" Nos. 8, 9, 10, 11, 12, 13, 14, 15, 16 and 17	Imperial ...	10	
	Plans.			
4 inches = 1 mile	Simla and Jutog, with Index	Atlas ...	1	
8 " = 1 "	Ditto Sheets Nos. 1, 2, 3 and 4 outline	Ditto ...	4	
" "	Ditto ditto Nos. 3 and 4, chalk hills...	Ditto ...	2	
	Miscellaneous Drawings.			
Various scales ...	Bengal Government Maps and Plans	Various sizes ...	13	
" " ...	Foreign Department Maps and Plans	Ditto ...	19	
" " ...	Archæological Survey Plans and Drawings ...	Ditto ...	6	
" " ...	Telegraph Department Diagrams	Ditto ...	8	
" " ...	Department of Revenue, Agriculture and Commerce Maps, Plans, &c.	Ditto ...	4	
" " ...	Miscellaneous Maps, Plans, &c.	Ditto ...	95	
			145	
	Total ...		207	
	Coloring.		Colour stones.	
32 miles = 1 inch	Preliminary Map of Bombay Presidency ...	Double Elephant ...	2	
4 " = 1 "	Indian Atlas, Quarter Sheets, 34 S. E. and 53 S. E.	Half Sheet Atlas...	4	
128 " = 1 "	Hand Map of India, No. 2	Imperial ...	4	
8 " = 1 "	Map of Western Bengal, Sheets Nos. 13, 15, 19 and 20	Ditto ...	10	
8 miles = 1 inch	Map of Eastern Bengal, Sheets Nos. 7, 8 and 9 ...	Ditto ...	4	
" "	Map of Assam and North-Eastern Frontier, Sheets Nos. 1, 2, 3 and 6	Ditto ...	5	
16 miles = 1 inch	Map of North-Western Provinces, in four Sections	Ditto ...	8	
	Index to the Sheets of the Atlas of India ...	Ditto ...	1	
	Index to the Sheets of the North-East Division, Central Provinces Topographical Survey ...	Foolscap ...	1	
	Index to the Sheets of the Ganjam and Orissa (old series) and Vizagapatam Agency and Central Provinces (new series)	Super Royal ...	1	
	Index to the Sheets of the Bhopal and Malwa Topographical Survey	Foolscap ...	1	
	Index to the Sheets of Khandesh and Bombay Native States Topographical Survey ...	Ditto ...	1	
	Index to the Sheets of Rajputana Topographical Survey	Super Royal ...	1	
	Index to the Sheets of Gwalior and Central India...	Ditto ...	1	
4 miles = 1 inch	Map of District Maldah	Ditto ...	1	
" "	Map of District Moorshedabad	Atlas ...	1	
2 " = 1 "	Map of District Saugor, Sheets Nos. 1, 2, 3, 4, 5 and 6	Super Royal ...	6	
32 " = 1 "	Map of Bengal, Behar and Orissa	Double Elephant...	3	
32 " = 1 "	Sketch Map of India, Sheets Nos. 1, 2, 3, 4, 5 and 6	Ditto ...	19	
32 " = 1 "	Map of North-Western Provinces, under the jurisdiction of the Lieutenant-Governor, to illustrate the Administration Report	Imperial ...	2	
128 " = 1 "	Map of India, Nos. 1 and 2, showing Factories, Arsenals, Magazines, Depôts, &c.	Ditto ...	6	
15 " = 1 "	Map showing the Geographical Distribution of the *Ficus Elastica* in Assam	Atlas ...	3	
128 " = 1 "	Map of India to illustrate the Annual Report of the Sanitary Commissioner for 1874 ...	Imperial ...	1	
16 " = 1 "	Maps of Eastern and Western Districts of Dacca Division	Half Sheet Imperial	2	
4 " = 1 "	Settlement Map of District Bharaich, Nos. 6 and 8	Imperial ...	2	
" "	Map of District Burdwan, illustrating Fever ...	Ditto ...	3	
16 " = 1 "	Map of Tenasserim, shewing the proposed boundaries for the Government Forest	Ditto ...	1	
32 " = 1 "	Sketch Map of the Islands of Bay of Bengal ...	Half Sheet Atlas ...	2	
8 " = 1 "	Sketch Map of Ajmere and Mhairwarra ...	Half Sheet D. Royal	3	
2 " = 1 "	Map of Buxa Plain Reserve	Foolscap ...	4	
	Guide Plan of Simla and Jutog	Atlas ...	1	

Abstract of Lithographic Drawings.—concluded.

Scale.	New Maps., &c., the Lithographic Drawings of which were completed during the present year.	Size.	No. of colour stones.	Remarks.
	Coloring.—continued.			
Various scales ...	9 Military Maps	Various sizes ...	9	
	Boundary Map	Foolscap ...	2	
	Field Map	Half Sheet Foolscap	3	
	Plan of Juggernath or Puri ...	Foolscap ...	3	
	Rough Sketch Survey of Bahreyn Islands ...	.....	3	
	Wreck Chart of the Coast of India for 1875 ...	Special ...	1	
	Course of the Cyclone of the 15th and 16th October 1874 in India	.....	3	
	Chart No. 1, showing District Police Returns of Fever Mortality	.....	2	
	Chart No. 3 A, showing Rainfall, the Fluctuation of the Sub-soil, Water, &c.	.....	2	
	Chart No. 3 B, showing Rainfall, &c.... ...	.....	2	
	2 Plates of Fungus Disease, Nos. 1 and 2 ...	.....	5	
	3 Telegraph Diagrams, Nos. 4, 5 and 6 ...	.....	3	
			142	
	Coloring of Geological Maps.			
¼ inch = 1 mile	Geological Map of Trans-Indus Salt Region ...	Double Royal ...	1	
256 miles = 1 inch	Map of India, showing the present state of progress of the Geological Survey, 1875	Foolscap ...	3	
			4	
			146	

ABSTRACT.

General Maps	...	17 Sheets.
Revenue Survey Maps	...	38 „
Plans	...	7 „
Miscellaneous Drawings	...	145 „
Color Stones prepared	...	146 „
Total	...	353 Sheets.

Abstract of Printing executed at the Surveyor-General's Office, Lithographic Branch, during the year 1875.

Subjects.	No. of Sheets.	No. of Copies.	No. of Pulls.
Lithographic Branch.			
District and General Maps	15	3,317	7,033
Index Maps	9	4,420	7,328
Revenue Survey Sheet Maps, 1 mile = 1 inch	54	14,352	19,586
Plans	1	355	710
Reprints	151	77,697	38,694
Miscellaneous Maps	53	20,504	34,573
„ Plans, Sketches, &c.	188	71,942	75,980
Geological Maps	1	862	3,448
Total ...	472	1,93,449	1,87,352
Type Department.			
Departmental Orders, &c.	26	4,775	6,435
Memoranda and Forms for use of the Department	521	1,29,944	1,67,353
Forms of Topographical and Revenue Surveys	71	57,735	1,10,207
Transfers of Headings, Foot-notes, References, &c., to published Maps	1,553	6,532	19,596
Total ...	2,171	1,98,986	3,03,591

Statement of Cost of the Lithographic Branch, Surveyor-General's Office.

	Rs.	A.	P.
Permanent Establishment	34,968	2	3
Contingent Expenses	4,346	15	3
Extra Contingencies	1,617	4	6
Total ...	40,822	6	0

Calcutta :
1*st January* 1876.

(Sd.) J. WATERHOUSE, *Captain*,
Asst. Surveyor-General,
in charge Lithographic Branch, S. G. O.