GENERAL REPORT

ON THE

Topographical Survey of India,

AND OF THE

SURVEYOR GENERAL'S DEPARTMENT,

FOR SEASON

1876-77.

BY

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Dated Calcutta, 28th December 1877.

Introductory remarks.

THIS review of the operations of the Imperial Topographical Surveys of India for the professional season 1876-77, and on the work performed in the several branches of the Surveyor General's Head-Quarters Office for the year 1877, is submitted, in continuation of the report dated 4th December 1876, and with it is included a very brief review of the various operations conducted during my own administration of the department as Surveyor General of India from 1861, and as Superintendent of Revenue Surveys from 1847, which it may be useful to place on record on the occasion of my resignation of the appointment I have so long had the privilege and honor to hold, and on making over charge to my successor, Colonel J. T. Walker, C.B., R.E., Superintendent of the Great Trigonometrical Survey, whose appointment as Surveyor General from the 1st January next was conveyed in the letter as per margin.

Revenue, Agriculture, and Commerce Department No. 605, dated 12th October 1877.

Parties employed.

2. During the past working or field season, the number of executive parties was unchanged, and numbered from 1 to 7 in Northern India, and two others (8 and 9—*vide* paragraph 4 of the report for season 1875-76) were employed in the Mysore State ; but on return from the field, No. 3 Party, Central Provinces and Vizagapatam Agency Survey, was, on the completion of its allotted work, broken up from the 10th May 1877 and absorbed, and No. 4 Party, North-Eastern Division, Central Provinces Topographical Survey, was also subsequently (from 30th September 1877) broken up and amalgamated with No. 7 Party, Rajputana Topographical Survey,—thus leaving only five parties for future employment in Northern India ; while, owing to the famine in Mysore, the two parties, Nos. 8 and 9, have been reduced and combined to form a single one, so that at the present time the Imperial Topographical Surveys are reduced to only six parties.

Index maps to illustrate progress.

3. The several index maps attached, represent the areas allotted to each party and the progress each has made up to date, while the Map of India shews the total general progress of the combined Imperial Surveys in the three branches, Topographical, Trigonometrical, and Revenue.

4. During the season under review the total out-turn of the Topographical Surveys amounts to 18,909 square miles, and the several different scales on which the work has been conducted for the reasons given elsewhere is shewn in the margin.

Season's total out-turn of work.

13,928	square miles on 1	inch	=1 mile.
3,942	" on $\frac{1}{2}$	"	=1 "
971	" on 2	inches	=1 "
55	" on 4	"	=1 " *
13	" on 6	"	=1 " *
18,909	Total square miles.		

* These represent Forest Reserves and City and Cantonment Surveys.

5. The triangulation completed, covers 22,119 square miles. Observations were taken at 438 stations, from which 3,463 points and 1,880 heights were trigonometrically fixed, giving on an average one fixed point for every 7 square miles, and one height for every 22 square miles: these averages are good, considering that a considerable portion of the ground triangulated will be surveyed on the $\frac{1}{2}$-inch scale.

6. All the season's topography is stated by the Executives to have been accurately delineated, and was duly tested in the field either by check routes extending over 1,863 linear miles, or by *in situ* examinations. The total amount of fair mapping completed by the several parties, covers on the different scales 20,237 square miles, in which is included a portion of the last season's survey which could not be rendered before in complete standard sheets, and some revised mapping in the Naga Hills, rendered necessary by fresh information obtained during the season under report.

Season's final fair mapping.

7. This area of fair mapping is contained in 52 standard sheets, and will furnish excellent materials for the completion of, or additions to, the sheets of the Indian Atlas detailed in the margin. Much of the geography obtained in the Naga Hills on the Eastern Frontier of Assam, and in the Central Provinces in district Bálághát and the Native State of Bustar, is perfectly new, and a great portion of the remainder in Malwa, Khandesh, and Rajputana furnishes reliable topography, in place of the very rough routes and sketches from which the old existing maps were compiled. All the season's fair mapping has been rendered in a satisfactory and complete manner, and bears favorable comparison with that of the previous season. The standard sheets prepared for the photozincographic process have re-produced very satisfactorily, and are well advanced towards immediate publication.

No. 1	Party—3	standard sheets,	scale 1	inch=1	mile,	part of Atlas sheet 35.	
" 2	" 3	"	"	2 inches and 1 inch=1	mile,	parts of Atlas sheets 36 and 37.	
" 3	" 9	"	"	$\frac{1}{2}$ inch=1	mile,	part of Atlas sheet 92.	
" 4	" 6	"	"	1 "	"	"	71, 72 and 91.
" 5	" 0	"	"	1 "	"	"	53.
" 6	" 14	"	"	$\frac{1}{4}$ "	"	"	138.
" 7	" 8	"	"	$\frac{1}{2}$ "	"	"	32 and 33.
" 8	" 1	"	"	1 "	"	"	60.
" 9	" 2	"	"	1 "	"	"	59.

8. The cost of the season's operations amounts under all heads to Rs. 4,81,958, inclusive of Rs. 1,21,161 paid by the Mysore State, so that the charge to the Imperial Revenue is only Rs. 3,60,797, or Rs. 25,535 less than in season 1875-76. The mean average mileage rate is Rs. 25-8 per square mile, which is somewhat in excess of that of the previous season, owing to the very small out-turn in Mysore, owing to the difficulties caused by the famine and pestilence there, the high cost of the exploration and survey on the Eastern Frontier in Assam, and the cessation of operations in two divisions where there was nothing left for survey.

Total cost of the season's work.

9. Exclusive of Mysore, which as yet has yielded very little but skeleton triangulation, the average mileage rate is reduced to Rs. 21-12, which is within the ordinary general mean average, and is as low as can be expected for the description of survey employed.

10. Compared with the general results of the previous season, there is an excess of 2,689 square miles of triangulation, while the area topographically delineated is nearly equal (less than one-third of a square mile in defect). In statements A, B and C, in the Appendix, detailed information is given connected with the out-turn of each party, cost, results of the triangulation, and comparison of the out-turn of season 1876-77 with that of the previous season 1875-76.

Comparison of the results of season 1876-77 with season 1875-76.

11. On the whole, the results are very favorable and promising. The separate review of each party will best explain the nature and value of the precise work performed, and the importance to be placed on it.

Combined results of the Topographical and Revenue Surveys, for season 1876-77.

12. The combined out-turn of Imperial Topographical and Revenue Surveys for the season under review is as given below:

	Area in square miles.	Total cost.	General average mileage rate.	Remarks.
		Rs.	Rs. A.	
Topographical Surveys, ...	18,909	4,81,958*	25 8	*Rs. 3,60,797 paid from Imperial Estimates. Rs. 1,21,161 paid from Provincial Funds, Mysore. Includes also the cost of 22,119 square miles of triangulation in advance of the topography.
Revenue Surveys, 4 inches=1 mile, in Bengal, North-Western Provinces and Punjab.	5,424	2,75,418	50 12	Includes 4 square miles of the Midnapur City Survey.
Topographical (Bombay), 2 inches=1 mile ...	4,072	1,12,377	27 10	
Topographical (Bengal), 1 inch =1 mile ...	1,299	49,280	37 15	
Total ...	29,704	9,19,033	30 15	General average for combined Topographical and Revenue, per square mile.
Cadastral Surveys.				
North-Western Provinces, 16 inches=1 mile ...	738	1,39,898	189 11	or per acre, 4 annas 9 pie.
Bengal, 16 inches=1 mile ...	167	33,869	202 13	Ditto 5 „ 1 „
„ 32 inches= 1 mile ...	845	3,01,098	356 7	Ditto 8 „ 11 „
Grand Total ...	31,454	13,93,898		

Revenue Survey results for 1876-77.

13. The results of the Revenue Survey alone for the season 1876-77 are:—of Cadastral Survey on 16 and 32 inches to the mile, respectively, 1,749 square miles, at a total cost of Rs. 4,74,865, the average mileage rate being Rs. 271-7; and of Revenue or Village Survey on 4 inches, and Topographical on 2 and 1 inch to the mile, 10,795 square miles, at a cost of Rs. 4,37,075,—the average mileage rate for this combined work being Rs. 40-8.

14. Complete information in detail, connected with the progress and cost of the Cadastral and other Revenue Surveys, will be found in the separate report, which will be submitted, in the usual course, by the Superintendent of Revenue Surveys, it not being ready at present.

Combined Topographical and Revenue Survey results up to date.

15. In continuation of paragraph 27 of the last printed report, the aggregate results of the Topographical and Revenue Surveys of late years are given:—

	Square miles.	Rupees.
Total up to 1876 . .	866,752	2,42,64,417
Add for 1877 . .	31,454	13,93,898
Total .	898,206	2,56,58,315

16. This grand area of 898,206 square miles, which for the most part has been accomplished during my own administration, and forms such a considerable contribution to the first survey of India, does not include the Topographical Surveys executed under the Superintendent, Great Trigonometrical Survey, in the Himalaya Mountains, as well as in Katch and Guzerat of the Bombay Presidency, undertaken there under special circumstances by that branch of the department.

17. On the Index Map of India attached to this report the area above referred to is shewn in green for Topographical Surveys, and red color for Revenue Surveys; whilst the surveys conducted under the separate superintendence of the Trigonometrical Branch are tinted brown. This map shews at a glance what has been effected and what remains to be done.

Index Map of India shewing the progress of Surveys.

18. Under paragraph 16 of my last report, a statement was given to shew how any changes in the constitution, strength, and conditions under which survey parties work, affect the out-turn and mileage rate, and in it the total out-turn and cost since 1866-67, with mileage rates, was shewn. I now purpose to review very briefly the total out-turn and cost of each topographical party during my own tenure of seventeen years (since 1861) of the appointment of Surveyor General, and of Superintendent, Revenue Surveys, for the past 31 years.

Progress and cost of Topographical Surveys since 1861.

Abstract of work performed by Topographical Survey Parties since 1860-61.

Designation of Party.	Total area final topography.	Total area triangulated.	Total cost.	Remarks.
	Sq. Miles.	Sq. Miles.	Rs.	
No. 1 Party, Gwalior and Central India, since season 1860-61.	45,734	52,607	9,69,197	Sanctioned by order of Government, Foreign Department, No. 1975, dated 15th June 1861, to survey the Native States in Central India and Rajputana.
No. 2 Party, Khandesh and Bombay Native States, since season 1860-61.	29,957	39,185	7,29,224	Party organised in 1854 for the Nizam's territory, *vide* Military Department letter No. 521, dated 1st October 1854. Broken up by Home Department letter No. 100, dated 11th May 1870. Reorganised by order of Revenue, Agriculture, and Commerce Department No. 104, dated 6th September 1871.
No. 3 Party, Central Provinces and Vizagapatam Agency, since season 1860-61.	44,572	38,182	9,56,436	Party organised from the old Madras Survey, and placed under the control of the Surveyor General in 1841, for the survey of Ganjam and Orissa Tributary States.
No. 4 Party, North-Eastern Division, Central Provinces, since season 1860-61.	47,596	47,699	8,42,970	Sanctioned by order of Government, Military Department, No. 543, dated 17th November 1855, for the joint survey of the Orissa States in conjunction with No. 3. Transferred or continued on to the Chota Nagpore Division by Military Department letter No. 725, dated 22nd July 1862.
No. 5 Party, Bhopal and Malwa, since season 1862-63.	34,578	40,419	8,14,930	Sanctioned for the survey of Rewah and Native States in Bundelcund, by Foreign Department No. 271, dated 22nd November 1861. Transferred or continued on to Bhopal and Malwa by Home Department letter No. 413, dated 28th October 1870.
No. 6 Party, Khásiá, Gáro, and Nágá Hills, since season 1863-64.	46,846	38,919	7,53,690	Sanctioned by Home Department order No. 4110, dated 29th December 1863, *vide* Supplement, *Calcutta Gazette*, No. 41, dated 22nd July 1863, for the survey of the hills on the Eastern Frontier, Assam.
No. 7 Party, Rajputana, since season 1865-66.	39,745	44,683	6,14,171	Sanctioned by order of Government, Military Department, No. 771, dated 20th September 1865, for the survey of the Native States in Rajputana.
No. 8 Party, Mysore, since season 1875-76.	1,465	10,862	1,05,022	Sanctioned by Government, Revenue, Agriculture, and Commerce Department No. 423 dated 23rd June 1875, for the survey of the Mysore State.
No. 9 Party, Mysore, since season 1875-76.	861	8,541	97,494	
Since 1860-61, Grand Total ...	291,354	321,097	58,83,134	Average mileage rate Rs. 20-3 per square mile for final topography.

In addition to the above, various special large scale surveys of Military Cantonments, Cities, Forts, and Sanatoria have been completed annually, too numerous to detail in this report.

19. Nos. 1 to 4 Parties only were in existence in 1861; No. 5 Party was organised in 1862 for the survey of the Native States in Rewah and Bundelcund; No. 6 in 1863 for the survey of the Khásiá, Gáro, and Nágá Hills, and the Eastern Frontiers of Assam and Bengal; and No. 7 Party for the survey of Rajputana in 1865. The two parties, Nos. 8 and 9, for the survey of the Mysore State, were drafted from the Topographical and Great Trigonometrical Survey only in 1875, and, in consequence of the famine prevailing since throughout the Province, the work has not progressed as it would otherwise have done, and might reasonably have been expected, with old and experienced hands, such as formed these new parties. Taking, therefore, an average for the rest of the original parties (Nos. 1 to 7) during which they have actually been at work, the extensive out-turn of 289,028 square miles in about 15½ years is obtained, at a mean average cost of Rs. 19-10 per square mile, inclusive of the cost of triangulation, which, it will be noticed, is considerably in advance, as it always should be, of the final topography.

20. The work thus accomplished embraces nearly all the Native States of the Central India Agency; about one-half of the Rajputana Agency; the South-west Frontier of Bengal, *viz.*, the Gurjat States and Chota Nagpore District; the

Orissa Tributary States and Khond Mehals; the whole of Bastar, and its tributary States; nearly all the Hill States in the Agencies of Ganjam and Vizagapatam; the Sátpura Hills, and the north-eastern zemindaries in the Central Provinces; the eastern portion of Berar and the Godavery Taluks, and about one-fourth of Khandesh; in Assam, the Khásiá, Gáro, Daphla, and Nágá Hills; on the Eastern Frontier, Hill Tipperah and the Lushai Hills, and part of Bhutan.

Blanks filled in the Map of India since 1860.

21. A reference to any of the old Maps of India will shew that most of the countries above noted have, for the first time, been entered and surveyed; and we now possess accurate geographical information for many ugly and inconvenient blanks, long left unnoticed and untrodden, owing to their peculiar insalubrity, and great difficulty of accomplishment, and which only in 1860 were conspicuous on all our maps; while the cost at which this valuable information towards the accurate delineation of the whole of India was obtained, *viz.*, Rs. 19-10 per square mile, is comparatively very small, taking into consideration the nature of the work performed, and it may be anticipated that such rates are never likely to be realised in future, with all the circumstances of India so greatly changed.

22. The printed reports annually submitted to Government since 1861 will clearly shew the labors of the Imperial Topographical Surveys, and the nature of the work performed in all its details, while the 1-inch and $\frac{1}{2}$-inch standard maps now annually produced by each party and published by the aid of photo-zincography, year by year, sufficiently testify to the various improvements which have been made; and a comparison of the quantity of the work annually placed before the Government, and at the disposal of all departments of the public service, without the loss of a month's time, prove the value of the results as now produced.

Progress and cost of Revenue and Cadastral Surveys since 1845-46.

23. In the Revenue Survey Branch, under my immediate superintendence from 1847 to 1865, and subject to my general control subsequently, up to the present date, the work has been considerably more, embracing a period of 31 years; and, to form a just estimate of all that has been accomplished, a comparison of the results and maps of the present day must be made with those which, from time to time, were issued during the prior period, under the authority of the Board of Revenue, at that time responsible for the conduct of the Revenue Surveys, both in the North-West Provinces and in Lower Bengal.

24. The following abstract shews the total out-turn and cost of Revenue Surveys since 1845-46, and in Appendix I a more detailed statement is given, shewing each division and district completed, date of survey, and area and cost, which it may be useful to place on record:—

	Provinces.	Period.	Area surveyed in square miles.	Total cost.	Average mile rate.			Remarks.
					Rs.	A.	P.	
Scale, 4 miles=1 inch.	Bengal	1845—77	137,209	44,44,153	32	6	2	
	Assam, part of— ...	1849—75	29,159	18,44,004	63	3	9	
	British Burma, part of— ...	1853—70	11,533	3,15,138	27	5	2	Includes some 1-inch Topographical work in Arrakan Hills.
	Oudh	1859—71	24,531	10,97,295	44	11	8	
	North-Western Provinces ...	1848—76	19,915	7,79,448	39	2	3	
	Central Provinces ...	1857—74	59,633	25,92,334	43	7	7	
	Punjab	1846—76	134,255	32,53,785	24	3	9	Includes some 1-inch Topographical work.
	Rajputana, Ajmere, Mhairwara, and Neemuch ...	1847—56	3,841	86,685	22	8	1	
	Sind	1855—70	56,880	8,17,306	14	5	2	Includes a large amount of 1-inch Topographical work.
	Bombay	1871—77	16,337	6,02,618	36	14	2	Scale of survey, 2 inches=1 mile.
	Total ...		493,293	1,58,32,766	32	1	6	
	Cadastral Surveys—	scale, 16 and 32 inches =1 mile.						
	Bengal and Behar —	1871	1,510	4,49,207	297	7	9	Scale, 32 inches 1 mile.
	North-Western Provinces ...	to	10,718	17,90,858	167	1	5	Scale, 16 inches=1 mile.
	Punjab	1876	53	7,596	143	5	1	
	Total ...		12,281	22,47,661	183	0	3	

25. By the Revenue Surveys on the mouzawar, or village by village, system, scale 4 inches=1 mile, and including some 1-inch topographical work in hilly districts, the total out-turn amounts to 493,293* square miles, at a total cost of Rs. 15,832,766, from which a general average rate of Rs. 32 per square mile is obtained. The Cadastral Surveys, on the scale of 16 inches for the North-West Provinces, and 32 inches to the mile for Orissa and Behar, were commenced in 1871, and up to date 12,281 square miles have been completed, shewing each field or separate allotment, the total cost being Rs. 22,47,661, from which an average rate of Rs. 183 per square mile is obtained; the mileage cost in Behar being Rs. 297-8 for the 32-inch scale, and Rs. 167 and Rs. 143-5 respectively in the North-West Provinces and the Punjab.

* This area includes some 1-inch Topographical work in the Kohistan of Sind, part of the Punjab Frontier, the Arrakan Hills, and the 2-inch work in the Bombay Presidency.

26. For the village or mouzawar survey, scale 4 inches=1 mile, the rates in different provinces vary considerably, according to circumstances. Thus, in Bengal the mean rate is Rs. 32-6; in Oudh, Rs. 44-12; in Assam, Rs. 63-4; North-West Provinces, Rs. 39-2; Central Provinces, Rs. 43-8 per square mile. All the other provinces include a considerable portion of 1-inch topographical work. For the Province of Sind the general average mileage rate is lowest, *viz.*, Rs. 14-5 per square mile; but in it is included a large amount of rough reconnaissance in the Kohistan, and of extremely rapid and partial survey in the open sandy desert of the Eastern and Southern Districts. In Assam the cost was highest, owing to the difficulties of the country, and the excessive rates of labor and carriage.

27. The aggregate out-turn of the combined Topographical and Revenue Surveys during the period above specified is as follows:—

	Square Miles.
Topographical Surveys since 1860-61	291,354
Revenue Surveys since 1845-46, 4-inch by villages and 1-inch Topographical for hills	493,293
Cadastral, 32 inches and 16 inches	12,281
Total Square Miles ...	796,928

or fully one-half of British India, the latest estimated area of which, including Native and Feudatory States, is 1,473,415 square miles (*vide* "Manual of Surveying for India," page 440, 3rd edition, 1875).

28. In placing these remarkable results on record for future reference, I have the satisfaction of looking back on the part I have had the privilege to take in their accomplishment, with just pride. It is not easy for every one to realise the real extent and precise benefit of what has been achieved of late years by this Department, but I leave the records of my office to speak hereafter for themselves, in full confidence that when a fair comparison or review can be instituted with a corresponding period of equal length, the labors of the last 30 years will not shew to disadvantage.

29. The gradual expansion of the Department, and of its sphere of action, year by year, as shewn in the various reports, both in the Topographical and Revenue Survey Branches, are solely due to the pressing requirements of the public service, caused by annexation of territory, and the demands of local Governments or Administrations for resettlements and other objects in British States, and for military purposes in the Native States; and in no instance has any additional work been sought for, or undertaken, except under the most clear and specific orders of the Government of India, on the requisitions of the Civil Officers concerned. In many instances urgent and immediate demands have been made for new surveys, totally irrespective of the departmental means available, and I have been frequently compelled to strain the resources at my disposal, in trained agency, to the utmost, which has caused much anxiety in finding ways and means, for the due and efficient execution of new surveys.

Causes which have led to the expansion of the Department.

30. But, however much the general strength and number of survey parties may have extended during the past quarter of a century, owing to the rapid growth of British territory and British interests in that time, there is the best evidence of a fair and good return for the outlay expended, by the absolute number of square miles of country laid down, and, for all the revenue portion of the work, by the increase of assessment, or other advantages obtained for the great Public Works which have been introduced of late years. Perhaps in no other department of the public service is the money spent so fully and accurately accounted for, by the periodical published history of the results attained, and the definite assignment of the cost to its own particular objects. For every rupee spent there is the equivalent in square miles of country laid down.

Much work still remaining to be done.

31. The completion of the entire first survey of India is a mere question of time and money. It is admittedly a most important object to get this done at the earliest practicable period, and it is not likely to be accomplished at mileage rates below what we have already attained. Therefore the diminution of the trained machinery, by reductions of parties as recently insisted on by the Government at such a critical period of the progress of the great National work on which we have been so long engaged, appears to be as much a mistake financially, as it must be injurious to the crying wants and necessities of the Administrations, which must have the surveys they ask for, sooner or later.

32. What sufficed for mere first assessment purposes at the time of the old settlement in the North-West Provinces, nearly fifty years ago, will not do now, with the material and moral progress of the country advancing in such rapid strides, and the value of the land of so much higher importance in the administration of justice, to meet the legal enactments of the present day. Consequently, not only is the remaining portion of the first general survey yet to be done, but re-surveys of much of that previously executed are called for by competent authorities on larger scales, and in more minute detail and precision, for specific objects now constantly arising.

33. To suppose, therefore, that surveys are no longer required, or that there is not very much to be done in India still, is a fallacy, which it is right should be declared and recorded by those who are most competent, by knowledge and experience of the subject, to speak. It has been repeatedly asked of late,—when the whole of the survey of British India will be completed? But such a question cannot be answered as long as local Governments and Administrations shew good cause for demanding new surveys of provinces and districts, and which are admitted by the Supreme Government. Only within the last two or three years we have been called on to inaugurate new Cadastral Surveys on the largest scales, in both the permanently settled and unsettled districts in the North-West Provinces, in Behar, in Orissa, and in British Burma: and in the three former, such operations are now in full force.

34. If such refinement of large-scale surveys are declared necessary and proper for the permanently settled districts in the North-West Provinces, then precisely the same reasons apply to the whole of Bengal and Behar; and thus, as I have had occasion to report elsewhere, this becomes a very large question indeed, and one which does not portend the end, of the use or necessity of the Survey Department. I believe, therefore, that the present generation cannot possibly foresee any termination for the labors of a skilled department like the one at present employed, and which has been raised and trained with such infinite labor and expense.

35. The Ordnance Survey of the British Isles was commenced long before that of India, and they are still going on with it, and, doubtless, will continue to do so for a very long time to come. This, therefore, may be a fair test for the guidance of those in this country, who may think that the entire survey of a country like India can be accomplished in less time, or that in a country of such diversified character, and such multifarious objects to be attained,

there will not always be found a vast amount of survey work to be cared for, and for which competent machinery must be maintained; for it cannot be had for the asking, or be put down and raised up again at pleasure, without serious financial loss.

Reductions in the Department.

36. The utmost exertions have been, of late, made to bring the Budget Estimates down, lower and lower annually, as required by the Financial Department. Several establishments, both Topographical and Revenue, have been broken up, and the native agency discharged; whilst several Officers and European Assistants have been either allowed to retire on pension, or to go to other Departments, as will appear in the sequel. The precise reductions effected have been fully explained in the letter as per margin,* as well as shewn in the Budget for the ensuing year, just submitted. To attain this object, there has also been an absolute stoppage of all promotions in the Department for the past two years. The effect of such a severe measure is very serious, and detrimental to the real interests of the Government, as well as to the prospects of old and well-tried servants, like those who have so freely sacrificed their health and lives in the arduous and perilous duties necessarily entailed in the survey of this vast country.

* No. $\frac{F}{161}$, dated 16th May 1877, from Surveyor General, to Revenue, Agriculture, and Commerce Department.

37. The estimates, as I have had occasion to point out, have been reduced as low as it is practicable to make them, without further discharge of some of the European element, and the loss of additional working parties. But, to whatever extent the limit of the Survey Budget may be of necessity brought, it is of vital importance that the organisation of the Department should be fixed and admitted according to the reduced authorised numbers of its members, and the promotions carried on in strict accordance therewith, instead of a system of complete blockade, as prevailing at present, which is altogether opposed to the due and proper administration of a large and important Department, if fair results are to be expected, and such progress is to be obtained, as the Annual Reports have now for so many years been successfully recording.

The following table shews the savings from the sanctioned estimates that with the co-operation of the Superintendents of the Trigonometrical and Revenue Surveys) have been effected in the three branches of the Survey Department during the period from 1869-70 to 1875-76:—

Financial Year.	Sanctioned Budget Grant.	Actual Expenditure.	Difference between Budget Grant and Actual Expenditure.	
			Decrease.	Increase.
	Rs.	Rs.	Rs.	Rs.
1869-70	27,08,282	24,58,938	2,49,344	...
1870-71	23,67,273	20,87,103	2,80,170	... ...
1871-72	24,04,710	22,18,409	1,86,301	.....
1872-73	24,56,190	24,10,796	45,394	.....
1873-74	24,15,570	24,55,198	.....	39,628
1874-75	24,15,930	24,35,124	.....	19,194
1875-76	23,81,000	23,38,614	42,386	.....

Cartography-Geographical.

38. In the Appendix statements are given (marked E and F) shewing, in detail, the work completed and in progress in the Geographical, Drawing and Compiling, and Engraving Branches, under the charge of Mr. J. O. N. James,

Assistant Surveyor General. A large amount of very useful work has been accomplished, the details of which could not be referred to here, but the more important compilations and publications are as follows:

INDIA: *scale, 64 miles=1 inch.*—Various additions from recent surveys. Hill features added to the manuscript, either for engraving or lithography, as may hereafter be decided on.

A preliminary edition of this fine map (without hills), with the territorial divisions tinted by chromolithography, was published in January 1877, and has since been in great demand. It is further being utilised for the Geological Map of India, and it is hoped that a second edition, with the hill features added, will soon be ready, to meet the constant requisitions from Government Departments and the public for a reliable map of India on a tangible scale, to provide for which my best efforts for a long course of years have been directed. The hill features are drawn in manuscript, and will be lithographed in chalk, preliminary to being etched on copper, which must take time.

INDIA: *scale, 32 miles=1 inch.*—Additions from recent surveys. Sheets 1 and 4 are in the engraver's hands in outline. Sheet 3, containing Rajputana, Central India, Sind, and part of the Bombay Presidency, is under completion. Sheet 5, Madras Presidency, is nearly ready in outline for the engraver.

BENGAL TRADE MAP: *scale, 16 miles=1 inch*, completed and photozincographed. This map was drawn and published at the request of the Bengal Government to illustrate a report on trade.

BENGAL POSTAL MAP: *scale, 16 miles=1 inch*, based on the map published last year. Under compilation for the Postal Department.

SIND PROVINCE: *scale, 16 miles=1 inch.*—Edition with hills in lithography. Hill drawing completed and published.

CENTRAL PROVINCES, RAJPUTANA AGENCY, CENTRAL INDIA AGENCY: *scale, 16 miles=1 inch.*—These are sister maps to the Provincial ones of Bengal, Punjab, Sind, North-West Provinces, and are all in a forward state, as far as survey results for each have been received.

THE KHANATE OF KELAT OR BALUCHISTAN: *scale, 16 miles=1 inch.*—New edition, with hills. Revised after much labor and enquiry from information received from various sources as quoted on the map, and issued under the approval of the Foreign Department.

COUNTRIES BETWEEN HINDUSTAN AND THE CASPIAN SEA: *scale, 64 miles =1 inch.*—New edition, with hills. Revised and corrected to date, with the approval of the Foreign Department.

INDIAN ATLAS SHEETS for engraving.—The following new manuscript sheets have been taken up and completed in outline and names:—91 N. W. and S. W.; 95 N. W. and 12 N. E. and S. E.: 18 N. W.; 33 S. W.; 36 N. E.; 37 S. E., are in various stages of progress. Large additions have been made from recent surveys to sheets 17 full plate; 22 S. W. and S. E.; 23 N. W.; 33 S. E.; 34 N. E., N. W., S. W.; 35 N. E., S. E.; 36 S. E.; 37 N. E.; 52 N. W., S. W.; 66 and 67 full plates; 71 N. E., S. E.; 74 full plate; 90 S. W.; 92 N. W., S. W.; 93 N. W.; 113 full plate; 124 all four quarters; 125 S. E.; 130 N. W., S. W. Some of these have been completed up to margins and made over to the engravers (*vide* details in Appendix E).

Ganjam and Orissa Survey Sheets completed.

39. Further considerable progress has been made towards the completion of the series of 1-inch standard maps of the old Ganjam and Orissa Survey, referred to in paragraph 41 of last report. Sheets 30, 31, 32, 33, 41, 43, 46, 48, and 52 have been re-drawn in this office and photozincographed. Sheets 62, 63,

64, 65, 66, and 67 are in progress, and the entire series will very shortly be completed, and prove of great value to the local officers.

40. Various other drawings and tracings of maps, plans, and charts have been completed, or are in progress (*vide* Appendix E). No less than 5,271 proofs of maps, charts, and plans have been examined and corrected for press, and 28,738 impressions of maps and plans have been colored during the year.

41. The geographical duties connected with the feeding of the three printing departments, Engraving, Lithographic, and Photographic, are exceedingly heavy, as the details of all the results fully indicate; and this business increases every year. To Mr. James, Assistant Surveyor General, whose zeal and great ability in the discharge of his multifarious duties, connected with so large an establishment, never flags, I am chiefly indebted for the admirable manner in which he manages to meet the great pressure put upon the office, and for the credit which our Geographical publications deservedly enjoy in the estimation of competent persons, both in India and in Europe. The labors of such a Department have, I regret to say, told on Mr. James, whose failing health compelled him to seek a respite from work for three months during the past hot season, and which, I fear, will have to be further extended next year. The special merits of this Assistant Surveyor General are well known in the Department, and to the Government he has served so long and so faithfully. I have the utmost satisfaction in again recording the high sense I entertain of his excellent services, and my earnest hope that he may meet the reward which he has so thoroughly earned.

Mr. J. F. Baness, Chief Draftsman, has rendered good aid. As an old Topographical Surveyor and good Orientalist he has great experience, and is devoted to his work. My acknowledgments are due to Mr. Baness for many years of hard, satisfactory work.

Messrs. Chamarett, Belletty, and Babonau are also entitled to commendation for the satisfactory manner in which they have continued to conduct their respective duties.

A new catalogue or priced list of all available maps and plans has been prepared on the same plan as that issued from the India Office, and the first portion printed, the remainder is shortly expected from the press. The preparation of this catalogue has entailed very considerable labor, and its issue will supply a want long felt.

Copperplate Engraving.

42. In the Copperplate Engraving Branch very great progress has been made during the year, both with the sheets of the Indian Atlas and other general maps: the details of work completed and in progress are given in Appendix F, only the most important work being here referred to.

New Sheets—Indian Atlas—completed and in progress.

* Plates finished with hills.
† Ditto hills engraving.

Indian Atlas plates; sheets 23 S.W.; 52 N.W.; 72 N.W. and N.E.; 93 S.E. and S.W.; 105 S.W.; 124 S.E. and 124 S.W., have been completed and published; nine new sheets in all. The following plates have had large additions from recent surveys: 33 S.E.*; 34 N.E.*; 53 S.E.†; 91 S.E.†; 125 S.E.*; 130 S.W.†; 131 S.W.†

The following new plates of the Indian Atlas are engraving and in various stages of progress: 12 S.E.; 22 S.W. and S.E.; 23 N.W.; 34 N.W. and S.W.; 35 N.E. and S.E.; 36 S.E.; 37 N.E.; 52 S.W.; 72 S.W.; 90 S.W.; 91 N.W. and S.W.; 92 S.W.; 93 N.W.; 95 N.W.; 124 N.W. and N.E.; 125 N.W.; 130 N.W. Many of these are in a fair way towards the completion of outline and writing, and on a few the hills are etching. Heavy

additions have been completed and are in progress on the following old, full-size (double elephant) plates : 17 ; 31 ; 73 ; 74 ; 94 ; 103 ; 106 ; 108 ; 113 ; 119 and 121. Trifling corrections and additions to date have been made to no less than 70 other quarter plates.

Engraving of general maps.

INDIA.—*Standard map : scale, 32 miles=1 inch.*—Sheets 1 and 4; outlines completed; writing well advanced.

SIND PROVINCE, ASSAM PROVINCE :—*scale, 16 miles=1 inch,* completed and published without hills.

BENGAL BEHAR, AND ORISSA :—*scale, 16 miles=1 inch.*— In two sheets ; outlines completed, writing in progress.

INDIA.—*Skeleton maps, on scales, 80 and 96 miles=1 inch,* to illustrate reports and various projects, as occasion so often requires. Outlines completed, writing just commenced.

Of the series of maps for the " Statistical Account of Bengal," all the maps which were in hand, *viz.*, the Divisions or Commissionerships of Bhagulpur, Patna, Chota Nagpur, and Rajshahi and Kuch Behar, were completed and published, and a large number of each were forwarded to Dr. W. W. Hunter, Director General of Statistics to the Government of India. To illustrate the several volumes of the Statistical Account of Bengal, no less than 18,269 copies of maps have been furnished to Dr. Hunter.

The following statement briefly describes the progress made in engraving the sheets of the *Indian Atlas* since the work was transferred to India, or since January 1869 :—

NEW QUARTER SHEETS completed and published in India	50
NEW QUARTER SHEETS in progress, with details considerably advanced. Eight of these have been published without hills as a preliminary edition.	26
NEW QUARTER SHEETS projected on copper, and borders, &c., cut ...	70
OLD SHEETS (double elephant size) to which extensive additions and corrections from new surveys have been made; names recut; railways, roads, boundaries, &c., added. On five of these the hills have been re-engraved or touched up throughout	18
OLD SHEETS now in progress in various stages	8

Work done in England since 1869.

NEW QUARTER SHEETS completed and published	26
NEW QUARTER SHEETS in progress	5
OLD SHEETS (double elephant size) largely added to	4

Index to the Sheets of the Indian Atlas.

13. Prefaced to this report, a small Index to the Sheets of the Indian Atlas is given, to illustrate the present state of the engraving and publication of these important maps. Since the engraving work was first transferred to India, in December 1868, no less than fifty new quarter plates have been completed, while twenty-six new quarter plates are in progress (some near completion), and eighteen of the old large plates have been revised and completed to date, besides corrections, renewals, and additions to numerous other old plates, which were completely worn out from age before they were sent out from the India Office, and unfit to give impressions, but which it was very desirable and necessary to save by some means, until such time as new materials, from surveys now in progress in the Madras and Bombay Presidencies, and in the North-West

Provinces, could be obtained for the engraving of new sheets or plates based on proper longitudes.

Utility of the Engraving Branch.

44. In addition to the above ordinary Atlas sheets, much useful work has been executed in the shape of the maps of India, the Provincial maps of Bengal, Behar and Orissa, Assam, Oudh, Sind and the Punjab, and the Divisional Gazetteer maps of Bengal—all of which are in large demand—to illustrate various reports and projects of the Local Governments and other State purposes.

45. The utility of this branch of the Head-Quarters office is annually becoming more apparent, as its work adds permanency to the labors of the Survey Department, and ensures the saving of a vast amount of extraneous labor, which was formerly expended in producing new maps to illustrate special reports, &c.; also in preparing geographical scale district maps, revising the old plates for district and sub-divisional boundaries, railways, roads, canals, &c. The possession of copperplate standards is quite invaluable, obviating the necessity of making fresh drawings on the stone. With the cheap native agency now largely employed, which is daily growing in efficiency, I believe that, under the European aid and supervision now maintained, the progress, quality, and cost of engraving in India will bear favorable comparison with any work of the same kind executed in England; whilst the advantage of the final publication of the Survey of India being conducted under the immediate eye and supervision of the responsible officers in this country, cannot be over-estimated.

46. To Mr. Coard, Superintendent of the Engraving Branch, and his very efficient staff of Europeans, much credit is due for the progress and quality of the work performed, year by year. Mr. Coard's excellent supervision and management of this important work deserves every commendation. The proficiency of many of the native assistants and apprentices is highly creditable to the skill and good management of the Superintendent. Messrs. George G. Palmer and D. Mitchell, hill etchers, and Messrs. Fulford and Tarrant, outline and writing engravers, having completed their full term of five years' approved service, under their engagement with the Indian Government, in November and December 1877, were re-entertained, and allowed an increase to their salaries under the orders of the Revenue, Agriculture, and Commerce Department, No. 368, dated 28th June 1877.

Copperplate printing.

47. In the Copperplate Printing Branch the following work was performed during the year:—

Proofs of maps and atlas sheets	1,129
Transfers from various plates for stone	691
Impressions of maps and atlas sheets	9,687
TOTAL ...	11,507

48. The services of Mr. H. G. Martin, Plate Printer, will be dispensed with from February next, when his agreement expires, the conditions under which he desired to be re-entertained not having been confirmed. He will be provided with a free passage to London under the terms of his agreement, and his duties will be provided for by one of the copperplate engravers, Mr. Rodgers, who is competent for the duty; the salary of Mr. Martin being thus saved.

Photographic Branch.

49. In the report by Captain J. Waterhouse, Assistant Surveyor General, in charge of the Photographic Branch, details connected with the work of re-pro-

ducing and printing maps by photozincography are given (*vide* Appendix G), and the following is an abstract:—

Abstract of work performed in Surveyor General's Office, Photographic Branch, from 1st October 1876 to 30th September 1877.

	Number of		Prints.							Remarks.
	Sections or sheets.	Negative Plates.	Carbon Prints.	Silver Prints.	Photograph Transfer Prints.	Transfer to Zinc or Stone.	Number of Pulls.	Number of Sheets.	Number of complete copies.	
Topographical Maps	163	281	...	252	249	100	24,625	20,655	20,655	
Revenue Survey Maps	487	535	...	...	522	127	23,460	19,100	19,100	1,430 Anastatic.
District Maps	5	20	...	...	12	4	7,914	6,334	2,897	
General Maps	55	102	...	40	208	57	16,550	7,829	5,291	620 Anastatic.
City and Cantonment Plans ...	30	62	...	66	144	37	5,442	5,442	1,902	
Miscellaneous Maps, &c.	367	475	...	507	528	180	63,551	82,455	79,783	
Zincographic and Anastatic Transfers	...	...	...	...	...	30	.....	.....	.....	
Proofs	...	...	...	...	...	...	5,883	.....	.....	
Cadastral Survey, Bengal	137	...	...	...	...	137	6,950	6,850	3 500	
Photographs of Life-convicts ...	...	...	3,132	...	...	...	.....	.....	.....	
Total ...	1,244	1,505	3,132	871	1,063	672	144,184	148,665	133,318	
Cadastral Survey, North-Western Provinces	2,009	4,034	...	...	4,350	2,021	97,000	97,000	65,900	
Grand Total ...	3,253	5,809	3,132	871	6,013	2,693	241,184	245,665	199,218	

50. The work in this branch is still very greatly increasing with the strong demands for the re-production and publication of the full-scale plans (16 inches) of the Cadastral Surveys of the North-West Provinces, but for which a separate establishment and Budget grant from that Government has been allowed. The urgency of the re-production of the cadastral plans for settlement, irrigation, and water-tax purposes has necessitated much additional pressure on this branch of the Head-Quarters office, intended only to deal with the regular one-inch and smaller scale publications of the Department, but which has been cheerfully met; and Captain Waterhouse's excellent management and zeal, as usual, cannot be too highly praised.

51. Further demands for the cadastral plans of Bengal, Lower Provinces, scale 32 inches, is still pressing; and special arrangements will be necessary to cope with the vast accumulation of executive work of this kind, which it is impossible to deal with, without extensive increased accommodation, establishment, and plant. Every possible assistance has been rendered towards meeting, in some measure, the call for these maps for the Soane irrigation, and the resources of both the photographic as well as the lithographic printing presses have been taxed to the utmost.

52. Attached to Captain Waterhouse's report is a "statement showing the work done for other departments of the public service," which business is greatly on the increase, and demands proper consideration for crediting this office with a fair set-off in the Budget Estimates of the Department. It has always been the object of this Department to comply promptly with the requisitions of other departments for fine or artistic work, which could not be done elsewhere; but, with seriously-reduced Budget Estimates, it is a matter of grave importance that the value of outside work performed should be fully credited.

Lithographic Branch.

53. The Lithographic Branch has, during the past year, accomplished much useful work of a nature not suitable for engraving or photozincography, the details of which are given in the report (Appendix H) by Captain R. V. Riddell, R.E.,

Assistant Surveyor General, in charge. The following abstract shows briefly the nature and extent of the work performed:

Abstract of Drawing and Printing executed at the Surveyor General's Office, Lithographic Branch, from 1st October 1876 to 30th September 1877.

Subject.	No. of Sheets	No. of Copies	No. of Impressions.
District and General Maps, &c.	56	11,789	30,308
Index Maps	11	5,764	11,242
Revenue Survey Sheet Maps; scale, 1 mile = 1 inch	23	5,541	5,591
Plans	10	1,375	1,884
Cadastral Maps	132	6,864	6,864
Miscellaneous Drawings	15	4,223	4,425
Forms	50	27,545	27,845
	297	...	...
Maps drawn but not printed	31	—	..
Total	328	63,101	88,159
Work done for other Departments.			
Miscellaneous Maps	66	31,495	82,903
Miscellaneous Plans and Sketches, &c.	83	49,728	61,598
Geological Maps	7	5,929	18,215
	156	...	...
Maps drawn but not printed	12	...	...
	168	87,152	162,716
Total of Printing in Lithographic Branch	496	150,253	250,875
Type Branch.			
Departmental orders	27	2,686	3,036
Memoranda and Forms for use of the Department	256	119,922	166,726
Forms for Topographical and Revenue Surveys	49	75,724	218,906
Transfers of Headings, Footnotes, and References to published Maps	3,614	12,493	12,493
Total	3,946	210,825	401,161

54. The total number of maps, plans, and diagrams printed amounts to 122,708 copies, which represents 223,030 pulls, or impressions. Of these, no less than 87,152 copies of maps, plans, sketches, and diagrams were for various outside departments. The work in this branch is always of an emergent character, and demands on it from various departments of the public service are incessant. The Lithographic Department is a valuable agency for all ephemeral productions and urgent local wants, preliminary to the preparation and issue of the engraved maps of final surveys, which of necessity take time.

55. The most important lithographic publications during the year are as follows:—

India: *scale, 64 miles=1 inch,* preliminary, without hills.

Territories of the Khan of Kelat or Baluchistan: *scale, 16 miles=1 inch,* with hills, published while this report was passing through the press.

Hindustan to the Caspian Sea: *scale, 64 miles=1 inch,* with hills.

Geological Map of India: *scale, 64 miles=1 inch,* is still in progress, and about two-thirds completed. This map is in four sheets, each bearing from 8 to 10 colors, and of which 1,000 impressions are required, thus entailing about 40,000 printings for a single map. This will probably be ready by March or April 1878, and will be a highly creditable production.

New plan of the Town of Calcutta and Environs: *scale, 6 inches=1 mile,* with numerical and alphabetical Index.

New series of District Maps: *scale, 4 miles=1 inch,* as per margin, obtained by transfers from the copperplates of the sheets of the Atlas of India, with corrected boundaries of districts and internal sub-divisions, and addition of railways, roads, canals, &c., to date, made on the stone.

District Sarun.	District Lucknow.
„ Mozufferpore.	„ Oonao.
„ Durbhanga.	„ Bara Banki.
„ Monghyr.	„ Fyzabad.
„ Puri.	„ Roy Bareilly.
„ Burdwan.	„ Sultanpur.

MAP OF THE PRESIDENCY DIVISION: *scale, 8 miles=1 inch,* re-transfers from very old lithographs.

MAP OF THE DACCA DIVISION: *scale, 8 miles=1 inch.*

MAP OF THE CHITTAGONG DIVISION: *scale, 8 miles=1 inch.*

Work executed for other Departments.

56. For other Departments, 163 maps, plans, diagrams, &c., were completed, from which no less than 87,152 complete copies were printed and supplied.

Color printing still continues to be largely utilised, as far as the competency of the press establishment permits, with great advantage, and tints (engraved on copper) have been especially prepared, to produce gradations in tone or depth of color when transferred to the stone.

57. Captain R. V. Riddell, R.E., in charge of the Lithographic Branch, has been indefatigable in his exertions, and has conducted his duties to my entire satisfaction: he is an officer of considerable departmental experience, and his transfer to head-quarters has been most opportune, as he is able to render good and efficient aid in all the branches, in addition to the special conduct of the Mathematical Instrument Department. Captain Riddell reports favorably of the continued good services of Mr. E. Jevezy, Head Assistant, and Messrs. Lepage and Niven of the Lithographic Department.

Meteorological Observatory.

* Revenue, Agriculture, and Commerce Department No. 129, dated 14th August 1876.

58. By the order of Government marginally noted,* the Observatory Branch of this office was transferred from the 31st March 1877 to the Meteorological Reporter to the Government of India. One computer has been pensioned, two observers have received gratuities, and one has been transferred to the Engraving Branch, to fill a vacancy caused by the death of a writer.

The daily time-ball operations and registering of the maximum and minimum pressures of the standard barometers and thermometers are still conducted in this office under the superintendence of Babu Gopinath Sen and two assistants, and this work will continue to be performed here until such time as the new Observatory at Alipore is completed.

Babu Gopinath Sen, after a service of nearly 38 years, has been granted a superannuation pension, but, by the orders of Government, is directed to continue at his post until such time as the Meteorological Reporter can arrange for the dropping of the time-ball from the new Observatory. Babu Gopinath Sen well deserves every consideration for his long and faithful services.

Office accommodation.

59. The commencement of the erection of the new offices on the ground in Park Street, referred to in paragraphs 65 and 66 of last report, has not yet taken place, nor has a final design been approved of. But the concentration of all the survey offices is a matter of great importance to the efficient working and supervision of different establishments amounting to several hundred persons; and I would urge this strongly for early action. The purchase of the present office, No. 46, Park Street, has been sanctioned, but the conveyance of the property has not as yet, I regret to say, been completed by the Government Solicitor, who has been urged on the subject.

Map issues.

† This includes the despatch of 28th December, which usually goes after 1st January of each year.

60. During the past year five† despatches of maps, new publications of this office, have been made to the Geographical Department, India Office, London. The following statement shews the total issues of new publications made to various Departments of the State, and to local Map Sale Agents:—

	Maps.	Value. Rs.
‡ From Surveyor General's Office ...	26,930	36,317
Issued from Photographical Branch	6,949	3,908

	Number	Value. Rs.
To Government Officials *bonâ fide* on service‡	32,879	40,125
To the Geographical Department, India Office	4,370	5,878
To local Map Sale Agents ...	5,087	7,676
TOTAL ...	42,336	53,679

61. The correspondence and references connected with the issue and sale of these maps, and the details of accounts for mounting, registering receipts and issues, &c., are exceedingly heavy and troublesome. To convey some idea of the clerical work performed in this office, the following statement is given, extending from 1870 to 1877, which will be useful to place on record:

Correspondence, &c.

Years.	Letters received.	Letters issued.	Total.	Total number of Dockets.	Number of Dûk Parcels.	Number of Receipts issued.
1870	3,690	2,811	6,501	26,004	1,427	1,427
1871	3,790	2,685	6,475	25,900	3,846	3,846
1872	3,736	2,893	6,629	26,516	1,937	1,937
1873	3,980	3,245	7,225	28,900	1,622	1,622
1874	3,936	3,086	7,022	28,088	2,009	2,009
1875	3,942	3,629	7,571	30,284	1,183	1,183
1876	3,614	3,246	6,860	27,440	1,269	1,269
1877	3,960	3,101	7,061	28,244	1,270	1,270

62. In continuation of paragraph 73 of the printed report for season 1875-76, the usual Account-current shewing the money transactions connected with map sales is given in Appendix D of this report. The total sum paid into the General Treasury up to the end of December 1877, and for which receipts have been furnished to the Comptroller General, amounts to Rs. 5,670-10-5½, and no money remains in hand. There still remains to be realised from Map Sale Agents Rs. 3,678-6, which on receipt will also be forwarded to the General Treasury.

Map Sale Account.

63. No credit is allowed to this Department for the sale of its productions, which entail a heavy outlay, especially in coloring, mounting, and binding after the maps are struck off,—all of which public officers obtain gratis. Several recommendations have been made on this subject. The time appears to have arrived when the English principle of every official officer purchasing such maps as may be necessary for his purposes, and charging it to his own Budget, should be carried out. With the pressure put on the Survey Estimates, it appears to me something of this sort is very necessary, and it would have the effect of securing more care of public property.

64. With the above and previous expositions of the transactions of the Department for so many years past, my connection with it now ceases. Having obtained Colonel's allowances on the 27th of February last, after a service in India of 44 years, 40 of which have been passed in this Department, the Government of India were pleased to re-appoint me by the orders, as per margin, for the remainder of the current year, and I have now only to record the regret I feel at the separation from the great work I have been engaged on, and from such a body of officers and subordinates with whom it has been my good fortune so long to be associated, and to whom I am so deeply indebted for that cordial co-operation and support, which has alone enabled me to carry on the duties of such a Department. The succession of such a distinguished Officer as Colonel J. T. Walker, C.B., R.E., Superintendent of the Great Trigonometrical Survey, as Surveyor-General from the 1st January 1878, is a matter of the highest gratification to me, as I believe it will be to the Department at large; and my sincere wishes and aspirations will always continue to be for the honor and credit of the Survey Department of India—sentiments which I have circulated in a Departmental Order for the information of all the Members.

Revenue, Agriculture, and Commerce Department No. 323, dated the 23rd May 1877.

65. The review, in detail, of the work performed during the past field season of 1876-77 by the Imperial Topographical Executive Survey parties is as follows:—

EXECUTIVE ESTABLISHMENTS.

No. 1 TOPOGRAPHICAL PARTY.

GWALIOR AND CENTRAL INDIA SURVEY.

66. The programme of this party, as detailed in paragraph 85 of my printed report for the season 1875-76, with a somewhat reduced strength, was, with the exception of triangulation in advance, for which there was no urgent need, fully carried out in a very difficult portion of Central India, along part of the great water-parting of the rivers draining eastwards into the Bay of Bengal, and those which flow into the Gulf of Cambay.

Oodeypore or Meywar, and small detached portions of Gwalior or Sindia's territory, Tonk, and Dungarpur.

67. As it was necessary to make early and special arrangements for a new and improved large-scale survey* of the Fortress of Gwalior, the Cantonments of Morar, and the surrounding country, on the pressing requisition of the Military authorities, and as reported to the Government of India (*vide* correspondence noted in the margin†) the party was divided into two detachments, under the officer in charge and his Assistant; the former, Captain Charles Strahan, R.E., superintending the special large-scale survey, while to Lieutenant Hobday was entrusted the conduct of the ordinary or regular 1-inch work, which lay, for the season, at a considerable distance to the west, in the Native States of Oodeypore, Dungarpur, and Tonk, in the Rajputana Agency, between the parallels of 24° and 24° 45′, and the meridians of 74° and 74° 30′, in the western half of Degree Sheet XII, and about equidistant between the well-known cities of Neemuch and Oodeypore: *vide* Index Map in Appendix.

Strength of Party and Season's Out-turn.

	Topography 1-inch scale.	
Captain Charles Strahan, R.E., Deputy Superintendent, 3rd grade, in charge, ...	35	Also Triangulation and Topography for Gwalior, Morar, and Chitorgarh.
Lieutenant J. R. Hobday, Assistant Superintendent, 3rd grade, ...	192	
Mr. H. J. Bolst, Surveyor, 1st grade, ...	198	
Mr. C. A. R. Scanlan, Assistant Surveyor, 1st grade, ...	...	Employed for the whole season on the large-scale surveys of Gwalior and Morar.
Mr. W. Cornelius, Assistant Surveyor, 2nd grade, ...	205	
Mr. P. J. Doran, Assistant Surveyor, 2nd grade, ...	138	
Mr. C. Templeton, Assistant Surveyor, 3rd grade, ...	148	
Sub-Surveyor, Joala Pershad, ...	...	Ditto ditto.
„ Abdul Subhan, ...	142	Also large-scale survey of Neemuch.
„ Abdul Gufar, ...	191	
„ Girdharee Lall, ...	194	
„ Abdul Aziz, ...	125	
Total square miles ...	1,568	

In addition, the triangulation for the large-scale survey of Gwalior Fort and City, and Cantonments of Morar was completed, and the detail survey of these places and the Cantonment of Neemuch.

* Fortress of Gwalior, scale 24 inches = 1 mile.
Morar Cantonments, „ 12 „ = 1 „
Country surrounding, „ 6 „ = 1 „

† No. 422 F., dated 14th September 1876.

68. The area for which final and complete topography was obtained on the inch scale is 1,568 square miles, all of most difficult ground, and through nearly all of which close traversing by chain measurements was unavoidable, owing to the dense forest by which it is covered, and the uniform height of all the small parallel ranges of hills running through it.

Final topography completed.

In addition to this work on the 1-inch scale, Captain Charles Strahan, R.E., assisted by Messrs. C. A. R. Scanlan, W. Cornelius, and a Sub-Surveyor, completed the large-scale survey of Gwalior Fortress on a scale of 24 inches to the mile, of Morar Cantonments on 12 inches, and of the Native City, Residency

lands, and surrounding country on 6 inches: for a radius of upwards of 2 miles Captain Strahan, assisted by two Sub-Surveyors, also completed the 12-inch survey of Neemuch Cantonments.

Triangulation.

69. The only triangulation undertaken was, for the large-scale plans of Gwalior, Morar and Chitorgarh. Observations were taken at 15 stations, from which 171 points were fixed.

Opinion on the season's out-turn.

70. Captain Strahan states his perfect confidence in all the season's final topography, which was tested by Lieutenant Hobday and himself in the field by *in situ* examinations, and in the more open portions of country by 32½ linear miles of routes. The total area (1,568 square miles) surveyed on the 1-inch scale, together with the special large-scale surveys of Gwalior, Morar and Neemuch, which entailed considerable time and labor, is a fair season's out-turn; and considering the strength of the party, and difficult nature of the greater portion of the ground, more could not be expected.

Cost of the season's work.

71. The total cost of the season's operations amounts to Rs. 58,632-6. The expenditure has been well controlled by Captain Strahan; and I have every reason to be satisfied with the progress made, the style of the work, and the efficiency of the party.

Description of country surveyed.

72. A most interesting account of the country surveyed, its people, &c., by Captain C. Strahan, R.E., and some notes by Sub-Surveyor Abdul Subhan on the Bheel Clans of Meywar, are given in the Appendix, from which the following leading facts are gleaned.

73. Describing the great water-parting of the rivers which drain to the east into the Bay of Bengal, and those which flow into the Gulf of Cambay on the west, Captain Strahan states:—

"The difference between the two tracts thus divided is most remarkable; the north-east portion being very flat and quite open, with several large towns and villages, and fairly well cultivated: it forms part of the plateau of Rajputana, and is on an average about 1,600 feet above the sea. * * * The change after crossing the water-shed is very abrupt: instead of a fine open, undulating, and almost level country, the whole surface is intersected by water-courses, which gradually become deeper and deeper, at last forming narrow valleys, enclosed by hills, varying from 100 feet up to about 500 feet above them. The fall of the country is very considerable; for the height of the Som river, the lowest point obtained, is 650 feet above sea, showing a drop of 950 feet from the plateau above in a distance of 25 miles, or nearly 40 feet per mile, and again from Bánsi to Dariawad, 17 miles, a fall of 850 feet, or 50 feet per mile." * * *

74. For the first 10 or 12 miles from the summit of the plateau, the hill tops are more or less covered with forest; but further to the south they are far worse, being sheeted over with dense tangled jungle, while the valleys continue to fall, or deepen rapidly, thus greatly increasing the difficulty of traversing the country, and offering no salient points as land-marks to the plane-tablers, as the uniform height of the ranges still continues.

75. The Jákhum, Som and Berach are the only rivers in this part of the country. They are tributaries of the Mahi river, and are not navigable; nor could they be rendered so.

76. There are only two passes in this ground which can be traversed by laden animals: one from Bánsi to Dariawad and on to Bánswára, and the other from Salúmbar to Oodeypur.

77. Teak trees were abundant; but they are cut down young by the Minas and Bheels, and very few large ones are seen. The "Mowah" is plentiful, also the "Tendu," or Ebony. In some parts of these hills the streams are literally poisoned by the abundance of plants of "*Croton tiglium*," or "Jamalgota."

Special survey of the Fortress of Gwalior and Morar Cantonments, &c.

78. The large scale survey of the Fortress of Gwalior, which is now held by the British, scale 24 inches = 1 mile; of Morar Cantonments, scale 12 inches = 1

mile; and of the Residency lands and surrounding country, scale 6 inches = 1 mile, were all most successfully and ably completed; and these valuable plans, which have long been a desideratum, are now photozincographed in excellent style, and supplied to the Military Authorities.

79. As it was essential that these large-scale plans should be thoroughly accurate and reliable in every respect, Captain Charles Strahan was directed to undertake the work himself, with a selected staff from his own party. Very close triangulation was necessary as a basis for the detail survey, and this was completed, first for the Fortress, and subsequently extended over the rest of the ground. Observations were taken at eight stations, from which 171 points were fixed and 61 elevations determined. The total area covered by this large-scale survey is 48 square miles.

80. In the Fort, the highest point is at No. 7 Battery (1,010 feet above sea-level, and 315 feet above the general level of the plains): from this point instrumental contours were run at 5 feet apart within the Fort walls. The extreme length of the Fort is 8,563 feet, and greatest breadth, not including outworks, 2,864 feet; the least breadth is 350 feet. Some useful notes on the Fortress by Mr. C. R. Scanlan, Assistant Surveyor, have been recorded, and will be useful to the Military Department. Much assistance was rendered to the party employed on the Gwalior Survey by Major H. Pearson, of the Quarter Master General's Department.

Good services of the party.

81. Captain Charles Strahan, R.E., has held charge of this party since 1st June 1867, and, under his able and efficient superintendence, the survey has progressed to my entire satisfaction. He is devoted to his duties, full of honorable pride in his profession, and energetic both in the field and recess. His promotion to a higher grade has long been due, owing to the retirement from the service of Major Godwin-Austen; but, under the existing orders of the Government of India, all promotions in the Survey Department have been stopped, the severity of which measure I may express a hope will not be longer perpetuated in the cases of old officers of distinguished merit.

82. Lieutenant J. R. Hobday, Assistant Superintendent, 3rd grade, is a young officer of great ability and promise, and has fully proved his fitness for this Department, where I have every hope he will soon occupy a position of trust and responsibility. He took an active share in the season's field work. Captain Strahan acknowledges his good services; and his talent for drawing is of the first order.

83. Messrs. H. Bolst, C. R. Scanlan, and W. Cornelius are favorably mentioned in the Executive Officer's report, and the two last are strongly recommended for promotion, both for length of service in their present grade and superior qualifications. Mr. Scanlan took a leading part in the survey of the Fortress, City and Residency lands of Gwalior, and Cantonment of Morar, and the Executive Officer reports on his good services in the highest terms. To his excellent judgment and tact in the management of natives is greatly due the success of the large-scale survey of Gwalior and surrounding country. In consequence of the reduction of executive establishments, this Assistant Surveyor has been transferred to head-quarters from 1st November 1877, where his knowledge and experience as a superior draftsman are much required, and can be well utilised.

84. Sub-Surveyor Joala Pershad has also rendered good service in the field, and receives favorable mention in the Executive Officer's report.

Programme for season 1877-78.

85. During the current season the triangulation in advance of details will be extended to the west from the meridian of 73° 30′ through Meywar and Sirohi towards Mount Abu, and the topography completed of the Standard Sheets 83, 84 and 87 in the eastern half of Degree Sheet XIII. This party, since season 1860-61, has completed up to date, or in 16 years, 46,283 square miles of triangulation, and 44,951 square miles of final 1-inch scale topography; also large-scale surveys of all the most important towns, cities, and fortresses

which have fallen within the scope of its operations in the Native States of the Central India and Rajputana Agencies—a task of no ordinary magnitude, some of it in very wild and inhospitable tracts.

86. The extent of work remaining to be done in this division has been estimated in my report cited in the margin at about 14,012 square miles, up to the limits of the Bombay Presidency, and to occupy a period of about seven years; but this will, of course, depend on various local circumstances, which cannot at present be foreseen.

No. 535, dated 13th August 1877.

87. Owing to the reduction in strength of the Mysore Survey Parties, and stoppage of work there, on account of the famine, Lieutenant Hobday, Assistant Superintendent, who had been told off for deputation, continues attached to No. 1 Party; and it is not now considered desirable to transfer his services elsewhere, as, owing to the increasing difficulties of the ground yet remaining for survey, it is absolutely necessary to strengthen this party, so as to secure a fair return for outlay. Mr. J. A. Vanderputt, Surveyor, 2nd grade, and Mr. T. E. M. Claudius, Assistant Surveyor, 1st grade, have been posted to this survey from the dates marginally noted,* in consequence of the abolition of Nos. 3 and 4 Topographical Survey Parties.

Transfers and changes in strength of party.

* 16th November 1877.
1st October 1877.

No. 2 TOPOGRAPHICAL PARTY.

KHANDESH AND BOMBAY NATIVE STATES SURVEY.

88. This party, as usual, worked in two detachments,—one being employed on the ordinary one-inch scale in the Native hilly States north of the Nerbudda, and the second, under the officer in charge, on the more important two-inch survey of the revenue-paying portions of the plains of Khandesh.

In Khandesh, portions of the talukas of Sauda, Chopra, Bhusáwal, Nasirabad, Erandol, Amalner, Shirpur, Sháhádá, Virdel, Dhulia and Nundurbár. In the Native States, portions of Ali-Rajpur, Chota Udepur, Mathwar, Kathiwara and Barwáni.

Strength of Party and Season's Out-turn.	Triangulation. Square miles.	Topography. 1 in.=1 mile	Topography. 2 in.=1 mile	Traversing. Linear miles.
H. Horst, Esq., Assistant Superintendent, 3rd grade, in charge, ...	493	for 2 inch scale.		
Mr. A. J. Wilson, Surveyor, 3rd grade, ...	...	...	87	209
„ A. G. Wyatt, „ 4th „ ...	...	197	19	153
„ F. E. Warde, Assistant Surveyor, 3rd grade, ...	...	138	63	82
„ E. Graham, Assistant Surveyor, 4th grade, ...	145	161	...	269
Sheikh Omar, Sub-Surveyor, ...	...	174	...	253
Mr. F. Rozario, „ ...	...	...	170	...
„ H. M. Holtham, „ ...	...	106	35	90
„ C. George, „ ...	...	...	97	...
Churaman Lall, „ ...	...	111	58	...
Hyder Ally, „ ...	...	143	56	...
Vishnu Moreshwar, „ ...	...	...	141	...
Bapu Jadu, ... „ ...	...	...	85	160
TOTAL ...	638	1,030	811	1,216
Triple junction village marks fixed, in number, ...				1,207
Linear miles of check routes, ...				1,064

89. The season's one-inch work lay in the south-western quarter of Degree Sheet VII (*vide* Index Map in Appendix), chiefly in the Native States of Ali-Rajpur and Chota Udepur, and included a wild and rugged tract from the Vindhya range to the Nerbudda river; while the two-inch survey in Standard Sheets XVIII and XIX extended along both banks of the Tapti river between the meridians of 75° and 76°.

90. The total out-turn of final topography completed covers 1,841 square miles, of which 1,030 square miles were on the standard one-inch scale, and 811 square miles on the scale of two inches to the mile, with village boundaries;

Area of final topography obtained.

1,216 linear miles of traversing with chain and theodolite on the scale of two inches was completed, and 1,207 triple junction village boundary marks accurately fixed. All this work was duly tested by 1,064 linear miles of check routes, and the Executive Officer, Mr. H. Horst, reports very favorably on the accuracy of all the final survey.

Triangulation.

91. A small amount of triangulation, 638 square miles, was also completed, of which 493 square miles were for the large-scale survey of the open revenue-paying portion of district Khandesh, and 145 square miles for the one-inch survey of Native States. Observations were taken at 59 stations, from which 187 points and 113 heights, or one to every five square miles, were fixed.

Cost of the season's operations.

92. The total cost of the season's operations amounts to Rs. 51,242. The work on two inches to the mile cost Rs. 27,343, and the inch survey, Rs. 23,899.

Opinion on the season's out-turn.

93. A description of the country through which the season's operations passed is given in the Appendix. All the country beyond the Nerbudda river, surveyed on the inch scale, in the Native States, was extremely wild and difficult, and presented great obstructions to the progress of the survey; yet, considering this, and the further disadvantage of working, season after season, in two separated tracts and on two different scales, the season's out-turn of 1,030 square miles on the one-inch scale, and 811 square miles on the two-inch scale, of final topography, and 638 square miles of triangulation, is fair. The excessive cost of labor, carriage and feed of elephants, owing to the drought in Khandesh and the neighbouring Native States, has added to the season's expenditure; but the Executive Officer was fully alive to the necessity for economy, and has used his best endeavours to keep down the cost of the survey.

Services of the party.

94. Up to date, since the commencement of this survey in season 1871-72, or during a period of five years, the total out-turn of work amounts to 15,262 square miles of triangulation, and 9,991 square miles of final topography, which speaks well for the zeal and energy of those who have taken part in the work.

95. The Executive Officer, Mr. H. Horst, Assistant Superintendent, 2nd grade, has great experience, having served continuously in the Department for upwards of 23 years, and brings much ability and zeal to bear on the difficult work on which he is engaged. His long, meritorious services deserve every consideration; but the present lamentable state of the Department, I greatly regret, has hitherto precluded my obtaining for him the ordinary promotion, in the room of existing vacancies, of which he is so highly deserving.

96. Messrs. A. J. Wilson, Surveyor, 3rd grade, A. G. Wyatt, Surveyor, 4th grade, F. E. Warde, Assistant Surveyor, 3rd grade, and E. Graham, Assistant Surveyor, 4th grade; also Sub-Surveyors Sheikh Omer and Mr. C. George, have rendered excellent service, both in field and recess. The two latter Assistant Surveyors, who are strongly recommended for promotion by the officer in charge, in whose opinion I fully concur, have more than served the qualifying period.

Programme for season 1877-78.

97. The programme for the next season is as follows: The triangulation in advance will be extended south-westwards, in Degree Sheets VIII and IX, south of the Tapti river; the detail survey, in continuation of the work of previous seasons, will cover the upper half of Degree Sheet VIII, in the Sátpuras, or Standard Sheets 29, 30, 31 and 32, and probably part of 33.

98. The estimated area remaining for survey amounts to 9,000 square miles, of which 6,500 is for the two-inch and 2,500 for the one-inch survey, the approximate time for the completion of which may be stated as seven years under ordinary circumstances and on the late average rate of progress.

99. Sub-Surveyor H. M. Holtham was allowed to resign from the 11th June 1877, and Munshi Churaman Lall was dismissed from the 27th June 1877.

Transfers and changes.

100. On the abolition of No. 3 Party, Messrs. W. F. Pettigrew, Assistant Surveyor, 2nd grade, A. Cooper, Assistant Surveyor, 2nd grade, and G. Vander Beek, Assistant Surveyor, 4th grade, were, from the 11th May 1877, transferred to this party.

No. 3 TOPOGRAPHICAL PARTY.

CENTRAL PROVINCES AND VIZAGAPATAM AGENCY SURVEY.

101. In paragraphs 111 to 113 of the printed report for season 1875-76, it was shewn that this party had only one season's work left, of about 3,150 square miles in the north-west portion of Bastar, conterminous with the Ahíri and other small zemindaries of district Chánda in the Central Provinces, and that, on completion of this blank, the party would be abolished; and it affords me very great satisfaction to report that this has been accomplished, though at the cost of much hardship and suffering to all the members of this party, some of whom were so completely prostrated by jungle fever, that they were with difficulty removed from the field on the conclusion of the work, and are still suffering from the evil effects of malaria in no small degree. The health of the Executive Officer, Captain T. H. Holdich, R.E., Assistant Superintendent, 2nd grade, necessitated his seeking, under medical advice, change of air to Europe, * and he embarked on the 14th May 1877.

Bastar, Native State (north-west portion) of the Central Provinces, Taluks of Parlakot, Partabpur, Narainpur and parts of Dongar and Chota Dongar

Strength of Party and Season's Out-turn.

Captain T. H. Holdich, R.E., Assistant Superintendent, 2nd grade, in charge.

				Final Topography.	
Mr. J. A. May, Surveyor,	3rd grade,		...	188 sq. miles and 94 miles routes.	
,, F. Adams,	,,	3rd	,,	...	330 ,,
,, T. E. M. Claudius, Asst. Surveyor,			1st grade,	496 ,,	
,, W. F. Pettigrew,	,,	,,	2nd ,,	395 ,,	
,, A. Cooper,	,,	,,	2nd ,,	434 ,,	
,, J. McCay,	,,	,,	3rd ,,	420 ,,	
,, G. Vander Beek,	,,	,,	3rd ,,	419 ,,	
,, D. Campbell,	,,	,,	4th ,,	477 ,,	
,, D. Holman, Sub-Surveyor,				66 ,,	
Total square miles				= 3,225 :	scale, 2 miles = 1 inch.

* Vide *Gazette of India* Notification, No. 436, dated 11th May 1877.

102. The triangulation for all the portion of country remaining unsurveyed had been completed during the previous season, and the strength of the whole party was therefore devoted to the topography, of which the entire blank portion in Parlakot, Chota Dongar, &c., on the Indrávati river, with a good overlap on the revenue survey of districts Raipur and Chánda, was finished, giving an area of 3,225 square miles, all of the wildest, most difficult, and unhealthy country which this party has had to survey, and in which communication with the several detached plane-tablers was almost impossible. A note by Mr. J. A. May, Surveyor, 3rd grade, descriptive of the country traversed during the season, is given in the Appendix.

Final topography completed.

103. The termination of work in this part of the Central Provinces,—by which the survey of the whole of those Provinces and of the entire division allotted originally to Colonel Saxton's party, as shewn on the index map, and embracing all the Orissa Gurjat States and Vizagapatam Agency, between the parallels of 17¼° and 22½°, or from the Chota Nagpore Frontier to the Godavari river, may now be considered completed,—is a subject for great congratulation to this party and the Department. The large out-turn of final topography obtained, 3,255 miles of such ground on the reduced scale of 2 miles=1 inch,

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

is most creditable to the exertions of all who participated in bringing this last and most arduous season's work to a satisfactory close.

104. The total cost of the season's operations, under all heads, up to the end of the month of May 1877, when it was completely broken up, amounts to Rs. 44,007, to which must be added a further sum of Rs. 3,102, being the pay and allowances of the Surveyors and Assistant Surveyors employed in completing the season's fair mapping, professional reports, computations and returns.

Services of the party.

105. The area completed by this party in the Ganjam and Vizagapatam Agencies of the Madras Presidency, the Orissa Tributary States of Bengal, and the districts of Sambalpur, Raipur and Biláspur, and their dependencies or zemindaries, with Bastar and its dependencies, amounts to no less than 72,144 square miles. Captain Holdich, R.E., on taking leave of the party prior to his departure for Europe, reported as follows, which is so honorable to all concerned, and so entirely in keeping with the high tone and spirit of zeal and energy which has existed, I am proud to say, up to the present period, in the Department, and I trust nothing may ever interfere to damp or destroy it:—

"The charge of it was made over to Mr. May, the senior Surveyor, who, with Messrs. Adams, Claudius and Campbell, proceeded on their way to Calcutta,—a mere fragment of the well-worn old No. 3 Party, which has worked its way so far, and over such a strange, wild country, almost from its commencement. The rest of it is scattered,—the assistants to other parties, and the native establishment to their homes,—and its career may be finally said to have closed; and in taking leave of it, I must record my high appreciation of that thoroughly good spirit (worthy of the name of *esprit de corps* bequeathed to it by the veteran Surveyor, Colonel G. H. Saxton, who held charge of it so long), which has never permitted one single complaint of hardship, or one single expression of disinclination for most arduous and risky work, to reach my ears during the time which I have had the honor to conduct it."

106. All the records of this survey are now lodged in this office. Messrs. May and Adams have been attached to the Drawing Branch at head-quarters, where they will continue until their services are required in some other executive party; at present their qualifications as draftsmen render them particularly useful at head-quarters, where there is so much mapping work to be done. Their shattered constitutions, also, absolutely demanded respite from active field work for a season. Mr. Claudius has been transferred to No. 1 Party, Gwalior and Central India Survey; Messrs Pettigrew, Cooper and Vander Beek, to No. 2 Party, Khandesh and Bombay Native States Survey; Messrs. McCay and Campbell to No. 6 Party, Khási, Gáro and Nágá Hills Survey.

107. To the excellent management of this party by Captain Holdich, R.E., is chiefly due the successful termination of its labors in this country; and it affords me sincere pleasure to record my appreciation of his professional ability, zeal, energy and sound judgment—qualifications which fit him for a better position than he at present occupies in the Survey Department, and which he has undoubtedly earned. Messrs. May, Adams, Claudius and Campbell receive special mention in Captain Holdich's report. The long, faithful and excellent services rendered by Messrs. May and Adams are worthy of all consideration, and to both of whom my thanks are particularly due for their continued good exertions. The former is a Surveyor of great merit, well up to his work in all respects, and thoroughly reliable. Mr. Adams has just received promotion to Surveyor, 3rd grade, for which he was recommended to the Government in September 1876.

No. 4 TOPOGRAPHICAL PARTY.

NORTH-EAST DIVISION CENTRAL PROVINCES SURVEY.

Portions of the parganas of Rámgarh and Mandla in district Mandla, parganas Bhanpur, Bijagarh, Chauria and Kinhi of district Bálaghát, and Kawarda zemindari of district Biláspur.

108. This party, reduced to half-strength, for the reasons specified in paragraph 122 of the Administration Report for 1875-76, was conducted into the field by Mr. G. A. McGill, Surveyor, 2nd grade, in consequence of the absence on privilege

leave of Lieutenant-Colonel Depree, and field work was continued in the portions of districts Mandla and Bálaghát, marginally named, in Standard Sheet 36 of Degree Sheet VI and Standard Sheets 33, 34, 35 41 and 42 of Degree Sheet VIII (see Index Map in Appendix), which, with the small forest reserve of Pandratola, was all that remained to be completed in the Central Provinces prior to the abolition of the party; the Chief Commissioner having intimated that he required no other work of a topographical character to be taken up.

Strength of Party and Season's Out-turn.

		Topography.	
		1-Inch.	4-Inch.
Lieutenant-Colonel G. C. Depree, Deputy Superintendent, 1st grade, in charge,	Observed at 39 stations, and ran 88 linear miles of test routes, &c.		
Mr. G. A McGill, Surveyor, 2nd grade, ...	...	205	2
„ J. Vanderputt, „ 3rd „ ...	...	195	...
„ J. H. Wilson, Assistant Surveyor, 3rd grade,	...	185	...
Sub-Surveyor, M. S. Dutt, ...	...	226	...
„ E. Sharif, ...	...	214	5½
„ I. Sharif, ...	...	195	...
Total square miles,	...	1,220	7½

A portion of the boundary between districts Mandla and Bálaghát was also defined, and permanent marks erected along it by Lieutenant-Colonel Depree.

Final topography completed.

109. The total area of final survey completed covers 1,220 square miles on the inch scale, and 7½ square miles (Pandratola forest reserve) on the scale of 4 inches to the mile. This completes all the work which had to be done by this party in the Central Provinces, working up to the limit of the Revenue Survey previously executed in the Jubbulpore, Bhandára, Bálaghát, Raipur and Seoni districts. All the detail survey was carefully tested by the Executive Officer in the field by *in situ* examinations and 88 linear miles of check routes, and Lieutenant-Colonel Depree states that it was all "accurate and good." Lieutenant-Colonel Depree observed at 39 stations to fix points for the Pandratola forest reserve survey, from which 44 points were fixed and 13 elevations determined. Some aneroid heights were also obtained. All the ground surveyed "was hilly, difficult and thinly inhabited: the part to the south contains only about seventeen souls to the square mile."

110. On the completion of all the work in the field, the native field establishment was discharged at Jubbulpore, and the Executive Officer, with the Surveyors and Sub-Surveyors, moved on to recess quarters at Simla, where this old and well-trained party was subsequently absorbed into No. 7 Rajputana Topographical Survey, which required to be strengthened to cope with the enormous area still remaining for survey in the Native States, situated in the north-west and western portions of the Rajputana Agency, and also to deal with the survey of the approaches to Simla from the plains, and the yet more tedious large-scale surveys of the Military Stations south of Simla.

Cost of the season's operations.

111. The total cost of the season's operations, including the cost of completing the season's professional records, fair mapping, &c., amounts to Rs. 44,119, and I am well satisfied with Lieutenant-Colonel Depree's economical management of the party.

Good services of the party.

112. The origin and progress of this party since 1856 can be traced through my several printed Administration Reports submitted to the Government of India, commencing with the report No. 24A., dated 15th April 1853. It has up to date completed no less than 51,805 square miles of triangulation and topography, nearly all of which has been in exceedingly difficult and unhealthy ground, through the entire division of Chota Nagpore, with the Tributary States; Sohágpur of Rewah, Mandla, North Biláspur and Bálaghát, comprising the north-east portion of the Central Provinces. The Executive Officer, Surveyors, and Assistant Surveyors have suffered much from the evil effects of constant exposure to malaria and the hardships they have constantly endured in the country, the greater portion of which has hitherto been carefully avoided by Europeans. A brief and interesting *resumé* of the labors of No. 4 Topographical Survey Party by Lieutenant-Colonel G. C. Depree, s.c., Deputy Superintendent, 1st grade, is given in the Appendix of this report, to which special attention is directed.

113. It affords me much satisfaction to record my high appreciation of Lieutenant-Colonel Depree's successful labors over a period of 21 years in connection with this Department, and in the highly successful accomplishment of the above very large area of an important and hitherto very unknown tract of country, which it was most desirable to become better acquainted with geographically: his industry, zeal and ability have always been conspicuous, and well deserve the favorable notice of the Government of India. Mr. G. A. McGill, Surveyor, 2nd grade, has again rendered good service: this excellent and able Surveyor has frequently been strongly recommended for the promotion he has so well earned. Mr. Wilson, also favorably mentioned by the Executive Officer, is a very deserving Assistant.

114. This party ceased to exist after the 31st October 1877. Lieutenant-Colonel Depree received charge of No. 7 Party, Rajputana Survey, at Simla, from Lieutenant E. P. Leach, R.E., who obtained furlough to Europe,* and embarked at Bombay on the 26th November 1877. Messrs. McGill and Wilson have been transferred to No. 7 Party, and Mr. J. Vanderputt, Surveyor, 3rd grade, to No. 1 Party, Gwalior and Central India Survey, to equalise the existing establishments.

* *Vide* G.G.O. No. 976, dated 2nd November 1877.

No. 5, TOPOGRAPHICAL PARTY.

BHOPAL AND MALWA SURVEY.

115. On the 25th October 1876 this party resumed work in the Native States marginally named, immediately north of the Nerbudda River. The topography to be taken in hand during the season was entirely in Degree Sheet VI (see Index Map in Appendix), and the triangulation in a small part of Degree Sheet IV, and in the south-west and western portions of Sheets VII and VIII. The programme given in paragraph 131 of the Administration Report for 1875-76 was fully and very successfully carried out, notwithstanding many difficulties caused by heavy forest and malarious fever in the Ghâts, immediately north of the Nerbudda River.

Triangulation through portions of the Subhats of Shâhjahânpur, Amjhera, and Ujjain of Gwalior territory; portions of the Dhâr, Dewâs, and Silana States, and Indore Subhat of Indore (Holkar's) territory.

Final topography in portions of Dhâr and Dewâs, in the Subhat of Duraiha in Bhopal; in the Pachmahâl (Nimâwar) pargana of Indore territory, and in the Ujjain Subhat of Gwalior territory.

Strength of Party and Season's Out-turn.

	Triangulation. Sq. miles.	Final topography. Sq. miles.	
Captain J. R. Wilmer, s.c., Asst. Supdt., 1st grade, in charge,	680	37	
Lieutenant St. G. C. Gore, R.E., Asst. Supdt., 2nd grade,	2,184	21	
Mr. D. Atkinson, Surveyor, 2nd grade,	...	254	
„ C. F. Hamer, Assistant Surveyor, 1st grade	...	306	
„ E. A. Wainright, „ 2nd „	...	266	
„ H. T. Kitchen, „ 2nd „	...	249	
„ W. H. Lilley, „ 3rd „	...	298	
„ J. E. Murray, „ 4th „	...	310	
„ A. Kitchen, „ 4th „	...	266	
„ G. R. Copping, „ 4th „	...	237	
Sub-Surveyor Prem Raj, ...	...	303	
„ Gobardhan Dass, ...	...	320	
„ Shivcharn, ...	...	101	
Total square miles, ...	2,864	2,968	Includes 83 sq. miles of overlap.

Linear miles of check routes, 344 miles.

Final topography and triangulation completed.

116. The area finally surveyed and mapped on the inch scale in Standard Sheets 31 to 36, between Sehore and Indore, including the Pachmahâl of Nimâwar Native State, is no less than 2,968 square miles, while the area triangulated in advance of the detail work is equally good, and covers 2,864 square miles. It has been a great object to get the country immediately in the vicinity of Indore and Mhow delineated on various accounts, and this has now been well accomplished. All the final topography was carefully inspected by the Executive Officer, and tested by 344 linear miles of traversing; and Captain Wilmer declares he is well satisfied with the results. Much of the topography, owing

to heavy forest, could only be obtained by chain and plane-table traversing of which 1,200 linear miles were completed.

117. Of triangulation, 680 square miles were completed by Captain Wilmer, and 2,184 square miles by Lieutenant St. G. C. Gore, R.E. Observations were taken at 59 stations, by which 357 points and 277 elevations were determined.

Cost of the season's operations.

118. The total cost of the season's operations amounts to Rs. 61,067, inclusive of all charges up to the 31st October.

Opinion on the season's work.

119. The work performed by this party during the season is exceedingly good. The party was strong and most efficient, and the result necessarily follows of a large out-turn at moderate cost. I have every reason to be well satisfied with the good exertions of Captain J. R. Wilmer, s.c., Assistant Superintendent, 2nd grade, in charge of the party, and of his Assistant Superintendent, Lieutenant St. G. C. Gore, R.E., R.E., the zealous endeavours of both of whom merit high praise.

120. In the Appendix of this Report, extracts are given from reports by Captain Wilmer and Lieutenant St. G. C. Gore, R.E., descriptive of the country surveyed topographically and triangulated during the season.

Programme for season 1877-78.

121. During the season 1877-78 the topography of all the country in Standard Sheets 22, 23, 24, 25, 41 and 43, in Degree Sheets IV and VII, will, it is expected, be completed. The triangulation in advance of topography will be extended over the north-west portion of Degree Sheet VII, and the south and south-west portions of IX and X, as far west as Partábgarh and Bánswára.

Good services of the party, and work completed up to date.

122. This party, organised in 1862 by the orders of the Government of India in the Foreign Department,* for the survey of Rewah and Bundelkhand, on the completion of that work was transferred, in 1871, to Bhopal and Malwa, to deal with all the country north of the Nerbudda River in the Central India and Rajputana Agencies, between the parallels of 22° 15′ and 24° on the east, limited by the boundary of the British District of Saugor (Revenue Survey), and on the west by the Political Agencies of Mahi Kanta and Rewah Kanta under the Bombay Government. Its operations in Rewah and Bundelkhand commenced in October 1862, and its progress since that date has been steady and continuous. Up to date its total out-turn is as follows:—

* Foreign Department letter No. 271, dated 22nd November 1861.

	Topography. Sq. miles.	Triangulation. Sq. miles.
In Rewah and Bundelkhand, 1862 to 1871, . . .	18,456	23,837
In Bhopal and Malwa up to 1877, ...	16,098	16,579
Total .	34,554	40,416

so that its annual average rate of progress has been about 2,159 square miles of topography and 2,526 square miles of triangulation, which, considering the difficulties experienced in the country south of the Son River, and the disastrous season of 1866-67 (*vide* printed Report to Government, dated 2nd January 1868, paragraphs 123 to 126), the out-turn annually is exceedingly good.

123. The estimated area remaining for survey is 18,738 square miles, which is likely to occupy such a party about eight years more.

124. Captain J. R. Wilmer, s.c., Assistant Superintendent, 2nd grade, who has now held charge of No. 5 Party since 1874, is an officer possessing every qualification for the head of a party, and has during the past three seasons conducted his duties with much zeal and judgment; and it is greatly to be regretted that after so long a service in the department, as eight years, and so highly deserving, he should be still an Assistant Superintendent only. His Assistant, Lieutenant St. G. C. Gore, R.E., Assistant Superintendent, 2nd grade, is most able and efficient; and the good aid rendered by him in the

season's triangulation, through a difficult tract, is cordially acknowledged by Captain Wilmer, and concurred in by myself.

125. Mr. D. Atkinson, Surveyor, 2nd grade, rendered good aid in the field: his plane-tabling was accurate, and the ground well described. Messrs. Hamer and Lilley, seniors of their respective grades, have been promoted to superior grades from 1st April last, by the orders of Government cited in the margin.

No. 702, dated 5th December 1877.

126. The usual valuable assistance was rendered to the party by the Political Agents at Sehore and Indore, for which our acknowledgments are due.

No. 6 TOPOGRAPHICAL PARTY.

KHÁSI, GÁRO AND NÁGÁ HILLS SURVEY.

127. The desultory and detached nature of the Frontier surveys and explorations on which this party has for several years been employed, again necessitated its being broken into three distinct sections or detachments: Major Badgley, Deputy Superintendent, 3rd grade, in charge, undertook the revisions in Standard Sheets 15 and 16 in the vicinity of Shillong, owing to the great changes and improvements made in that part of the hills (*vide* Index Map in Appendix); Lieutenant R. G. Woodthorpe, R.E., Assistant Superintendent, and Mr. M. J. Ogle, Surveyor, 4th grade, were detached to explore and map that wild and unexamined portion of the Lakhimpur district, south-east of the military out-post of Sadiya, and south of the Brahmaputra river, at the extreme head of the Assam valley, and close to the Burmah Frontier; whilst the other two Assistants were deputed on the Khási, Kámrúp, and Gáro boundary survey. This was the season's programme (*vide* paras. 148 and 149 of my printed report for season 1875-76), and it was carried out as successfully as could be expected with considerable difficulty delay and expense in the low and marshy ground facing the hills, where malarious fever is always endemic.

Boundary survey between the Khási and Gáro Hills districts and district Kámrúp, Assam. Exploratory survey in East Lakhimpur.

Strength of Party and Season's Out-turn.

	Topography in square miles.	Triangulation in square miles.
	2 inches = 1 mile. 1 inch = 1 mile.	
Major W. F. Badgley, Deputy Superintendent, 3rd grade, in charge,	...	369
Mr. A. W. Chennell, Assistant Surveyor, 1st grade,	43·3	...
Mr. W. Robert, Assistant Surveyor, 3rd grade,	116·9	...
		324
Lakhimpur Explorations.		
Lieutenant R. G. Woodthorpe, R.E., Assistant Superintendent, 2nd grade, in charge, Mr. M. J. Ogle, Surveyor, 4th grade,	717 square miles, ½ inch and 250 linear miles of route surveys	1,722
TOTAL ...	On scale 2 inches=1 mile=160·2 square miles.	
	„ 1 inch =1 mile=369·0 „	
	„ ½ inch =1 mile=717·0 „	
Final topography ...		1,246·2 square miles.
Triangulation, square miles=2,046		
Route survey, linear miles= 250		

128. The revisions and additions by Major Badgley, and the boundary work on scales 2 and 1 inch to the mile, give an area of 529 square miles; and the exploration in East Lakhimpur on the ½-inch scale, under Lieutenant Woodthorpe, gives a further area of 717 square miles. Total of final topography obtained on three different scales, equal 1,246 square miles: 250 linear miles of route survey was also accomplished by Lieutenant Woodthorpe and Mr. Ogle.

Season's out-turn of final topography.

129. The total area triangulated was 2,046 square miles, of which 328 square miles was for the boundary survey between the Khási, Gáro and Kámrúp districts, by which 189 points were fixed, and the remainder 1,722 square miles were in the Lakhimpur district, by which 39 points and 27 elevations were

Triangulation completed.

determined. The greater portion of the minor triangulation for this special object, through the most intricate ground, was of necessity conducted simultaneously with the detail survey.

Large-scale survey of Shillong.

130. During the recess Major Badgley completed the triangulation for the large scale (24 inches=1 mile) new plan of the station of Shillong, by which 110 points and their elevations were trigonometrically determined, in and around the station: some of the principal roads were also traversed by theodolite and chain with a view to the preparation of the new plan of this Hill Station, which is much needed, and which must occupy some time longer, as it can only be prosecuted according to the pressure of other work.

Cost of the season's operations.

131. The total cost of the season's operations amounts to Rs. 62,858, of which Rs. 29,609 was the cost of the explorations in East Lakhimpur, chiefly caused by the high rates of boat, elephant and coolie hire, essential in such a country.

Opinion on the season's out-turn.

132. The season's actual out-turn of area is small in comparison with the ordinary results of other surveys; but this is consequent on the nature of the duty on which this party was employed. The boundary work alone, on which no area commensurate to cost was obtained, occupied two European surveyors for the whole season; and the detached party in East Lakhimpur was so long delayed, owing to Political considerations, ere orders were issued permitting it to start work, and further, the scope of its operations was so restricted, that in such difficult country, covered with dense forest, swamps, and uninhabited, it was utterly impossible to secure a better out-turn; and it was only by dint of hard labor, under the most depressing influences, such as fever, want of good water and provisions, sores caused by the bites of venomous insects, &c., that Lieutenant Woodthorpe and Mr. Ogle were able to bring in any complete work. Similar difficulties, in a minor degree, were also experienced by the boundary survey party. Work of a detached and desultory nature of this kind must always prove expensive, even under the best management in Assam, with coolie labor at such exorbitant rates of wages. I am of opinion that the officer in charge, Major Badgley, Deputy Superintendent, and Lieutenant Woodthorpe, R.E., Assistant Superintendent, have well and ably conducted the season's operations. In the Appendix is given a report by Lieutenant R. G. Woodthorpe, R.E., on the country explored and mapped by him in East Lakhimpur, which contains some interesting details.

Programme for season 1877-78.

133. The party has again to work in detachments, which, throughout the field season, will be far separated from each other, and it has therefore been found necessary to break or divide it into two small parties to act independently, as communication between them is impossible.

134. The Chief Commissioner having declared that survey operations in Manipur, one-half of which Native State remains for survey on the small scale of $\frac{1}{4}$-inch to the mile, could not be undertaken during the absence of the Political Agent on tour, and that the work on the southern boundary of the Sylhet and Cachar Districts, *viz.*, the survey of the lands which at the time of the first Revenue Survey in 1860-68 were very dense, waste and forest lands, but which are now opened out, and occupied by tea plantations and rice cultivation, is of the utmost importance and far more necessary than any other work, the main detachment,* under Major W. F. Badgley, Deputy Superintendent, has commenced this work in South Sylhet and Cachar, and is also carrying out the completion of the revisions and additions on the 1-inch scale in Standard Sheet 14 (*vide* Index Map in Appendix).

* Major Badgley.
Mr. J. McCay.
Mr. D. Campbell.

North Assam Frontier exploration.

135. The second detachment, under Lieutenant R. G. Woodthorpe, R.E., Assistant Superintendent, 2nd grade, assisted by Mr. W. Robert, in concert with

Lieutenant H. J. Harman, R.E., Assistant Superintendent, officiating 2nd grade, Great Trigonometrical Survey, who has been employed on the main Triangulation up the Brahmaputra River, and whose work has consequently come into close contact with that of the Topographical Survey of this important part of the Frontier, will explore, triangulate and map the country on the north-east of the Lakhimpur District, in the vicinity of the Subansiri River, and also subsequently between the Dibang River and Brahmakund, as sanctioned by the Government of India, Foreign Department, memorandum No. 2334, dated 9th October 1877.

136. This expedition will, it is confidently hoped, add materially to our knowledge of the northern Frontier of Assam, or of some portion of that *terra incognita* between the Frontiers of Assam and Thibet which has on three occasions been so successfully entered by Major H. H. Godwin-Austen, Deputy Superintendent, Topographical Survey: first, in 1863, with the Bhutan Mission when he completed the survey of the greater portion of western Bhutan; in, 1864, when he surveyed and mapped 2,000 square miles of the Bhutan Duars, and accompanied the Military expedition against Bhutan; and in 1874-75, when, assisted by Lieutenant Harman, of the Great Trigonometrical Survey, and Mr. M. J. Ogle, Topographical Survey Department, he mapped 2,375 square miles of the Daphla hills, and was the first to define, with tolerable accuracy, the course of the Subansiri River and its probable proximity to the Sanpu or Yaru of Thibet, as sketched on the Provincial Map of Assam from the Pundit's Route, and lately published (1875) by this office.

The Subansiri River and probable course of the great Sanpu.

137. In connection with the subject of these geographical explorations, it is interesting to note that the question of the course of the great river of Thibet, the Nari Chu, Sangpu, or Brahmaputra, and its channel through the hills into the valley of Assam, which has so long been a subject of keen discussion between European geographers, and which was so ably treated by Captain Wilcox in the Asiatic Researches, Vol. XVII, is likely to be revived. Major Godwin-Austen writes as follows regarding the great valley, which he saw about longitude 70°, and the course of the Subansiri River and its branches, as shewn on his map of the Daphla hills, published in October 1875, and in the engraved Map of Assam, compiled in 1875, and published by this office in 1877: "It is not a probable course at all, but an *actual course*. I really think we are right. My branch of the Subansiri that joins the Pundit's Sikung River is perfectly accurate: that branch I know well, and saw well, and it is within 2 to 3 miles of its position all along, and in some places, I will be bound to say, exact. I am also sure of the great valley north and south, near longitude 94°. How well, again, the Dhirang Chu of the Pundit joins my Borowli and its tributaries.*"

* Lieutenant H. J. Harman, R.E., of the Great Trigonometrical Survey, has also lately collected some valuable information in connection with this subject.

138. Major Godwin-Austen is of opinion that the eastern branch of the Subansiri River, near longitude 94°, will prove to be the great river of Thibet, which hitherto has been supposed to enter Assam north-west of Sadiya through the Dibang River. This question might perhaps have been placed beyond doubt, had Major Godwin-Austen been allowed permission, as so often and so earnestly solicited, to continue his explorations in 1875: *vide* para. 150 of the printed report for season 1874-75. This valuable officer, during the year under review, has retired from the service from the 12th June 1877, and this able and accomplished surveyor and explorer is, I much regret, now lost to the Department. Major Godwin-Austen's good services in the Kashmir and Ladak Survey, and subsequently in Bhutan, Manipur and along the Eastern Frontier and Assam, have frequently been brought to the notice of Government in the printed reports of the Survey Department,† and in the special reports submitted from time to time forwarding the results of his labors. It affords me great gratification thus to place my appreciation of his merits on record, in taking leave of him after so long a connection.

† See printed reports of the Great Trigonometrical Survey and Topographical Surveys since 1861.

139. Since season 1863-64 this party has rendered 38,243 square miles of very intricate and difficult topography, on scales varying from 2-inches to $\frac{1}{4}$-inch to the mile, according to the locality and nature of the ground in which it has been employed, and which has varied considerably along the Eastern Frontier of Bengal, and the hills and plains of Assam, the Nágá and Lushai hills, Manipur, and the Burman Frontier. Major W. F. Badgley, Deputy Superintendent, officiating 3rd grade, is an excellent Frontier surveyor and explorer, gifted with powers of endurance, and most able in his field duties. Lieutenant R. G. Woodthorpe, R.E., Assistant Superintendent, 2nd grade, who now for the third time has been specially selected for survey expeditions beyond the British Frontier, is a young Engineer Officer of great talent and energy, with superior qualifications as a draftsman, and has been most successful in his intercourse with the wild tribes on the Frontiers of Assam. My cordial acknowledgments are due to this officer for much praiseworthy work, obtained under circumstances of considerable risk to health, and even life.

Good services of the party.

140. Mr. M. J. Ogle, Surveyor, 4th grade, and Mr. A. W. Chennell, Assistant Surveyor, 1st grade, are both very deservedly commended by the officer in charge for the good services they always render, both in the field and recess duties. They have, in consequence of bad health, brought on from constant hard-work on the Frontier, obtained furlough to Europe for a year, and, it is hoped, will return in renovated health to renew their labors, as the knowledge and experience they have gained is of great value on a wild Frontier survey.

141. In the interests of the local Administration, and to complete our better geographical knowledge of the entire Frontiers of Assam and the country around it, it is of the utmost importance that the explorations undertaken of late years by this party, by order of Government, should be continued and urged forward effectively and vigorously to completion, as we have still much to learn of the Frontier round the head of the Brahmaputra River, its people, and the routes between Assam, China and Burma; and without this, the survey of the Assam Province cannot be considered completed.

142. It is difficult to estimate the precise area which may yet have to be brought within survey or reconnaissance operations, or, in fact, to predict how far our explorers may have to advance in any direction round the North-East Frontier. A general rough approximate area of about 13,704 square miles was lately estimated under this head, and the probable time for completion about 3 years. This, however, is a mere assumption as to the probable area, including Manipur, likely to be examined, and what may be constituted the "outer line" of British boundary. The probability of completing all this will likewise depend on the nature and scale of the exploration, as well as on the Political and Physical difficulties met with.

143. With the above exception, the whole of the Province of Assam, both hills and plains, has been completed by the joint efforts of the Topographical and Revenue Branches of the Department, after much labor, anxiety and its consequences. Excellent maps, of all descriptions and on various scales, have been published for the use of the local Administration, and the conclusion of a work of such magnitude is a matter of the highest congratulation.

No. 7 TOPOGRAPHICAL PARTY.

RAJPUTANA AND SIMLA SURVEY.

144. In consequence of the late period at which the orders of Government for the large-scale survey (100 feet = 1-inch, with contours at vertical intervals of

Portions of the Native States of Bickaneer, Shekawati and Jodhpore, in the Rajputana States.

10 feet) of the Observatory Hill, Simla, were received, the officer in charge of the party, Lieutenant E. P. Leach, R.E., Assistant Superintendent, 2nd grade, was detained with a party of Sub-Surveyors at Simla up to the end of December. The senior Surveyor, Mr. R. Todd, was deputed accordingly to proceed with the main portion of the party into the Native States of Jodhpore and Bickaneer, to carry out the programme for the field season, described in paragraphs 169 to 171 of the printed report for 1875-76.

Strength of Party and Season's Out-turn.	Triangulation in advance of Topography	Final Topography.		Remarks.
		Inch scale.	Large scale.	
	Sq. miles.	Sq. miles.	Sq. acres.	
Lieutenant E. P. Leach, R.E., Assistant Superintendent, 2nd grade, in charge,	900	...	74 8,000	Simla Observatory Hill contour survey, 100 feet = 1 inch. Jodhpur City plan, 6 inches = 1 mile.
Mr. R. Todd, Assistant Surveyor, 1st grade, ...	3,687*	...	...	
„ C. Tapsell, „ „ 1st „ ...	2,390	145	...	
„ W. Kelly, „ „ 4th „ ...	...	1,060	...	
Sub-Surveyor Harlal Sing, ...	...	430	...	
„ Kalka Pershad, ...	...	798	...	
„ J. Nathaniel, ...	...	703	...	
„ Sher Shah, ...	...	742	...	
„ Atma Sing, ...	...	557	...	
Total ...	6,977	4,495	8,074	

Fifty linear miles of forest reserve boundaries traversed and mapped.

* Also, during the recess, 120 square miles of triangulation for the Simla approaches survey.

Completion of the Observatory Hill Estate Survey, Simla.

145. The elaborate contoured survey of the Observatory Hill was completed by Lieutenant Leach, R.E., most ably and expeditiously, and copies of the plan on the scales of 100 and 200 feet to the inch were printed and furnished to the Secretary to Government, Public Works Department, by the end of January 1877, for which the thanks of the Government of India* were accorded to Lieutenant Leach, who joined his party in Rajputana, near Ajmere, and prosecuted the field operations there by the middle of the same month.

* Government of India, Public Works Department, No 41M., dated the 8th February 1877.

Season's out-turn.—Final topography.

146. In the Native States of Marwar (Jodhpore), Shekawati and Bickaneer, in which the detail survey was conducted, an area of 4,495 square miles on the reduced scale of 2 miles to the inch was completed in Degree Sheets XI and XII (*vide* Index Map in Appendix). This reduction of scale in the desert portions of the Rajputana States received the approval and sanction of Government (*vide* paragraph 171 of the printed report for season 1875-76); and the measure has, I am glad to report, proved most successful, as the reduced scale not only admits of rapid progress, but is more than sufficient for the extreme desert and open nature of the ground, and the amount of details required. All the season's plane-tabling was duly tested in the field, and the Executive Officer states that he is well satisfied with its accuracy and completeness. In the southern and south-western portion of the country allotted to this party, there still remains some richly cultivated and thickly populated land, which will require to be dealt with on the 1-inch scale.

Triangulation completed in advance of details.

147. The total area of triangulation completed in advance of topography covers 6,977 square miles. Observations were taken at 59 stations, from which 515 points were fixed, and 407 elevations were trigonometrically determined, which gives one trigonometrical point for every 13·6 square miles and 1 elevation for every 17·1 square miles of ground, which, for the reduced scale of survey, is more than sufficient in a desert country, where only very small sand-hills and ridges, without any other feature, exist.

Plan of Jodhpore City and forest reserve boundaries.

148. In addition to the above, the usual survey (6 inches=1 mile) of the City and Environs of Jodhpore was completed, and 50 linear miles of forest reserve boundaries in Ajmere and Mhairwara were surveyed and mapped, at the urgent request of the Civil Authorities.

149. On the return of the party to recess quarters, the triangulation for the survey of the approaches to Simla, and of the several Military Cantonments between Simla and the plains, was taken in hand, and carried over 120 square miles. This important undertaking, the want of which has long been greatly felt, will be prosecuted now to completion, as weather and the other objects will permit: other minor local surveys, for the urgent wants of the Government and of the Municipality, were also performed.

Simla Approaches, survey.

150. The total work accomplished by this party, *viz.*, 4,495 square miles of final topography on the $\frac{1}{2}$-inch scale, 8,074 acres of large-scale survey (Observatory Hill contoured survey and Jodhpore City and Environs), and 6,977 square miles of triangulation, with 50 linear miles of forest boundaries, and 120 square miles of triangulation in the hills south of Simla, is an excellent season's work; and much additional anxiety and labour was imposed on Lieutenant E. P. Leach, R.E., Assistant Superintendent, both in the field and recess, in carrying out the details for so successful a season's out-turn, and completing all the computations, professional records, and season's fair mapping, including a revised series of the Standard skeleton Sheets of the Simla Survey, to show more clearly the estate boundaries, as revised and supplemented by the Deputy Commissioner, which will be published in due course.

Opinion on the season's out-turn.

151. A description of the country triangulated and surveyed in detail, with notes on the most important towns visited during the season's operations, by Lieutenant Leach, is given in the Appendix of this Report. Lieutenant Leach acknowledges with thanks the cordial co-operation and assistance he has at all times received from the Political Agents of Marwar and Bickaneer, Major Walter and Captain Burton.

152. In consequence of the drought in the northern portions of Rajputana, and the representations made by the Political Officers, who anticipated great scarcity of fodder for cattle, it has been deemed expedient to divert the regular course of the field season's operations temporarily into the better-watered and more fertile country west of Erinpura, in Degree Sheet XXI, between latitude 25° and 26° and longitude 72° and 73°, instead of allowing the work to proceed northwards into the Bickaneer desert. This unavoidable measure will, in some measure, affect the season's out-turn, first, as there is no triangulation available for that part, and next, because the scale of survey must again be maintained on the standard of 1 mile to the inch, to suit the nature of the ground in that locality.

Programme for season 1877-78.

153. The party has therefore been broken into three detachments: the first, under the officer in charge, to operate in the ground between Simla and the plains, as well as the Cantonments of Kasauli and Subáthu, urgently called for by the Military Authorities, until the triangulation in Degree Sheet XXI is sufficiently advanced for starting more hands on the details; the second, under the senior Surveyor, to triangulate in Degree Sheet XXI; and the third, to complete the southern half of Degree Sheet XII in Marwar or Jodhpore territory. No better disposition of the party could be made under the circumstances.

154. In the review of the work of No. 4 Party, which, under the orders of Government, has now been broken up and absorbed into No. 7 Topographical Party, it was stated that Lieutenant-Colonel Depree, Deputy Superintendent, 1st grade, had, from the 1st October 1877, received charge of this party from Lieutenant E. P. Leach, R.E., who, on the termination of the recess and satisfactory completion of all his work, proceeded on furlough on the 26th of November 1877.*

Changes and transfers.

* *Vide* G. O. No. 976, dated 2nd November 1877.

155. Lieutenant E. P. Leach, R.E., held charge of No. 7 Party for the past three years, and I cannot too highly commend the zeal and energy of this talented officer, who, on all occasions, has taken a very leading share in every duty

performed under his superintendence, and maintains efficiency in the highest degree. The fair hill drawing of the map of the Simla Extension Survey, as well as of the City of Jodhpore by this officer, is of a very superior order, and most creditable to his industry and speciality in this important line of a surveyor's profession.

156. The party, as now re-modelled by the junction of the two establishments is shewn in the margin; and I have every reason to believe that, under the able management of Lieutenant-Colonel Depree, it will continue to render as good service as it has done since its formation in 1874. The native agency of sub-surveyors of both parties has been retained, to deal particularly with the easy open ground in Rajputana, for which they are well qualified.

Lieutenant-Colonel G. C. Depree, Deputy Superintendent, 1st grade, in charge.
Lieutenant E. P. Leach, R.E., Assistant Superintendent, 2nd grade, on furlough.
Mr. G. McGill, Surveyor, 2nd grade.
" E. S. P. Atkinson, Surveyor, 4th grade (returned from furlough, 14th November 1877).
" R. Todd, Assistant Surveyor 1st grade.
" J. H. Wilson, " 3rd "
Sub-Surveyor, Babu Madhusudan Dutt.
" Mr. John Noah.
" Munshi Eusuf Sharif.
" " Imam Sharif.
" " Kulka Pershad.
" Mr. James Nathaniel.
" Munshi Hussain Baksh.
" " Sher Shah.
" " Atma Singh.

Transfers.

Mr. J. A. Vanderputt, Surveyor, 3rd grade, to No. 1 Party.
" C. Tapsell, Assistant Surveyor, 1st " to " 1 "
" W. M. Kelly, " to Forest Department.
Babu Hurlal Singh, Sub-Surveyor, to No. 5 Party.

157. The area still remaining in its allotted field of work is very large—48,092 square miles; but a considerable portion of this area is open, sandy desert, which can easily and rapidly be surveyed on the half-inch scale, with the aid of which reduction possibly the entire agency may be completed in about twelve years. The Index Map shows the whole of the western portion of Rajputana, Bickaneer, Jeysalmere, Malwa (Balmir), up to the Sind and Bhawulpore Frontier, and part of Jodhpore, as remaining for survey.

158. Since 1864 this party, originally raised by Captain Geo. Strahan, R.E., has completed 47,885 square miles of triangulation, and 39,349 square miles of final topography; also the large scale-surveys of ten cities and cantonments, including the important 24-inch scale survey with Estate boundaries of Simla and Jutogh, the contoured survey of the Observatory Government estate, scale 100 feet to the inch, and the partially-contoured survey of the Simla eastern extension to the Mahásu Range for the Water-works project, on 6 inches to the mile.

159. Mr. W. M. Kelly has been selected for a superior appointment in the Forest Department, for which he is well qualified and highly deserving. In consequence of the lamentable prospects for highly qualified and well-trained European agency in the Survey Department, owing to the chronic state of reductions enforced of late years, I have had great satisfaction in recommending Mr. Kelly for that well-deserved promotion, which could not be obtained for him here. I have considered it a duty under such circumstances to assist the subordinates of this Department, as far as practicable, in obtaining other situations to better their positions; but it is at the expense of the real interest and efficiency of this Department, in which the training of candidates or probationers is a most serious and expensive matter: unless young hands both in the senior and junior executive branches are constantly maintained, and trained up in all their duties, it is impossible for any Department to be in a position to meet the calls made on it.

No. 8, TOPOGRAPHICAL PARTY.

NUNDYDROOG DIVISION MYSORE SURVEY.

Portions of the districts of Bangalore, Túmkúr, Mysore and Kolar.

160. In my letter No. 163F., dated 21st May 1877, I especially reported the diffi-

culties under which the Mysore Topographical Survey labored in consequence of the famine and drought, which during the past season has prevailed nearly throughout the southern peninsula. Very little of the Mysore country which had been triangulated and prepared for detail survey could be entered, and it was therefore impossible for the party to carry on its work in a compact block or continuously, as so desirable. In consultation with the local authorities, certain tracts were selected in which it was comparatively easier to obtain water, provisions and forage; and although no more triangulation in advance was absolutely required, it was deemed expedient to employ several of the surveyors on this duty over new ground, so as to ease the bad parts of the country of any continuous strain for any length of time, in any one part, for water, carriage and food-supplies. No definite programme could, therefore, be attempted under these unfortunate circumstances; but care was taken to utilise the establishment, and to keep it in full employment, in some way or other, in whatever ground it was possible for the surveyors to enter and work.

Strength of Party and Season's out-turn.	Triangulation. Sq. miles.	Topography Sq. miles.
Captain G. Strahan, R.E., Deputy Supdt., 2nd grade, in charge	5,280 square miles of triangulation by Captain Geo. Strahan, Messrs. Chew and McNair; 35 miles of traversing by Messrs. White and Flemming.	...
Mr. R. W. Chew, Surveyor, 2nd grade, ...		...
„ R. D. Farrel, „ 4th „		136
„ I. J. James, Assistant Surveyor, 1st grade, ...		210
„ F. Kitchen, „ „ ...		280
„ W. Stotesbury, „ „		352
„ J. A. Barker, „ 2nd grade, ...		166
„ W. McNair, „ „		..
„ P. White, „ 4th grade, ...		22 *
„ G. L. Flemming, „ „		26 *
„ G. A Knight, „ „		273
and six Sub-Surveyors, all under training ... ... } Recording, traversing, &c....		...
Total square miles ...	5,280	1,465

In addition to the above, nine stations were observed at, embracing an area of 527 square miles, but the work could not be completed, and 1,440 square miles were reconnoitred and prepared for triangulation.

* On 4-inch = 1 mile.

Final topography completed.

161. The total area of final topography completed covers 1,465 square miles, of which 48 square miles, or the Bilikal forest reserve, was surveyed on the larger scale of 4-inches to the mile, and the rest, or 1,417 square miles, on the standard scale of 1-inch to the mile, in the districts of Bangalore, Túmkúr, &c., of the Nundydroog Division.

Triangulation, &c.

162. The season's triangulation in advance of details covers 5,280 square miles. Observations were taken at 95 stations, from which 770 points were fixed and 555 elevations were trigonometrically determined, 35 linear miles of close traversing on the 4-inch scale for the Forest survey and about 1,440 square miles of rough reconnoissance were also completed in the Túmkúr and Kolar districts.

Opinion of the season's out-turn.

163. For a short field season, during which the Surveyors were repeatedly stopped by cholera, famine and want of water, and the difficulties caused by the desertion of lascars and signallers, or carriers, the out-turn of work, *viz.*, 1,465 square miles of topography and 5,280 square miles of triangulation, is as much as could reasonably be expected; and it is most creditable to the party that it maintained its ground under such trying circumstances as the exceedingly unfavorable nature of the situation permitted, and was able to complete any work at all.

Cost of season's operations.

164. The total cost under all heads for the season's work amounts to Rs. 56,776, which is considerably below the anticipated amount. Great efforts were made to curtail expenditure in every possible way, and the transfer of the Assistant Superintendent, Lieutenant Hobday, estimated for and intended for this survey, was not carried out. A further and yet larger saving was also effected, when, at the close of the field season, Captain Geo. Strahan, R.E., in charge, obtained furlough† to Europe, and was relieved by Captain J. R. McCullagh, R.E.,

† Sanctioned by G. G. O. No. 382, dated 27th April 1877.

Assistant Superintendent, attached to No. 9 Party, on the 26th of April 1877; and subsequently, when this latter officer also obtained furlough* at the close of the recess, and left India on the 5th November 1877, the remaining of the two parties, Nos. 8 and 9 (all not deputed to famine duty), were amalgamated, and placed under the charge of a single Deputy Superintendent (Major H. R. Thuillier, R.E.); so that, instead of four Executives and Assistants, which is the ordinary complement for two full parties, there is but at present a single one, and the salaries of these have thus been saved to the Mysore State.

* Sanctioned by G. G. O. No. 912, dated 9th October 1877.

Changes in the executive superintendence.

165. This, though undoubtedly the most economical arrangement for the Mysore State, is not without considerable danger to the interests and future prospects of the Survey, as a single officer only, as its of no relief or protection against contingencies of any sort; and should his health fail, there is no responsible officer anywhere near at hand, to take up his duties, or conduct the ordinary routine of the survey. A second officer, or Assistant Superintendent, will therefore, be found essential to be posted during the ensuing financial year.

166. No definite programme for the ensuing field season of 1877-78 can be given just now, as the country still labors under the difficulties caused by the famine and drought of the past two seasons. Measures have been adopted, under the advice and orders of the Chief Commissioner, to place at the disposal of the Public Works Department, for employment on local and famine relief works, every Assistant Surveyor and Sub-Surveyor whose services can possibly be spared; and nine Surveyors and Assistant Surveyors, as detailed in the margin, have thus been transferred temporarily, while one has been sent back temporarily to the Great Trigonometrical Survey,† where he was urgently required, and one has been allowed furlough in India from 1st August 1877.‡

Programme for season 1877-78.

On Famine Works.

Mr. R. D. Farrell, Surveyor, 4th grade, from 1st November 1877.
„ L. J. Pocock, „ 4th „ „ „ „ „
„ F. Kitchen, Assistant Surveyor, 1st grade, 1st November 1877.
„ J. A. Barker, „ 2nd „ „ „
„ W. Oldham, „ 3rd „ 1st September „
„ P. White, „ 4th „ 1st October „
„ G. L. Flemming, „ 4th „ 1st September „
„ G. A. Knight, „ 4th „ „ „
„ J. M. Kennedy „ 4th „ „ „
† „ T. Kinney, „ 1st „ transferred to the G. T. Survey.
‡ „ J. W. Macdougall, on furlough in India, from 1st August 1877.

167. Thus reducing the survey establishment temporarily for the current season's work to the strength marginally noted, which is less than an ordinary party, as originally estimated for. The importance of squaring up and completing the detail work of the several sections of the past season is very essential, so as to secure the result on which both money and labor have been bestowed.

Major H. R. Thuillier, R.E., Deputy Superintendent, 1st grade.
Mr. R. W. Chew, Surveyor, 2nd grade.
„ H. Keelan, „ 3rd „
„ A. James, Assistant Surveyor, 1st grade.
„ W. Stotesbury, „ 1st „
„ H. Todd, „ 1st „
„ W. W. McNair, „ 2nd grade, and six Sub-Surveyors.

168. Under the recent orders of the Government of India, as per margin, it has been ruled, on the suggestion of the Chief Commissioner, that only one party is to be employed for the next year or two in Mysore, pending the recovery of the finances from the severe effects of the famine. On the return, therefore, of the several Surveyors and Assistants, as above mentioned, from the famine duty on which they are engaged, such number of them as will not be required to make up a full and efficient party under Major Thuillier are to be provided for elsewhere.

No. 765, dated the 21st December 1877.

169. This will involve the re-transfer to the imperial estimates of six out of the nine surveyors or assistants now on famine duty, and will form

of necessity an extra charge in the Departmental Imperial Budget. This transaction, which has doubtless arisen from unavoidable circumstances, it will be obvious, is exceedingly important to this Department, since it is impossible to depute our well-trained establishments to Native States for a specified period of employment, and to receive them back again at a moment's warning, without deranging both our machinery and financial position.

170. Such forest reserves as, in the opinion of the local Administration, require early survey, will be taken up on the large scale of 4 inches to the mile, and, wherever it is possible, the regular 1-inch survey will also proceed to the extent of the reduced agency employed.

171. Major H. R. Thuillier, R.E., now in sole charge of the combined parties, having previously conducted both Topographical and Revenue, as well as Trigonometrical surveys, I have every reason to believe that the nature of the work required in Mysore will be fully cared for; and when his establishment is completed up to full scale, on the termination of the famine duty, he should be reinforced by an Assistant Superintendent, as provided in the estimates.

172. The Executive Officer reports in the most favorable terms of all the Surveyors and Assistant Surveyors, who have, under exceptionally trying circumstances, performed their duties very satisfactorily, both in the field and recess. Mr. McNair, as before, is highly distinguished by both superior ability and zeal for his profession. It is a matter of the utmost regret to me, that it does not lie in my power to raise this excellent assistant to the position he has so well earned.

No. 9 TOPOGRAPHICAL PARTY.

NAGAR DIVISION, MYSORE SURVEY.

173. This party labored under the same difficulties and obstacles as No. 8, but suffered considerably more from sickness, which, in various forms, raged throughout the Province of Mysore, coupled with the famine and pestilence arising therefrom.

Topography in parts of the Chitaldroog and Mysore districts. Triangulation in portions of the Districts of Nagar, Mysore and Hassan.

174. As in No. 8 Party, no definite programme or systematic and continuous proceedure for the season could be adopted, and the Surveyors and Assistants were shifted about to the best advantage. Great efforts were made by the Executive Officer, Captain J. R. McCullagh, R.E., officiating in charge, to start work in the neighbourhood of Mysore, the capital of the Province, pointed out as a likely better or less affected part; and his efforts were so far successful, that he completed the triangulation of a very considerable area, and commenced the detail survey; but the plane-tablers were fairly beaten out of the ground subsequently by cholera and fever, and were moved to a more favorable locality. By dint of hard labor and good management, detail work was commenced, and successfully completed in Standard Sheets 16 and 17, and the better portions of Degree Sheets I, II and XI were triangulated: *vide* Index Map in Appendix.

Strength of Party and Season's out-turn.	Triangulation.	Final topography.
	Square miles.	Square miles.
Major H. R. Thuillier, R.E., Deputy Superintendent, 1st grade, in charge, joined 11th April 1877,	4,311 sq. miles of triangulation. 1,480 sq. miles of reconnaissance.	
Captain J. R. McCullagh, R.E., Assistant Superintendent, 1st grade, officiating in charge, ...		
Mr. H. E. T. Keelan, Surveyor, 3rd grade,... ...		
„ L. J. Pocock, Surveyor, 4th grade, ...		
„ J. W. Macdougall, Assistant Surveyor, 1st grade, on sick leave from 1st August 1877,		
„ H. Todd, Assistant Surveyor, 1st grade, ...	.....	353
„ T. Kinney, Assistant Surveyor, 1st grade, ...	.....	153
„ W. Oldham, Assistant Surveyor, 3rd grade, ...	.....	355
„ E. W. Lasseron, Assistant Surveyor, 3rd grade, resigned from 22nd March 1877,	.....	.....
„ J. M. Kennedy, Assistant Surveyor, 4th grade, ...	.....	.....
Six Sub-Surveyors, ...	.....	.....
TOTAL ...	4,311	861

175. The total area topographically surveyed covers 861 square miles, of which the greater portion is in the Chitaldroog district; the remainder, two small detached areas, in the Mysore district.

Final topography completed.

176. Of triangulation in advance of the detail survey, 4,311 square miles was completed, and 1,480 square miles was reconnoitred, and stations built. Observations were taken at 59 stations, from which 1,371 points were fixed, and 328 elevations determined.

Triangulation completed in advance of topography.

177. The total cost of the season's work amounts to Rs. 59,051-9 under all heads, up to the 30th September 1877.

Cost of the season's operations.

178. The whole of the field operations were conducted by Captain J. R. McCullagh, R.E., Assistant Superintendent, 1st grade, officiating in charge, to whose zeal and determination much credit is due. The out-turn of final survey is small, but it would have been smaller still, had he not resolutely held his ground against the ever-increasing difficulties caused by famine and disease; and I much regret the loss temporarily of his services with the party, by his departure on furlough* on the 1st of November last, as his knowledge of the country and its people was of great value.

Opinion of the season's work.

* *Vide* G. G. O. No. 912, dated 9th October 1877.

179. Captain McCullagh was relieved of the charge of No. 9 Party on its return from the field by Major H. R. Thuillier, R.E., Deputy Superintendent, 1st grade (who had previously been officiating as Superintendent of the Great Trigonometrical Survey during Colonel Walker's absence in England), on the 11th April 1877, and he then received charge of No. 8 Party from Captain George Strahan, R. E., proceeded on furlough, as has been noted in the report of that party. Nos. 8 and 9 parties have now been combined and formed into one, with the object of reducing the estimates consequent on the famine.

180. Both Captain McCullagh and Major Thuillier report favorably on the good services rendered by the Surveyors and Assistants who still remain with this party. Mr. T. Kinney, Assistant Surveyor, 1st grade, was transferred to the Great Trigonometrical Survey from 12th May 1877, and Messrs. W. Oldham and J. M. Kennedy were transferred temporarily to do duty with the Public Works Department. Mr. E. W. Lasseron, Assistant Surveyor, 3rd grade, resigned his appointment on the 22nd March 1877 for superior employment in the Mysore Revenue Survey. Mr. J. W. McDougall, Assistant Surveyor, 1st grade, obtained medical leave for one year, from the 1st August 1877, as his health completely failed, and he was unable to take any share in the season's work.

181. The whole establishment suffered considerably in health, and for a time nearly three-fourths of it was on the sick list. One man died from the effects of malarious fever and six from cholera.

182. The entire area triangulated in advance in Mysore by the two parties, now amounts to 19,403 square miles, of which only 2,326 square miles have come under topographical delineation as yet. The reduction of the strength of the establishments to about one-half will, of course, more than double the probable time for completing such an undertaking. The desire of the local Administration was, that the whole survey of 24,881 square miles, the area of the Province, should be completed in 5 years; but with the present allowed agency it is doubtful if such an undertaking will be accomplished in 12 years from the time of commencement. So much depending on local causes and climatic influences extending over such an area, I was unable to fix any specified period within which so extensive a survey could be brought to a close, and the effects of the famine and pestilence, which have devastated the Province, form a sufficient commentary on the uselessness of making any positive forecast of this nature. The ordinary progress may be put down at 2,000 square miles per season, under favorable circumstances, by such a party.

183. It is most desirable that due and proper progress should be made in carrying out this extensive survey. It is to be hoped, therefore, that the reduction now recommended on financial grounds, may prove only temporary, and that in another year or two the second party may again be put on to the work, with the view of getting it out of hand within a reasonable time. The single establishment now authorised should be kept in as full and efficient a state as possible, in order to secure a fair return of progress, and to keep the mean average mileage rate as low as it ought to, and may be, under proper management. A survey establishment is always the more effective, the stronger it is and the proportion of subordinates, both European and Native, should be carefully regulated by the cost of superintendence. Unless this is observed, the mileage rate must be injuriously affected; and this is the great test of the real cost of a survey.

184. The prospects of the present season in Mysore are declared to be much better than could have been expected; the appearance of the famine and pestilence has disappeared, pasturage and cultivation is universal everywhere, and, except as to the partially-deserted nature of the villages, the recent suffering is nowhere visible. Major Thuillier states that his work is consequently now progressing as favorably as could be desired, and it is to be hoped that no more sickness will appear.

H. L. THUILLIER, *Major-General,*

Surveyor General of India.

SURVEYOR GENERAL'S OFFICE,
CALCUTTA,
The 28th December 1877.

Nos. 8 & 9 PARTIES.

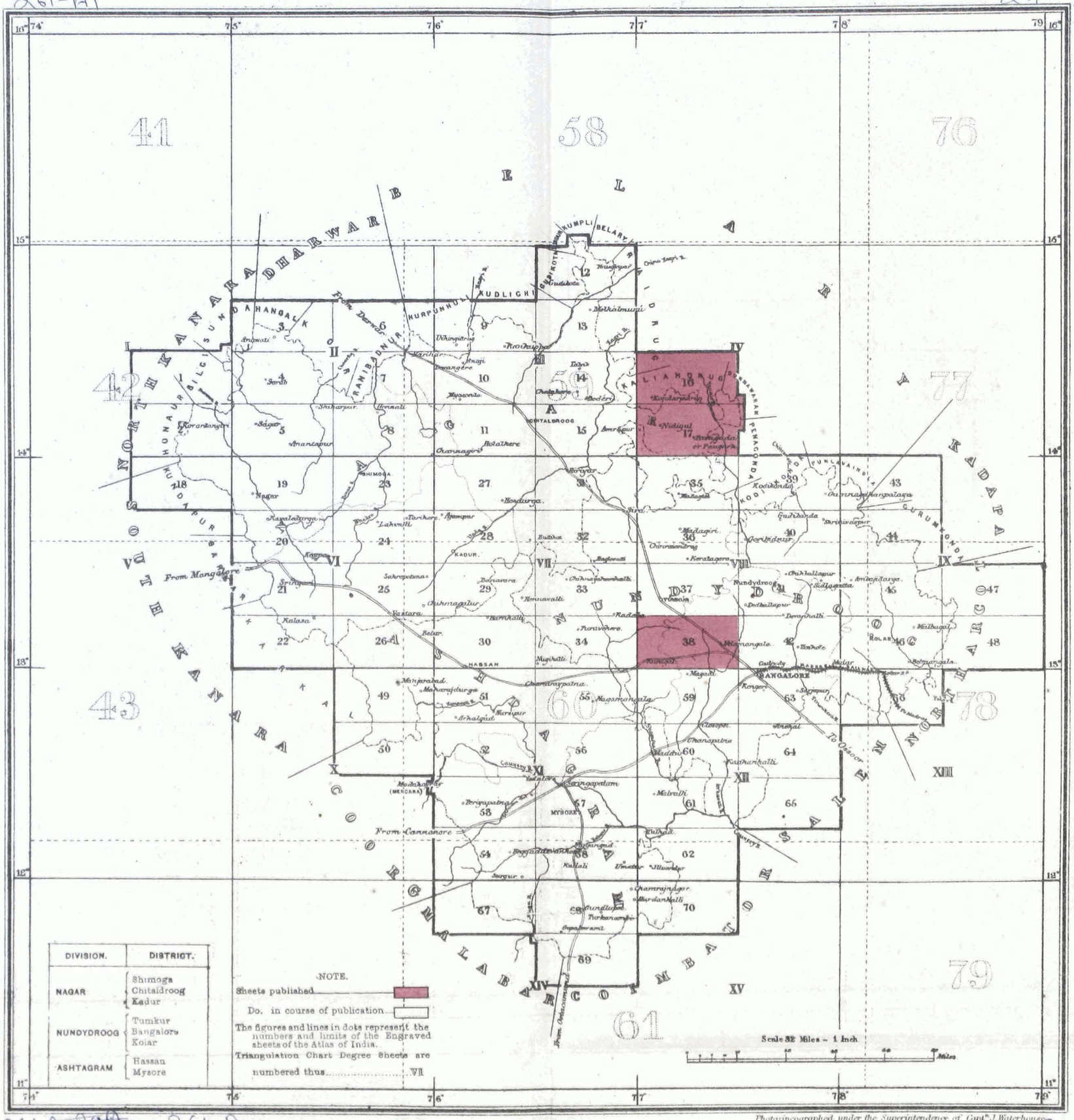
INDEX TO THE SHEETS OF THE MYSORE TOPOGRAPHICAL SURVEY

On the Scale of 1 Inch = 1 Mile.

~~261~~

261-A1

261-A2



DIVISION.	DISTRICT.
NAGAR	Shimoga
	Chitaldroog
	Kadur
NUNDYDROOG	Tumkur
	Bangalore
	Kolar
ASHTAGRAM	Hassan
	Mysore

NOTE.

Sheets published

Do. in course of publication

The figures and lines in dots represent the numbers and limits of the Engraved sheets of the Atlas of India.

Triangulation Chart Degree Sheets are numbered thus.....VII

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

Published under the direction of Major-General H.L. Thuillier, C.S.I. F.R.S., Surveyor General of India.

Surveyor General's Office, Calcutta. December 1877.

~~261-A2~~ ~~261-B~~ 261-B1

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No. 7 PARTY

INDEX TO THE SHEETS OF THE RAJPUTANA TOPOGRAPHICAL SURVEY.

On the Scales of 1 Inch = 1 Mile and ½ Inch = 1 Mile.

260 A-1

260 A-2

260 B-1

260 B-2

NOTE.

Sheets published on the Scale of 1 Mile = 1 Inch.

Do. in course of publication... Do. ... Do.

Do. Do. Do. on the Scale of 2 Miles = 1 Inch.

Triangulation Chart Degree Sheets are numbered thus V

The figures and lines in dots represent the numbers and limits of the Engraved sheets of the Atlas of India.

Nº 1 TOPL SURVEY GWALIOR AND CENTRAL INDIA

Published under the direction of Major General H. L. Thuillier, C.S.I.—F.R.S. Surveyor General of India.
Surveyor General's Office, Calcutta, December 1877.

No. 6 PARTY

INDEX TO THE SHEETS OF THE GARO, KHASI AND NAGA HILLS TOPOGRAPHICAL SURVEY

On the Scales of 1 Inch = 1 Mile, ½ Inch = 1 Mile and ¼ Inch = 1 Mile.

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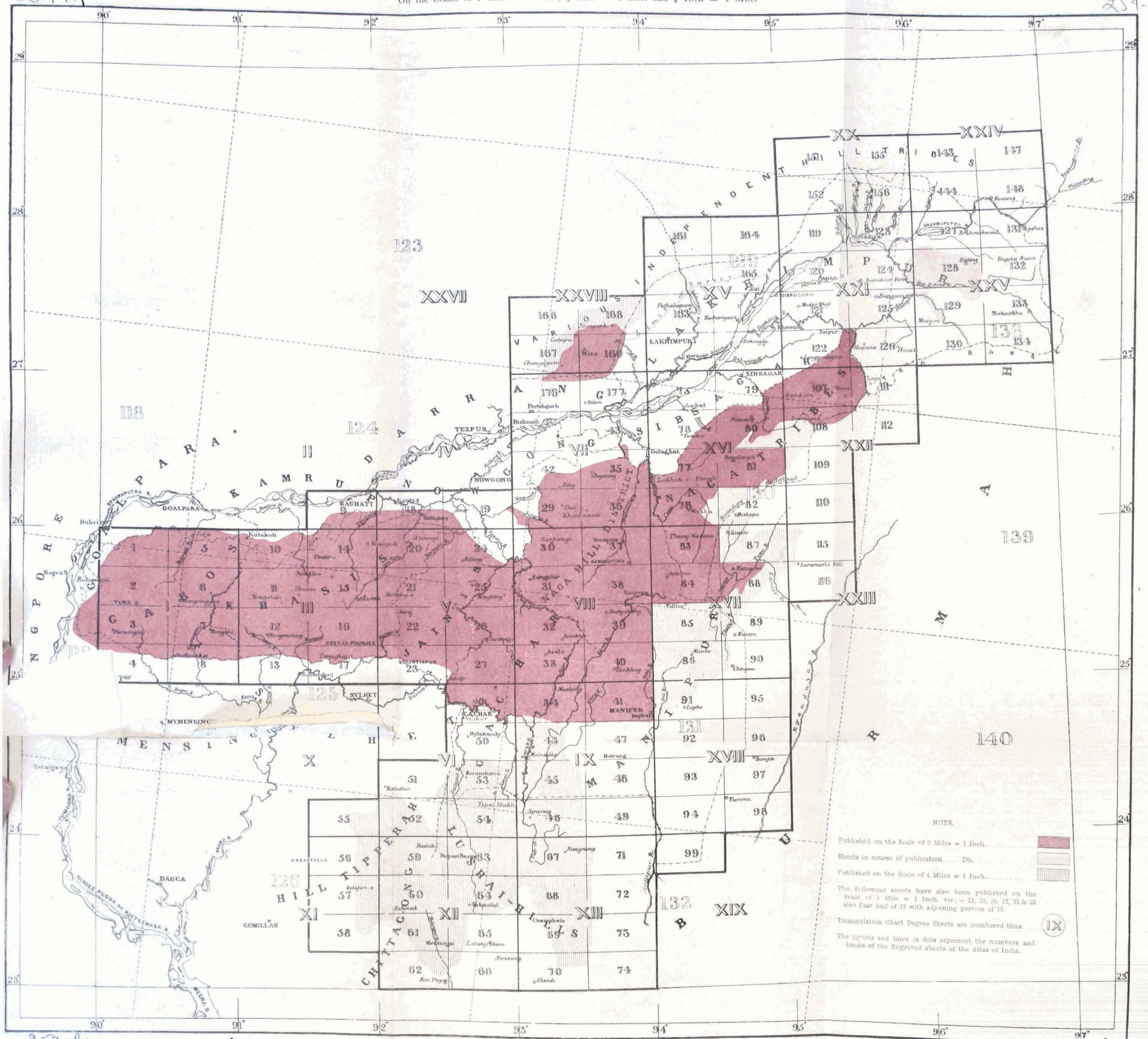
259-A1

259-A2

259

259-



NOTE.

Published on the Scale of 2 Miles = 1 Inch.

Sheets in course of publication ..... Do.

Published on the Scale of 4 Miles = 1 Inch.

The following sheets have also been published on the Scale of 1 Mile = 1 Inch. viz:— 11, 15, 16, 17, 21 & 22 also East half of 12 with adjoining portion of 13.

Triangulation Chart. Degree Sheets are numbered thus IX

The figures and lines in dots represent the numbers and limits of the Engraved sheets of the Atlas of India.

Published under the direction of Major General H. L. Thuillier, C.S.I.—F.R.S. Surveyor General of India,
Surveyor General's Office, Calcutta, December 1877.

259-B1

259-B3

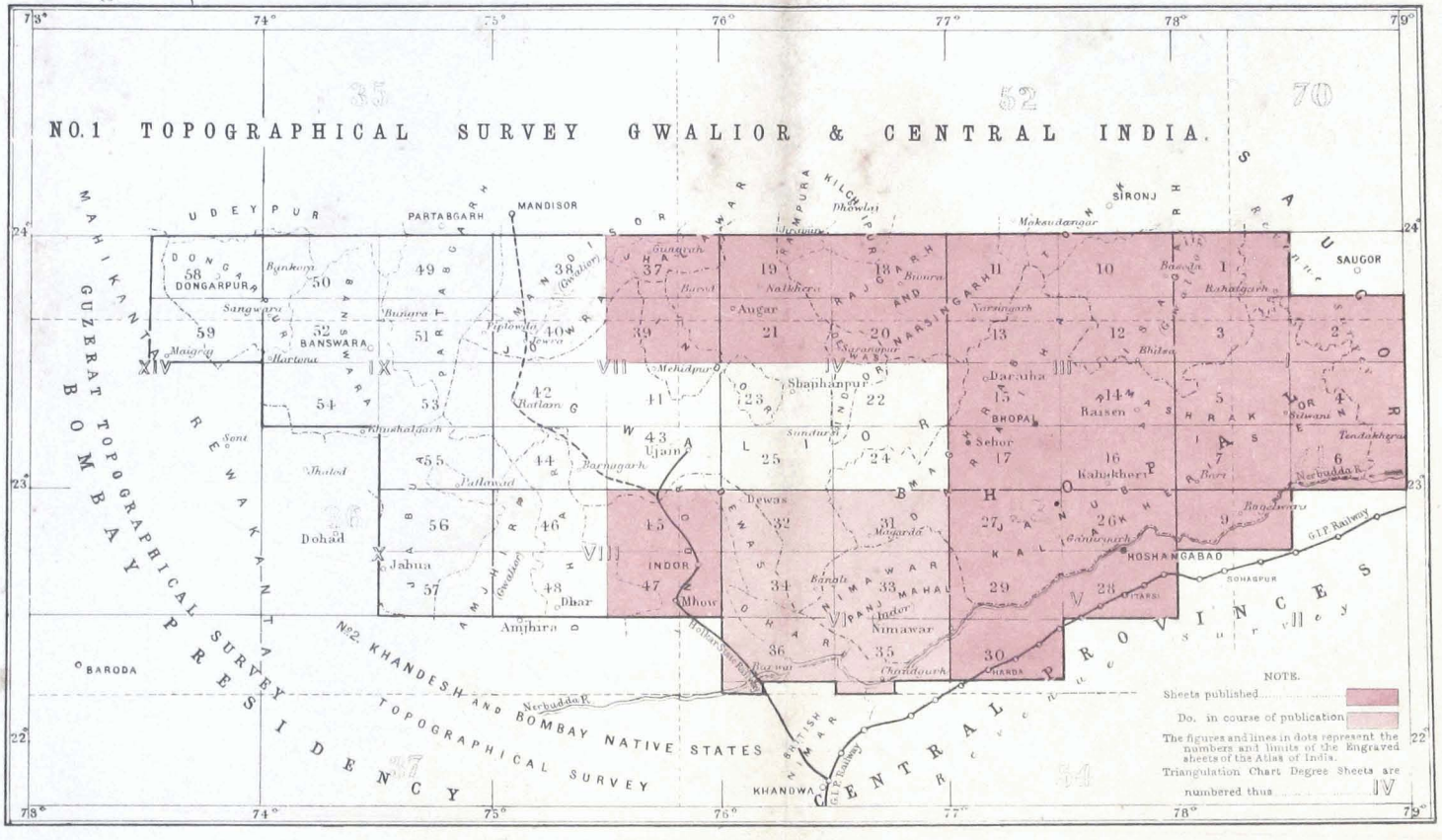
No. 5 PARTY

INDEX TO THE SHEETS OF THE BHOPAL & MALWA TOPOGRAPHICAL SURVEY.

On the Scale of 1 Inch = 1 Mile.

258-A1

258-A2



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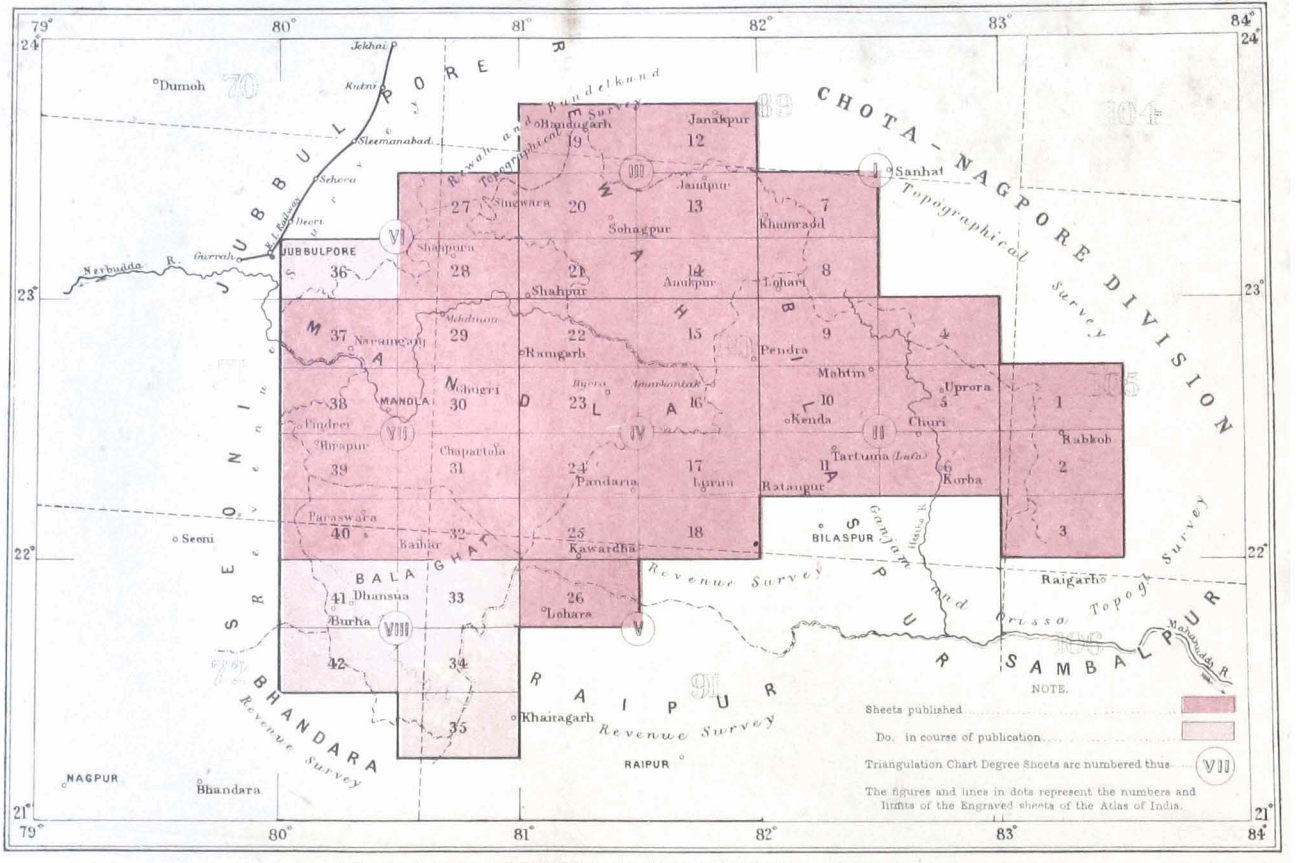
Surveyor General's Office, Calcutta, December 1877.

No. 4 PARTY

INDEX TO THE SHEETS OF THE NORTH EAST DIVISION CENTRAL PROVINCES TOPOGRAPHICAL SURVEY.

On the Scale of 1 Inch = 1 Mile.



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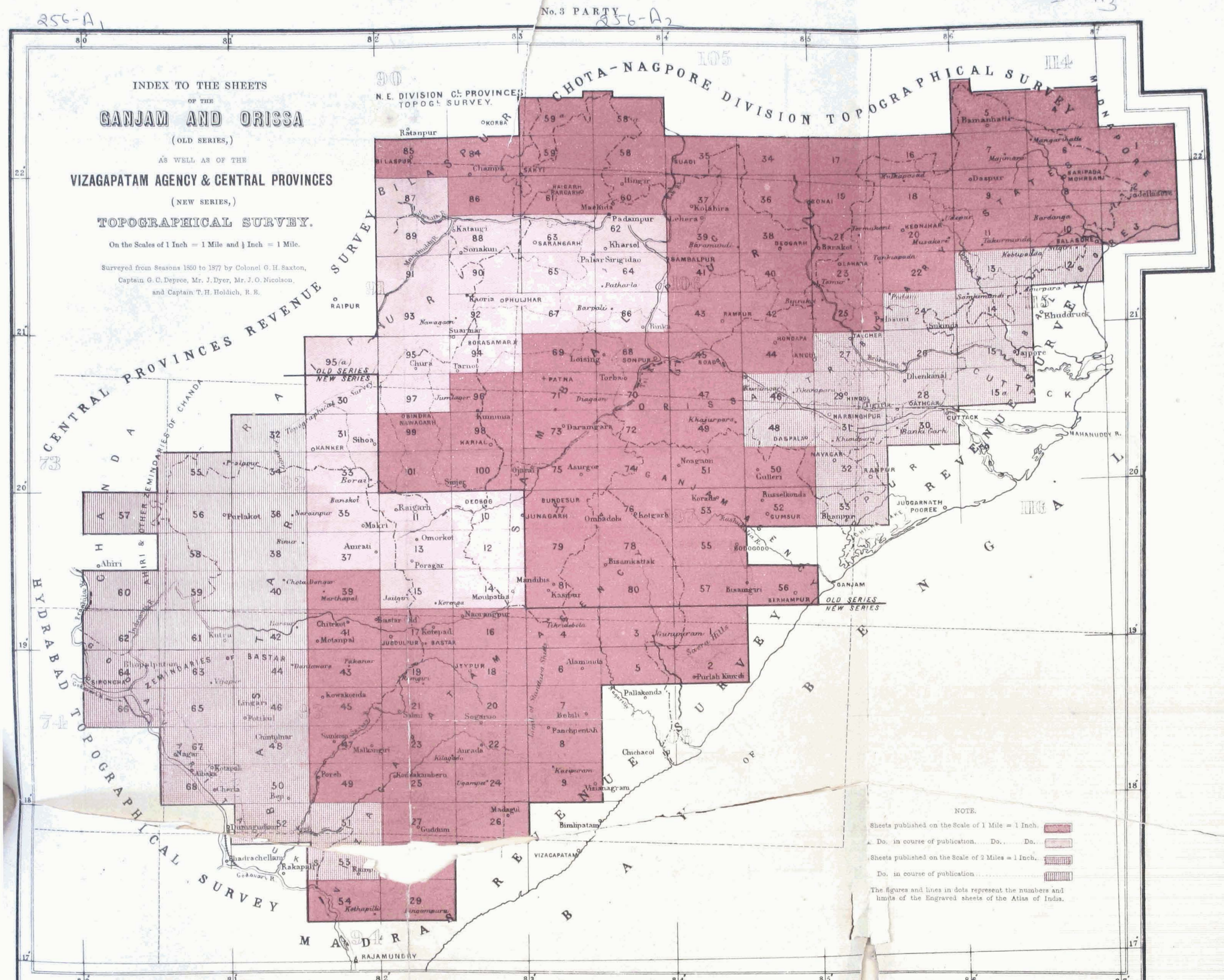
Surveyor General's Office, Calcutta, December 1877.



Published under the direction of Major General H. L. Thuillier, C.S.I.—F.R.S. Surveyor General of India, Surveyor General's Office, Calcutta, December 1877.

256-B2

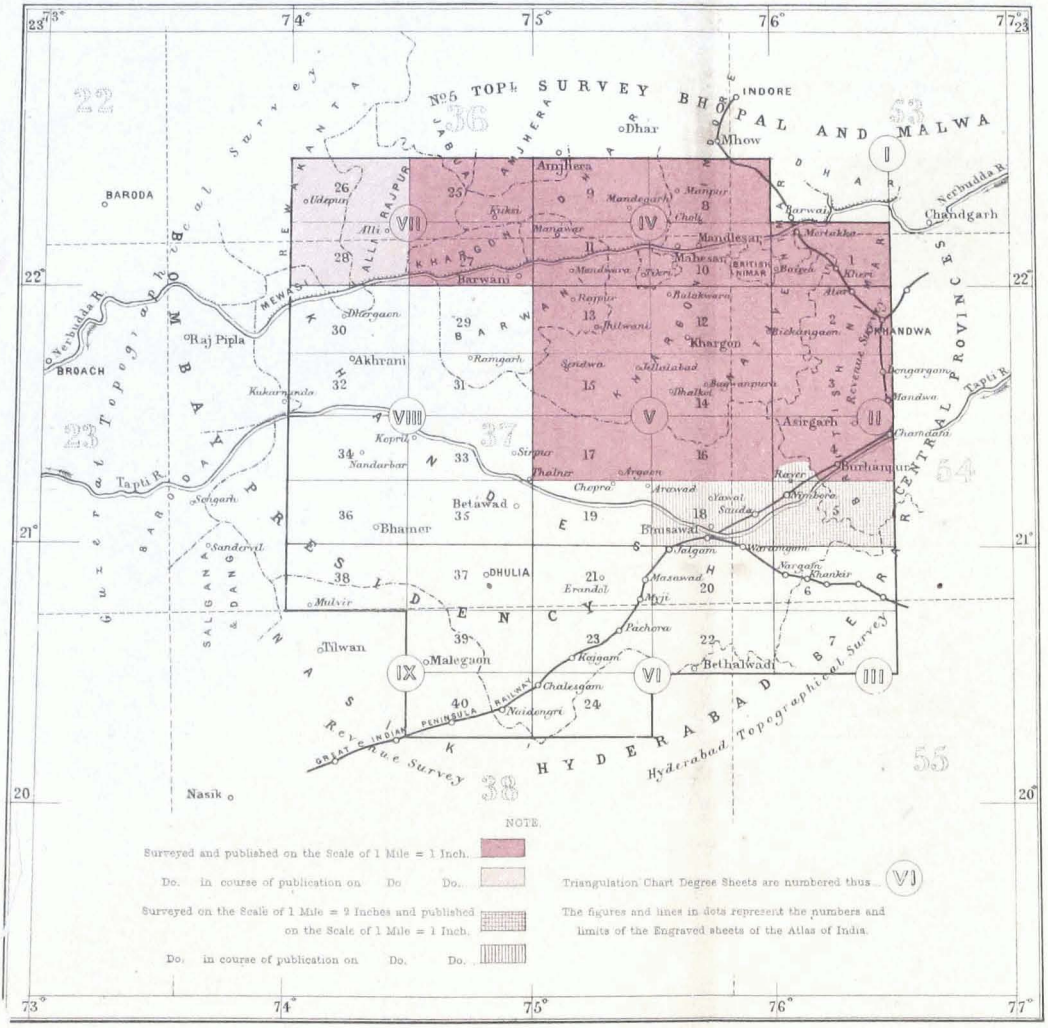
255 300

No. 2 PARTY

INDEX TO THE SHEETS OF THE KHANDESH & BOMBAY NATIVE STATES SURVEY.

255-A

On the Scales of 1 Inch = 1 Mile and 2 Inches = 1 Mile.



NOTE.

Surveyed and published on the Scale of 1 Mile = 1 Inch.

Do. in course of publication on Do. Do.

Surveyed on the Scale of 1 Mile = 2 Inches and published on the Scale of 1 Mile = 1 Inch.

Do. in course of publication on Do. Do.

Triangulation Chart Degree Sheets are numbered thus ... VI

The figures and lines in dots represent the numbers and limits of the Engraved sheets of the Atlas of India.

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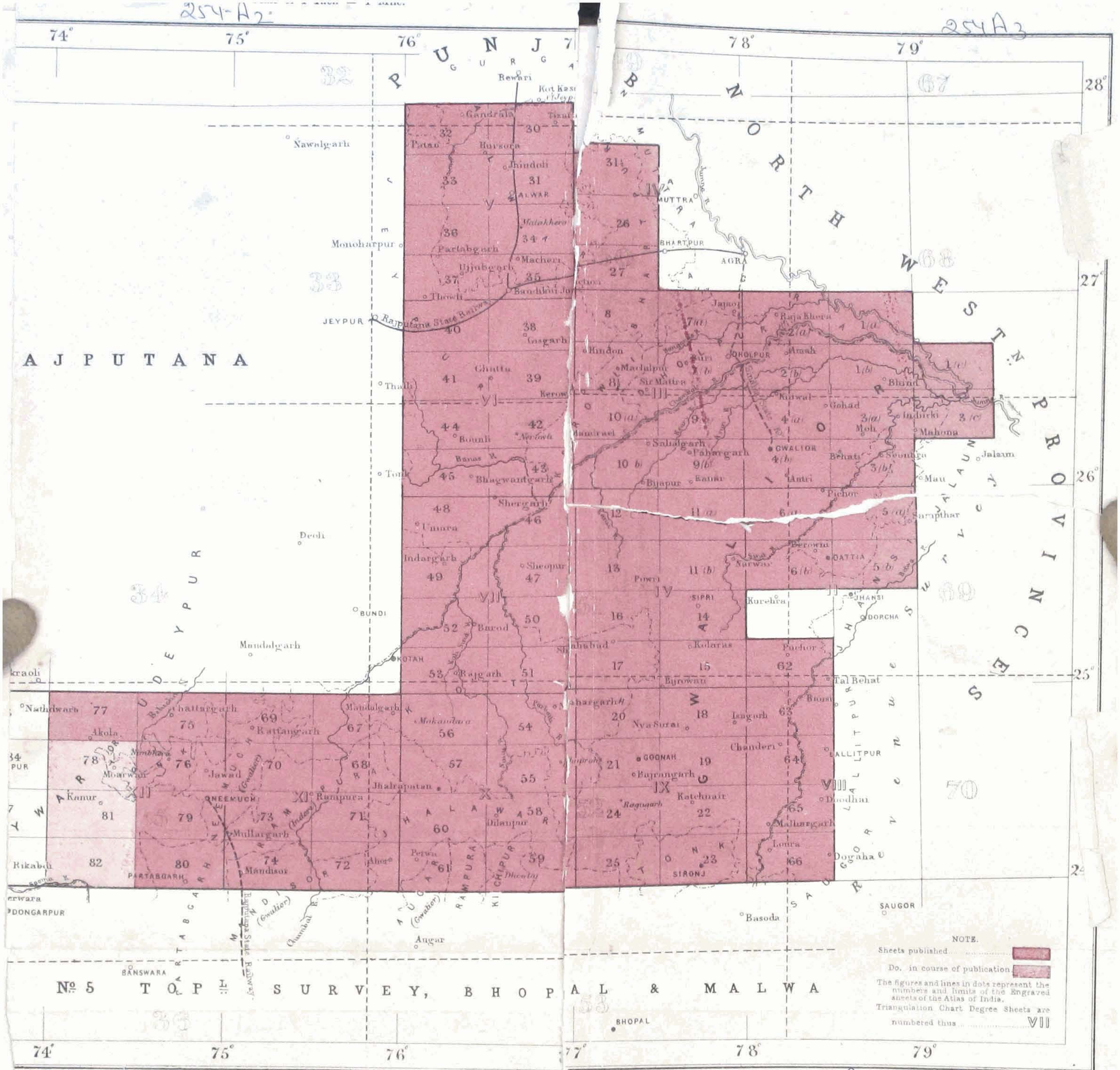
Surveyor General's Office, Calcutta, December 1877.



Published under the direction of Major General H. L. Thuillier, C.S.I.—F.R.S. Surveyor General of India,
Surveyor General's Office, Calcutta, December 1877.

APPENDIX.

STATEMENT A.

Showing progress and present cost of each Survey during 1876-77.

Surveys.	Final topographically 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 4", 2", 1" and ½" scales.	Total cost of survey.	Remarks.
No. 1.—Gwalior and Central India	1,568·1	...	8(*a*) 7(*b*) 15	171(*a*)	... ...	61(*a*)	... ...	1,661 ...	58,632 ...	(*a*)—Gwalior, Morar, and environs on 24", 12" and 6". (*b*)—Chittore.
„ 2.—Khandesh and Bombay Native States ..	1,840·7(*c*)	638	59	187	3	212	3	1,706	51,242	(*c*)—Includes 810·8 square miles on the 2" scale.
„ 3.—Central Provinces and Vizagapatam Agency ...	3,225(*d*)	...	...	...	...	...	...	3,220	47,119	(*d*)—On ½" scale.
„ 4.—North-East Division, Central Provinces	1,227·5(*e*)	...	39	44	...	13	...	1,265	44,925	(*e*)—Includes 7·5 square miles on scale 4"=1 mile.
„ 5.—Bhopal and Malwa ...	2,968·28(*f*)	2,867	59	357	8·0	277	10·4	2,968	61,067	(*f*)—Includes 83·44 square miles overlap.
„ 6.—Khási, Gáro, and Nágá Hills ...	2"=1 M. = 160 1" = „ = 360 ½" = „ = 717 1,246	2,046	53	228	6·9	27	77	4,040	62,869	
„ 7.—Rajputana ...	4,507·6(*g*)	6,977	59	516	13·6	407	17	4,228	34,955	Square Miles. (*g*)—1"=1 mile ... 4495·0 Simla, 74 acres on scale of 100 ft.=1 inch ... 0·1 6"=1 mile, Jodhpore ... 12·5
„ 8.—Mysore ...	1"=1 M.=1,417 4" = „ = 47·6 1,464·6	5,280	95	770	6·8	555	9·5	579	62,109	
„ 9.—Mysore ...	861	4,311	59	1,371	3·1	328	13·5	570	59,052	
Total ...	18,908·8	22,119	438	3,643	mean 7·2	1,880	mean 21·7	20,237	4,81,958	Including cost of Mysore survey, Rs. 1,21,161.

STATEMENT B.

Professional results and value of the Season's triangulation and average number of plane-table station fixings of detail survey, Season 1876-77.

Surveys.	Number of Triangles. 1st class.	2nd class.	Tertiary or Intersected points.	Triangular error in seconds. 1st class.	2nd class.	Mean difference of common sides in inches per mile. 1st class.	2nd class.	Tertiary.	Average plane-table fixings in each square mile of detail survey.	Number of linear miles of check lines run.	Remarks.
No. 1—Gwalior and Central India, ...	...	18(*a*) 11(*b*)	309(*a*) ...	...	4(*a*) 2·6(*b*	...	1·4(*a*) 0·7(*b*)	6·4(*a*)	13·1 on 1"	32·5	(*a*)—Gwalior. (*b*)—Chittore.
No. 2—Khandesh and Bombay Native States	...	83	341	...	13·9	...	4·0	5·7	7·4 on 1" 15·5 on 2"	111·1 on 1" 953 on 2"	
No. 3—Central Provinces and Vizagapatam Agency, ...	...	...	...	...	...	.....	...	...	2·1 on ½"	84 on-½"	
No. 4—North East Division, Central Provinces	...	2	86	...	...	...	18	48	9·8 on 1" 48·2 on 4"	69·9 on 1" 2·1 on 4"	16·1 linear miles of Forest boundary.
No. 5—Bhopal and Malwa	1	95	826	2·2	3·5	...	2·5	4·3	8·1 on 1"	344·0	
No. 6—Khási, Gáro, and Nágá Hills ...	...	57	277	...	13·3 (1") 14·8 (2")	...	9·6(2")	54 (1") 16 (½")	2·0 on 1" 9·4 on 2"		250 miles of route Survey on 1" scale.
No. 7—Rajputana ...	13	127	758	3·3	2·9	...	1·7	5·2	2·1 on 1"	Examined in situ.	
No. 8—Mysore ...	...	161	1,350	...	4·4	...	2·6	7·8	7·0 on 1" 59·2 on 4"		
No. 9—Mysore ...	...	79	1,292	...	4·9	...	2·8	12	3·2 on 1"		
Totals and Means	14	633	5,239	Mean 2"·8	Mean 7"·4	...	Mean in. 4·8	Mean in. 17·7	Mean 6·59 on 1" 12·45 on 2" 53·7 on 4" 21·7 on ½"	Linear Miles 557·5 on 1" 953·0 „ 2" 18·2 „ 4" 334·0 „ ½"	

STATEMENT C.

Comparative results of seasons 1875-76 and 1876-77, with general average mileage rates.

	Final topography, square miles.	Triangulation, square miles.	Number of stations observed at.	Number of points fixed trigonometrically.	Heights determined trigonometrically.	Cost.	Rate per square mile.	Remarks.
						Rs.	Rs. A. P.	
Season 1875-76	19,188	19,430	336	1,838	1,475	3,86,332	20 2 2	
„ 1876-77	18,909	22,119	438	3,643	1,880	4,81,958	25 7 9	
	—279	+2,689	+102	+1,805	+405	+95,626	+5 5 7	

STATEMENT D.

Abstract Cash Account of Moneys received from 1st January to 31st December 1877.

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.
Balance in hand on the 1st January 1877 ...	309 7 9		Amount paid to General Treasury, *vide* No. 85, dated 11th January 1877, ...	309 7 9	
Amount received from sundries	2,536 3 0½		Amount paid to General Treasury, *vide* No. 298, dated 8th February 1877,	634 12 10½	
Sales by Messrs. Thacker, Vining and Co., Bombay, up to 30th November 1876	171 3 0		Amount paid to General Treasury, *vide* No. 513, dated 5th March 1877, ...	98 14 8	
Sales by Curator of Government Books, Nagpur ...	48 14 8		Amount paid to General Treasury, *vide* No. 749, dated 2nd April 1877, ...	80 8 0	
Sales by Messrs. Thacker Spink and Co., up to 30th November 1876 ...	2,251 11 0		Amount paid to General Treasury, *vide* No. 465, dated 28th February 1877, ...	2,251 11 0	
Sales by Messrs. Higginbotham and Co., Madras, up to 30th November 1877	110 14 0		Amount paid to General Treasury, *vide* No. 932, dated 2nd May 1877, ...	222 9 0	
Sales by Mr. W. Ball, successor to the Punjab Printing Co., Lahore, up to 30th November 1877, ...	147 8 0		Amount paid to General Treasury, *vide* No. 1142, dated 15th June 1877, ...	156 10 6	
Sales by Curator of Government books, North-Western Provinces, Allahabad ...	94 13 0		Amount paid to General Treasury, *vide* No. 1279, dated 12th July 1877, ...	74 6 9	
		5,670 10 5½	Amount paid to General Treasury, *vide* No. 1179, dated 21st June 1877, ...	649 12 8	
			Amount paid to General Treasury, *vide* No. 1433, dated 14th August 1877, ...	240 12 0	
			Amount paid to General Treasury, *vide* No. 1519, dated 7th September 1877, ...	210 2 9	
			Amount paid to General Treasury, *vide* No. 1637, dated 5th October 1877, ...	192 5 6	
			Amount paid to General Treasury, *vide* No. 1809, dated 13th November 1877, ...	129 2 0	
			Amount paid to General Treasury, *vide* No. 1995, dated 11th December 1877, ...	28 8 0	
			Amount paid to General Treasury, *vide* No. 2116, dated 27th December 1877, ...	390 15 0	
					5,670 10 5½
Total ...	.....	5,670 10 5½	Total ..	.....	5,670 10 5½

H. L. THUILLIER, *Major-General,*
Surveyor-General of India.

Memorandum showing the total amount recoverable from the Map-sale Agents for sales up to 30th November 1877.

	Rs. A. P.
Messrs. Thacker, Spink and Co., Calcutta	3,595 2 0
Curator of Government Books, Central Provinces, Nagpur	83 4 0
Total ...	3,678 6 0

APPENDIX.

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

Remarks on country plane-tabled. Gwalior Territory.

The country under survey this season was divided into two by the water-shed of India, which here runs north-west and south-east. The difference between the two tracts thus divided is most remarkable; the north-east portion being very flat and quite open, with several large towns and villages, and fairly well cultivated; it forms part of the plateau of Rajputána, and is on an average about 1,600 feet above the sea. Villages are tolerably numerous, and several are of large size, but still I should by no means call it a thickly-populated country; in consequence of this, I believe, and not so much for want of water as I have heard stated, a considerable portion of the land is not under cultivation; the surface is more or less undulating, and it is true on the higher portions of the undulations the soil is generally rocky and poor, but still in the lower parts large wastes may be found, which to all appearance would repay cultivation. Almost every village has a tank, some of them of very large size; the water is used pretty considerably for irrigating the fields below the dam; but the water being conveyed only in channels dug in the soil, the waste of water must be very great. Being so near the water-shed, there are necessarily no large rivers. The Berach, a branch of the Banás, and its two tributaries, the Bágan and the Wankli, are the only streams of any note. The change after crossing the water-shed is very abrupt; instead of a fine, open, undulating, and almost level country, the whole surface is intersected by water-courses, which gradually become deeper and deeper, at last forming narrow valleys enclosed by hills varying from 100 feet up to about 500 feet above them. The fall of the country is very considerable; for the height of the Som river, the lowest point obtained, is 650 feet above the sea, shewing a drop of 950 feet from the plateau above, in a distance of 25 miles, or nearly 40 feet per mile; and again from Bánsi to Dariawad 17 miles, a fall of 850 feet, or 50 feet per mile. This rapid fall is, no doubt, the cause of this intricate hilly bit of country; for the large amount of drainage rushing for centuries down this slope of upwards of 40 feet a mile is, I should think, quite sufficient to account for it all. The first 10 or 12 miles of this ground is more or less covered with jungle, and the hills being of an almost uniform height, the difficulties encountered in surveying it were very great.

As you continue southwards the ranges become higher and higher, or, more strictly speaking, the valleys become deeper and deeper, and plane-tabling could be carried on more or less; but the jungle on them is, if anything, even heavier than in the upper portions, and the labor of getting about was very great, consequently, although traversing could be dispensed with, progress was still very slow. The drainage of the eastern part of this country is into the Jákhum river, a branch of the Som river, the course of which is from north-east to south-west; to the west it all flows into the Som, which here flows from west to east. These two rivers, of which the Som is by far the larger, after their junction flow into the Mahi. A very large portion of this western drainage is stopped by the Debar lake, described last year by Lieutenant Hobday. During the early part of the cold weather the overflow from the lake forms no inconsiderable stream in itself, but what with evaporation and irrigation, little or no water reaches the Som from this source after December. Having fairly passed through this rugged belt and reached the low country about the Som river, the country becomes far more open, with numerous villages and a fair amount of cultivation. Hills are still numerous, but they do not form large unbroken masses; and Dúngarpur, the State to the south of the Som, did not, as far as I could see, present any very great difficulties to a surveyor. Nearly the whole of the season's work belonged to Meywar; only on the plateau above are found a few detached portions of Tonk and Gwalior, below the water-shed, but very little revenue goes direct to the Durbar of Oodeypore, as it almost all belongs to the Thakurs (or Raos) of Salúmbar, Bhíndar, Bánsi, Kanur, Dariawad, Korábar and Bamora, and others of less note; and again between the Debar lake and the Som are a great many villages belonging to Brahmins, who pay no revenue at all.

Forts, towns and cities.

Of first class forts we found none, nor any second-rate ones worthy of mention. The principal towns in order, according to their size, are as follow: Salúmbar, Bhíndar, Kánur, Korábar, Dariawad, Bamora, Bátáru, Bansi, all residencies of Thakurs, of which the first three and Bánsi belong to four of the upper sixteen nobles of Meywar. The four first on the list are surrounded by a wall, but are not of any importance as fortified places. Besides these may be mentioned the tehsils of Kheroda, Untala, Boara and Lunda.

Passes.

We found only two passes from the plateau down to the low country which call for notice: one from Bánsi running almost due south to Dariawad and thence to Bánswára in the Bhopal survey, as it may be considered part of a good line of communication between Oodeypore and Bánswára. I shall report in detail on it amongst the routes. The other pass from Salúmbar to Oodeypore, I shall also make a special report on. Neither of these passes can be traversed by carts, but all sorts of baggage animals can easily pass through, laden. A few

other roads through the hills are shewn on our maps, but they are as a rule principally wood-cutters' paths, or only connect unimportant places, and are not well known at all; one is perhaps worth noting, from Dariawad up the Ratia-Kankar valley to Anjeni, and thence through the villages of Kharka, Gurel and Ghurla, to Korábar up to Ratia-Kankar; it is a rough jungly road, but fairly level and easy for baggage animals between Ratia-Kankar and Anjeni; it is a mere footpath over the hills, but still accessible for laden camels with a little difficulty: from Anjeni to Korúbar it is a good road, but not fit for wheeled vehicles of any sort. Dariawad and Salúmbar are connected by a road quite easy for baggage animals; it leaves Dariawad in a west-south-west direction, past the villages of Hawala, Arbura, and the small hamlet of Daran-ka-Khera, on the Jákhum river, through open country; it then passes through high jungly hills, but without any very formidable ascent or descent. Beyond the high hills the country is undulating, but still covered with jungle up to the village of Mánpur, where there is some cultivation and a little open space. Beyond Mánpur, again, is nothing but jungle up to Mátásola, but thence to Salúmbar there are no more hills and but comparatively small tracts of bush jungle. On the plateau above you can go almost where you like, either with or without a road, and there is no necessity for pointing out any particular routes in this report. The regular lines of communication will all be noticed amongst the routes.

Rivers.

The Jákhum and the Som, already spoken of, were the only rivers met with; the Berach, which afterwards becomes a good-sized stream, is here of quite secondary importance; when crossing it marching up, it was no longer even a flowing stream, the water lying in large pools. Neither the Jákhum nor the Som are navigable, nor could they ever be made so.

Inhabitants and crops.

In classifying the inhabitants, it is again necessary to divide the country into two by the water-shed. To the north, in the cultivated parts, the upper classes are all Rajputs, but the ryots or working classes are of the Dhákar, Dángis and Kalmi caste. In the rainy season, Indian corn and jowar form the principal crops; in the cold weather, wheat, barley and opium, of which opium is the crop from which the greatest revenue is obtained: from jowar about Rs. 2 per beegah is levied, from wheat and barley from Rs. 3 to Rs. 4 per beegah, and from opium from Rs. 8 to Rs. 12. In the hilly country below the water-shed are only to be found Bheels and Minas, these latter being almost identical with the Bheels; the Minas consider themselves slightly superior, but the only difference any of us could ever discover between them was, that a Bheel will eat camel and alligator and even tiger, whereas Minas will not. They both eat cattle and all sorts of deer.

These Minas must not be confounded with the Minas and Gujars of the northern parts, so well known, as a rule, as cattle-lifters. These are allied to the Rajput tribes, and are called Ujla (Anglice, clean) Minas, and have no connection at all with the others I am speaking of, who are aborigines and are distinguished as the Maila (Anglice, dirty) Minas. Nearly all the inhabitants of the "Páls," as they call their villages, met with this year were Minas; only a few Bheels proper were found near the Debar lake. Very little opportunity was thus afforded of finding out the different clans or sub-divisions of this tribe of the Minas. Lieutenant Hobday obtained the names of several, *viz.*, the Buj, Búror, Katara, Damar, Mal, Bargate and Kandar. Sub-Surveyor Abdul Sobhan gives another, *viz.*, the Armor, which he says is the highest in rank of all and are distinguished in dress by wearing short drawers, whereas all the others wear the ordinary "*dhoti*"; and again a Mina, not of the Armor class, greets one of this caste by unstringing his bow, and not with the ordinary salam and greeting of "Ram Ram." A man may not marry into his own clan, but must select a wife from some other one; but the Armor will only allow their daughters to marry into the Bargate. An Armor may, however, take for his wife a member of any other clan. These aboriginal tribes all live in the most inaccessible country amongst the hills; they never build regular fixed villages, but inhabit a valley, each man building his hut where he likes; this collection of huts, sometimes extending over some miles, is called a "Pál," and as a rule the inhabitants of one "Pál" are all of the same clan, but not necessarily so, for sometimes they are curiously mixed; they are all considerably addicted to drink and are very independent. During any of their great festivals they are sure to be more or less intoxicated, and it is advisable to keep clear of them at such times, as they are apt to get quite beyond control, and very little is sufficient to bring them out under arms against any intruder. At any time any act of oppression towards a Bheel or Mina within a "Pál" is sure to call forth the war cry, which echoing up and down the valley is answered all round and speedily collects the others to the spot; it then requires some little tact to smooth matters and prevent recourse to arms. This happened more than once, but never through any fault of the members of the party, but in consequence of some camp-followers trying to bully a Mina, in virtue of his being attached to an Englishman's camp. These wild men, however, appeared to be open to reason, for they always quieted down when they saw that there was no intentional injustice on our parts and that oppression would not be allowed. On the whole they are not very difficult to deal with if you start fair with them, and if they clearly understand that you do not wish to do them any harm. Although they are much addicted to robbery, sending out regular gangs to waylay merchants and rich travellers, no case of robbery occurred in any of our camps. They are essentially idle, and it was very difficult at times to procure coolies; and whilst out at work, a Mina, when acting as flagman, would often run away, having previously tied his flag to a bush to prevent suspicion; setting this aside, they did not impede our survey operations in any way. They cultivate the ground close to the streams in their "Páls," irrigating them from the streams by means of Persian wheels, and they also grow "jowar" on the hill sides

by the process of "Bhalra" or "Sur;" they cut down the jungle and burn it when dry; a man then drills holes with a stick, in which he puts the seed without any further preparation of the ground. As a rule, they select different places each year for such cultivation. On these crops no tribute is levied. They prize the Mowah trees greatly, from the flowers of which they distil their liquor. In every "Pál" may be found a distillery, and when the flowers are in full bloom, you see men, women and children collecting the fallen flowers. They almost invariably go about armed with bows and arrows, but seldom have other arms. Their bows are of bamboo, well hardened in the fire, and although short, are of considerable strength. The curious part of them is, that the string is also a strip of bamboo; neatly and carefully bound at either end are loops of sinew, which catch in the notches at the extremities of the bow; the arrows are also of small bamboo, with four feathers, strongly, but rather coarsely bound on, and pointed with flat iron in the shape of a spear-head also bound on; they are rather too heavy at the point, but fly fairly truly. From what I saw they did not appear to be very skilful shots, even at a range of about 30 yards.

Wild animals.

Notwithstanding the amount of jungle and the wild character of the country, there are wonderfully few animals to be found. In places a few "Sambhar" may be seen, and bears are met with now and then, but they are by no means plentiful. "Chital" were not even heard of. The small jungle four-horned antelope was seen in several places. Tigers and leopards are scarce; but pigs were met with in the "Dhankeri" jungle pretty frequently. There is very fair fishing to be had in the rapids of the Som and Berach rivers, but not much in the Jákhum river. With regard to the fish, there is one fact well worth noting and of which there is apparently no doubt—in all the streams which belong to the Bay of Bengal drainage, even in very small ones, the Indian trout is very plentiful, and during March and April can be caught by dozens with fly; whereas they are absolutely unknown in the rivers and streams flowing to the Gulf of Cambay. The "Mahseer" is to be caught in most of the large streams on both sides of the water-shed.

Minerals.

Lieutenant Hobday reports that in the hills between Bedawal-ki-Pal and Anjeni he found on certain ranges large quantities of iron ore, and a little to the west again, copper ore. In the days of the Rahtors these ores appear to have been worked, but no exact information about the time of working them could be ascertained; they are not made use of at all now-a-days.

Trees, &c.

Large quantities of teak were found in the forests, but as they are in no way preserved, the Minas and Bheels cut them all down when young, and few large trees are to be found. Now and then a fine specimen may be found growing over some sacred spot. The "Mowah" trees are very plentiful and are much valued on account of its flowers, from which liquor in large quantities is distilled; they also dry the flower and mix it with their bread. From the fruit they extract oil. The male bamboo grows in quantities about the hills, more particularly about Bidawal-ki-Pal. The "Tendu," or ebony tree, was found in considerable quantities. In many places the "Kiwanch" (Anglice, cowhage) caused great annoyance from the irritation caused by the hairy pods, the natives more particularly suffering from it on their bare arms and legs. "Jamalgota" (*Croton tiglium*) is also to be seen more or less everywhere, but Abdul Sobhan states that, between the villages of Nar, Kontha, Mánpur and Palsora, it was in such quantities that the water in the streams was quite impregnated with it, and that he and all his men were completely laid up when working there. The inhabitants also suffer greatly in that neighbourhood.

Notes by Sub-Surveyor ABDUL SOBHAN *on the Bheel clans of Meywar.*

The territory of Meywar is divided into five portions, known under the following names: Meywar, Sappan, Meval, Katara or Kantar and Magra (Anglice, hilly country). To the south of Gamra, near the Debar lake, lies the Sappan division, the capital of which is Salúmbar; to the north of this is the Meval district, capital Kanor. The whole of Katara now no longer belongs entirely to Meywar, the present state of Pertabgarh having formed a large portion of it; its ancient capital was Pertabgarh, but the principal town in that part of it, now belonging to Meywar, is Dariawad. Meywar proper occupies the centre, and its capital is Oodeypore. The country known as the Magra includes all the Aravalli range both north and south of Oodeypore. The Sappan, Meval, Katara and Magra divisions are occupied principally by the Bheel tribes, of whom the Minas form one; they assert their origin from the Rajputs, but these latter do not admit it. Their clans (Got, is their term for a clan) are known as the Armor, Buj, Báror, Kattara, Damar, Mál, Bargot and Kandar; the first is acknowledged to be the chief, the others all pay homage to them. Their villages are called "Páls" (the literal meaning of which is an embankment of a tank). To cultivation, these Bheels, like all other aboriginal hill tribes, pay little or no attention, but make their living principally by plundering and cattle-lifting. They are acknowledged to be brave men; the following triplet being in praise of them: "*Rani jáio, Mini jáio, Marta áio*, which freely translated means that the offspring of a queen or of a Mina scorns death. Especially it is a matter of note that no exhibition of feeling should be shewn for those who have been killed in a raid, but at the same time the spot where any man has fallen is

marked by a pile of stones, each man adding to the pile as he passes it. These piles of stones are very constantly met with, showing how very frequently such casualties occur. Their chief wealth consists in the number of cattle they possess, and these are almost invariably obtained by force from their neighbour. Every "Pál" is governed by a "Gammeti," whose power in that "Pál," is paramount, and who is assisted by one or more "Gaddas." They only appreciate the coarser kinds of grain for food, and altogether reject wheat. They eat not only all wild animals of the deer tribe, but also dead cattle, although they will not, like all Hindoos, kill them. They do not touch opium which is remarkable, living, as they do in a country where this drug is so universally used; but they are very much addicted to liquor; the women however, religiously abstain from it. They do not court marriage for their daughters, and only give them away when men of their own accord come forward to ask for them; in consequence of this a great number of unmarried women are to be found among them. When a marriage has been agreed upon, the father of the bride takes from the bridegroom an amount varying from Rs. 50 to Rs. 100. The Bheel women are very chaste. All the married women wear the "choli," or boddice, but an unmarried woman never does so. Among the Bheels the practice of woman-selling exists.

The following details were gathered at Dariawad, the chief of which place ranks amongst the second order of nobles of Meywar, 32 in number. The tribute or "chatund" as it is called, paid by the Rao to Oodeypore is 6 annas in the rupee (the value of which is 13 Government of India annas), and in the event of one of his ryots failing to pay in his share, the Rao takes possession of his cattle; should the ryot be still unable to pay, his daughter or daughters are seized until the claim is satisfied.

The only products which this country yields for export are gum and "ghee" (clarified butter), the market being Ahmedabad, which in return sends to the fair in February, held at Benesar Mahadeo at the junction of the Som and Mahi rivers, such necessaries of life as cloth, tobacco, cocoanuts and "gúr". The gum is principally used in dyeing cloth. The principal wood marts are Dungarpur and Banswárá to the south, Shalamgarh near Pertabgarh to the east, and Bhervi to the north.

On the northern bank of the Jákhum there is said to have been a very large Rathor city called Abisa; tradition says it extended from the Karmohi river to the Kairmalia hills, a distance of about 5 miles; this no doubt is a gross exaggeration, but at the same time old temples and heaps of bricks may be found more or less over this ground. From the fact of great quantities of bricks being found around the small village of Arbara, it would appear that the main part of the city was on the junction of the Súkli naddi with the Jákhum river. In the valley to the east of the Kairmalia hill is a very picturesque group of temples evidently connected with this old city. Bedawal ki Pál is also the site of an old Rathor city, and near this "Pál" to the south, are the remains of a fine old fort beautifully situated on one of the hills in the midst of the forest; this is known as Sálgarh. Other traces of the old Rathor inhabitants were found in these wild tracts, but these two are the most important.

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

Remarks on the country triangulated.
Khandesh and Sátpuras,—Bombay Native States.

The country triangulated, *viz.*, 638 square miles, lies principally in Degree Sheet VIII, a part being in Degree Sheet IX. That below the river Tapti, or 493 square miles, is revenue-paying, and the remainder, or 145 square miles, north of the river lies in the Sátpuras. The former tract is hilly, the hills rising occasionally to 600 feet above the flat and cultivated ground. About half of this tract is only under cultivation, but not very productive, "*bajra*" and "*jowár*" being the principal crops raised. The Agra and Bombay road, still kept in good repair, intersects the tract, but the traffic is not great now since the opening of railways. It was considered advisable to triangulate this area closely, because it will be found inconvenient to run many traverses owing to the unevenness of the ground, and the detail survey will have to be carried on in the ordinary way to a great extent. The piece of triangulation in the Sátpuras is wild and mountainous, with few villages overrun with wild animals. On one occasion when returning to his camp, Mr. Graham was stopped by a couple of bears which made towards him, but the klassies coming up just then, raised a shout and the animals moved away leisurely. The principal villages in the triangulation intended for the 2″ survey are marginally noted, in all of which weekly markets are held.

Songir.	Chimtáj a.
Virdel.	Dhonchicha.
Wársa.	Nahlod
Betáwád.	e

Remarks on the country plane-tabled.

The country plane-tabled on the 2″ scale, lies between latitude $\frac{21^{\circ}\ 0'}{21^{\circ}\ 15'}$ and longitude $\frac{75^{\circ}\ 0'}{76^{\circ}\ 0'}$. It is intersected by the River Tapti, which enters it at the south-east corner and passes out of the north-west corner, and is cut up by several tributaries, *viz.*, the Áner, into which flows the drainage of the Sátpuras coming within the limits of Degree Sheet V, the Wágur, Bori and Girna, the Girna being the largest. On either side of the Tapti the ground is considerably broken up with deep ravines, especially near the junctions of the tributaries, which of course increased the labor of plane-tabling considerably; but for this, Degree Sheet V would have been completed during the season under report. There is not much of it remaining however, only about 35 square miles.

The principal towns and villages situated in the area plane-tabled on the 2″ scale are named in the margin. None of them can properly be classed as towns, but the first ten are very large villages. Yáwal alone has a masonry wall surrounding it, but fast falling into decay. The first seven, except Nasirábád, have Post Offices with Deputy Post Masters attached to them, and are connected by fair district roads. Bhusáwal, Nasirábád, Amalner and Chopra are the chief villages of the talukas of the same names and the head-quarters of Mamlatdars (a term equivalent to Tehsildar in the North-Western Provinces), but the Mamlatdar of Nasirábád resides at Jalgáon on account of its being on the Great Indian Peninsula Railway line. Yáwal is the chief town of the Peta (sub-division of a taluka), where the Mahalkari or Naib Tehsildar resides. He is subordinate to the Mamlatdar of Sauda in revenue, but not in judicial matters. There is also a sub-judge at Yáwal, as well as one at Amalner.

Towns and Cities.

Bhusáwal.	Aráwad.
Nasirabad.	Kanalda.
Amalner.	Sonwad.
Chopra.	Cháwalkhera.
Yáwal.	Kingáon.
Dharangáon.	Dhanora.
Jalgaon.	Amalgáon.
Sákli.	Nánder.

In Khandesh a sub-judge exercises judicial powers over three or four talukas, and is subordinate only to the District or Session's judge; while over every four talukas there is an Assistant Collector. Bhusáwal is the name of the principal station of the Great Indian Peninsula Railway, and the point of junction of the Nagpore extension with the Great Indian Peninsula Railway main line. It is a flourishing place, and has been greatly improved by the company. It boasts of a nice public garden, and water is laid on to all the Railway buildings by means of pipes, the supply being obtained from the river Tapti, a mile to the north of Bhusáwal, raised by means of a steam-pump. It is the head-quarters of the Railway magistrate also. A company has lately been formed to utilise the water-power of the Tapti, and the requisite works will be established near the rapids to the north of the station. The company should prosper if economically worked, for the trade in cotton and flax is large. Jalgaon is another thriving place; it is situated on the Railway line, and has two cotton spinning and weaving mills, worked by steam. The cloth turned out is good and has nearly superseded the country manufacture. There is also a second class railway station and a dispensary with an assistant surgeon attached to it. An attempt is being made to construct a lake to the south of the village to supply water by means of pipes to the station; but it is feared it will not succeed as there is too much percolation. Dharangáon is the head-quarters of the Khandesh Bheel corps, commanded by Major O. Probyn. It is composed of Bheels, who are only entertained for political reasons, as they generally make wretched soldiers on account of their intemperate and indolent habits. In all the villages named in the margin there are vernacular schools, but the attendance is irregular.

In the Native States the principal towns which come within the season's operations are Rajpur, the capital of Ali-Rájpur, and Chota Oodeypore of the State similarly named. The former is under the jurisdiction of the Political Agent of Bhopáwar (Central India Agency) and the latter of Rewa Kánta (Baroda Agency). These towns are not protected by walls, nor do they possess forts. Like most native cities their sanitary arrangements are most imperfect, and it is always advisable to keep clear of them. The State of Ali-Rájpur is managed by a native Superintendent appointed by the Governor General's Agent for Central India.

Chota Oodeypore is situated on the right bank of the river Or, which is dry in the hot weather and is surrounded by very dense jungle. To the south and east, about 6 miles distant, there are pretty high hills. The town contains no nice buildings, nor is there any other attraction, not even that of sport in the surrounding jungle. A Post Office has lately been established as an experiment, which should succeed as there is none at Rajpur, nor at any of the neighbouring petty States. It was most convenient for the party, otherwise Katol, about 50 miles to the north, would have been the nearest place to post letters. The ancient capital of Chota-Oodeypur was at Mohan, in latitude 22° 3′ 49″, and longitude 74° 6′ 43″, a description of which was given last season by Mr. D. Atkinson, Surveyor, 2nd grade. The principal villages which fall in the season's operations on the 1″ scale are named in the margin. In the Ali-Rájpur State all, except Sondwa and Phulmal, are the head-quarters of Thanadars, a title equivalent to Tehsildar in British territory. Sondwa and Phulmal are the chief "jagir" villages, the Thakurs being relatives of the Raja. In the Chota-Oodeypore State, Kawant and Pánwar are the two most important villages as far as that State comes within the operations of No. 2 Party, and each is the head-quarters of a Thanadar, the parganas are similarly named. Káthiwára and Mathwar are the seats of two protected Thakurs, their "jagirs" being designated by similar names. The Thakur of Mathwar is a minor, and is obliged to reside at Indore for his education, while the State is managed by the Dewan, otherwise Superintendent of Ali-Rájpur.

In Ali-Rajpur.	In Chota Oodeypore.
Umráli.	Kawánt.
Walpur.	Pánwad.
Chaktaláo.	Protected Thakurs.
Chandpur.	Káthiwára.
Amkút.	Máthwár.
Bhábra.	
Sondwa.	
Phulmal.	

Along the northern boundary of the area plane-tabled on the 1″ scale, the southern slope of the Vindhyas stretches, and Rattan Mál, the highest western extremity, just comes within the overlap. This mountain is 2,146 feet above mean sea level at the point where the temple stands, and has been ere this, recommended for a sanitarium for Indore, as there is a fair-sized plateau

Hills and passes.

and plenty of good water; but the suggestion was never carried out, as it is considered malarious at certain times of the year. Along the southern boundary of the tract under description, the Nerbudda flows (part only coming within the season's operations) through a deep, narrow gorge, overlooked on either side by frowning precipices and high peaks, which are frequently inaccessible. The intermediate tract, *i. e.*, the country lying between the Vindhyas and the hills stretching along the Nerbudda, is composed of low ranges of hills with intermediate valleys, all inhabited and cultivated; and to the north of Chota-Oodeypore there are extensive jungles in which a few peaks rise abruptly to a considerable height, making admirable points for the plane-tabler.

Roads.

The principal lines of communication taken up or continued during the season under review are in the 2″ scale work from—

1. Malkápur in West Berar to Dhulia, *viâ* Nasirábád, Jalgáon, Dharangáon and Amalner.

2. Maijee to Bárhanpur in the Central Provinces, *viâ* Mhasawad, Jalgáon, Sauda and Ráver, crossing the Tapti river by means of a ford or ferry, according to the season of the year, near Boráwal between Jalgáon and Sauda.

3. Dhulia *viâ* Amalner and Chopra, Dhoulid and Gada Ghati pass in the Sátpuras to Indore, crossing the river Tapti by ford or ferry, according to the depth of the water, at Nimgowhán, between Amalner and Chopra.

4. Bárhunpur *viâ* Sauda, Yáwal, Chopra and Thálner to Shirpur.

The above are all good *district* roads and are kept in fair repair. The Great Indian Peninsula Railway line also passes through the work and needs no remarks.

In the 1″ work comprising parts of several Native States, the principal roads are from—

(1). Rájpur of Ali-Rájpur *viâ* Umráli, Chaktaláo and Kawánt to Bhákar, which lies in work assigned to the Guzerát Party, Great Trigonometrical Survey.

(2.) Rájpur of Ali-Rájpur *viâ* Wálpur to Chaktaláo where it meets route No. 1.

(3. Rájpur of Ali Rájpur *viâ* Umráli to Sondwa and Mathwar.

(4.) Rájpur of Ali-Rájpur to Chota Oodeypore and thence to Daboi, the terminus of the Gaekwar State Railway in work of Guzerát Party, Great Trigonometrical Survey.

(5). Chota Udepur *viâ* Pánwar and Kawánt to Háf.

(6). Rájpur of Ali-Rájpur *viâ* Khatali, Ghora and Bori to Sirdarpur, in work of No. 5 Topographical Party.

(7). Rájpur of Ali-Rájpur *viâ* Bhábra to Dhawad in work of No. 5 Topographical Party.

(8) Rájpur of Ali-Rájpur *viâ* Sorwa and Pánwar to Baroda in Guzerát.

(9. Rájpur of Ali-Rájpur branching off in route No. 8 from Pánwar to Kalali in work assigned to Guzerát Party, Great Trigonometrical Survey. Of these routes, Nos. 1, 2, 4, 5, 6 and 7 are important (the others being of secondary note) and are practicable for wheeled conveyances.

Rivers.

The following rivers fall in the season's operations, but none of them are navigable:—

In 1-inch scale work.

1. Nerbudda, flows through south-east corner of Standard Sheet 28, about 6 miles, through a deep gorge overlooked by lofty hills which are very rugged and covered with dense jungle.

2. Hathni river, which enters the northern limit of work allotted to No. 2 party in Standard Sheet 26, latitude 22° 30′, longitude 74° 27′, and flows south-south-west, under Khatiáli in Standard Sheet 25; 8 miles south of which it takes a southerly course and enters Standard Sheet No. 28 in latitude 22° 7′, longitude 74° 30′; it joins the Nerbudda in latitude 22° 2′ 17″ and longitude 74° 29′ 43″. The Hathni derives its name from a rock at its source resembling an elephant.

3. Ankár river, takes its rise among some low hills in latitude 22° 18′, longitude 74° 10′, about 5 miles west of Rájpur, and after flowing south-south-east, joins the Hathni river about 3 miles north of its junction with the Nerbudda.

4. Heran, takes its rise near the village of Sagbara in latitude 22° 10′, longitude 74° 19′, and after flowing under Phúlmál and 1½ miles south of Pánwar in a westerly direction enters the work of the Guzerát Party in latitude 22° 7′, longitude 74°.

5. Kara, rises in hills 2 miles east of Gendra village, latitude 22° 3′, longitude 74° 19′, and passing Kawant joins the Heran close to Zelawat village in latitude 22° 9′, longitude 74° 1′.

6. Sukar, rises near Ikdari village in some elevated ground in latitude 22° 27′, longitude 74° 23,′ and after flowing in a southerly direction as far as Rajpur, sweeps eastwards at right angles and joins the Hathni in latitude 22° 13′, longitude 74° 34′.

7. Or river, rises near Bhábra, the principal village appertaining to the pargana of the same name in the Ali-Rájpur State, from a plateau of the Vindhya range, and flows due south about 9 miles; then takes a turn at right angles westwards, which course it follows for 16 miles, when it diverges to south-west as far as Chota Oodeypore, whence it flows in a north-west direction to the limit of work, and enters the area allotted to the Guzerát Party in latitude 22° 20′, longitude 74°.

8. Ani river, rises close to Ratanmál mountain in the Vindhyas; enters northern limit of work in latitude 22° 30′, longitude 74° 8′, keeping a south-west direction till it runs into a allotted to the Guzerát Party and joins the Or river some miles off.

9. Bharej river, enters the northern limit of work in latitude 22° 30′ and longitude 74° and keeping a south-west direction, flows into work assigned to the Guzerát Party in latitude 22° 26′, longitude 74°.

In 2-inch scale work.

1. Tapti river, enters the present season's operations near Borawal, situated half-way between Nasirábád and Yáwal, and running with very little deviation almost due west, flows into Degree Sheet VIII under the well-known and ancient village of Thálner.

2. Aner river, rises in the Sátpuras, as already described in the report of season 1874-75, and joins the Tapti at Piloda village, at the trijunction point of the parganas of Chopra, Shirpur and Amalner.

3. Wághur, 4. Girna, 5. Bori, } All large tributaries of the Tapti, flowing into that river from the south; but as very small portions of these rivers have been surveyed, a proper description of each will be given in a future report.

Inhabitants, their manners and customs.

The inhabitants of Khandesh in the revenue-paying portions being chiefly Mahrattas, need no particular notice in a report like this; those in the Native States under review are chiefly Bheels and Bheelalas (the latter being a cross between a Rajput and a Bheel woman). The Bheelalas are an industrious and a peaceable race, and are the principal cultivators. The Bheels, too, are quiet and orderly, except to the north of Rájpur in the Chandpur and Bhábra parganas of Ali-Rájpur, where they are considered a murderous and treacherous lot, requiring all the tact and energy of the Dewan to keep them in order. All go about armed with bows and arrows, and at 50 yards they are dead shots, of which abundant proof is present in the country being almost totally devoid of game, although covered with jungle and fairly well watered. At 20 or 30 yards a Bheel will send his arrow, of which the shaft is 6 inches long, being flat, and the edges as sharp as a razor, right through a leopard or a bear. This was done last year on three occasions. The people of Máthwar are exclusively Bheels and no better than savages. The men are perfectly nude and the women wear only an apron consisting of three or four "*dhak*" leaves, but are laden with trinkets of all descriptions from their heads to their loins, and from their knees to their toes, their arms and fingers being similarly decorated.

Sheik Omar, Sub-Surveyor, who surveyed Máthwar and the Nerbudda, as much of it as fell in the past two seasons' operations after it enters the hills, says: "there is a certain class of mendicants or Gusains, styled Parkama Básis, who commence their pilgrimage from any shrine on the Nerbudda, travelling up one bank as far as Amarkantak at its source, and down the other to its mouth near Broach, where they cross over and return to the same shrine whence they started, when they recommence the same journey, always keeping close to the water's edge, and drinking no water but that of the river. The Bheels who dwell on the banks of the Nerbudda, particularly those of Dasana in the Dahi State, have a great aversion to these mendicants, whom they rob and seize, when they can do so with impunity, and after making them stark naked, force them to jump and dance for their amusement on the hot sand, touching them up with their arrows if they hesitate, and wounding them rather severely at times; the Bheels being under the effects of liquor or toddy show little mercy."

Sorcery among the Bheels.

Incredible accounts are given of the Bheels practising sorcery during the "*Holee*" and "*Dusera*" festivals, for instance, walking through the fire and not being burnt; holding a red-hot bar of iron in their bare hands and licking the same without hurting the tongue; taking a rupee out of a pot of boiling oil, and the like. The first, *viz.*, that of walking through the fire and not getting burnt, came under observation oftener than once. On the 5th April, when encamped at Kua village in the Amkhút pargana, appertaining to Ali-Rájpur, Mr. Horst was told by Mr Graham of certain Bheel priests who could make people go through fire. They were accordingly sent for and after a great deal of persuasion and the offer of a rupee they very reluctantly consented, affirming that the time was inauspicious. A hole about 4 feet long and 18 inches wide and the same in depth was dug, and after being well heated was half-filled with live coals. The "*pujari*," or priest, then muttered some incantations and fanned up the coals till they were quite bright and glowing; he then killed a fowl as a sacrifice and waved a naked sword six times over the fire, after which he told a Bheel sitting beside him to walk through the fire, which he did, treading six times deliberately, and repeated the operation three times. Suspecting some trickery, the soles of the man's feet were examined, but they were not burnt or blistered in the least. A Mahomedan chaprassi, native of Oudh, who happened to be standing near, was asked if he would venture to walk through the fire. He replied "yes, because there is a charm over the fire and it can't injure me," and without the least hesitation he went through, moving 6 inches at a time and very slowly. On examining his feet, it was found the flesh was not even singed. The Dewan of Ali-Rájpur assured me it was a common practice and frequently adopted by village "*punchayets*" for trials of theft and murder.

Products, soil, cultivation, &c.

In the area under report in Khandesh, no products or manufactures worth mentioning, except that of cloth at Jalgaon already alluded to, came under notice. The country produces the ordinary cereals, but in consequence of the drought the crops were few and very scanty. Cotton is

and ully grown in large quantities, and the trade in favorable seasons is brisk. There was not at a sufficient grass for cattle last season, and consequently large herds were driven into the No puras as early as November and December for pasture, during which months the climate is idly and the result was, that the owners or herdsmen were stricken down with jungle fever, ov mbers dying and others being prostrated for months. In the latter part of January there sil us heavy rain throughout the district of Khandesh, but unfortunately too late to be of any st enefit, excepting that the water-supply was increased. In the Native States under review, al bajra" and "jowar" are the only crops, and sufficient only for local consumption. The palmyra w palm is extensively grown for its toddy, which the natives partake of in large quantities, and t during the season, *viz.*, in March and April, they are in a continual state of intoxication. The people are extremely poor, particularly in the Chota Oodeypore State, where assessments are much heavier than in the neighbouring one of Ali-Rájpur. The soil on the revenue-paying portions of Khandesh is black cotton, very productive during a fair season of rain; whereas in the Native States it is stony, though every available spot is ploughed up and crops grown on it.

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

Remarks on country plane-tabled.

A description of the country plane-tabled would be merely a recapitulation of the description of the country triangulated last year. But in such a wild, rugged, tract as this, such an untrodden land of promise to the explorer, antiquarian, ethnologist or sportsman, there must be many points of deep interest which cannot be touched on in a report of field operations, which comprises, at the best, merely a superficial examination of the surface of the ground and deals almost exclusively with the configuration of hills and valleys. The archæologist, ethnologist or naturalist, who carefully follows up his science into the high-ways and bye-ways of such a wilderness as this, would find his time fully occupied with his own special hobby, and the business of the surveyor is rather to make the map which may help others to arrive at a comprehensive knowledge of the land and of the manners and ways of the people. To the sportsman only, it may be worth while to point out that the hills and valleys of Bastar immediately south of Raipúr, which can be approached by the Raipúr and Dhamtari road, seem to be full of large game of all descriptions, and with the map in his hand no sportsman would find much difficulty in making his way about this part of the country with carts. A more general description of the whole area embraced in the season's operations I will leave to Mr. May, who is well qualified to give it.

Note by MR. J. A. MAY, *Surveyor, 3rd Grade, on the ground surveyed by No. 3 Party,— Season 1876-77.*

Petty Native States, Central Provinces.—Bastar.

In describing the country surveyed during the past field season, I can add but little of interest to that which has already been written by Captain Holdich in his Narrative Report of season 1875-76; but as he has expressed a wish that I should give a description of it, having, while on my tour of inspection through the several plane-tables, had an opportunity of ascertaining personally the character of the ground, I will endeavour to do so to the best of my knowledge, though it is almost impossible to render an adequate idea of a country so little known and so difficult of access, where information is obtained with the greatest difficulty, and the time necessary for enquiry and investigation is of so short a duration.

The portion of the Bastar district in which the party was engaged, lies between the parallels of 19°0′ and 20°15′ north, and the meridians of 80°30′ and 81°30′ and embraces the taluks of Narainpúr, Pertabpúr, Parlakot and portions of Dongar, and Chota Dongar, the characteristic features of which are extensive plateaux of from 1,800 to 2,000 feet above sea-level surmounted by masses of flat-topped hills, which rise to elevations exceeding 3,000 feet, the culminating point being the commanding hill of Asnar, misnamed Hachel in the triangle sheets, situated in the taluk of Chota Dongar. These high lands are a continuation of the great plateau system of Central India, which decreasing in elevation by a succession of steppes, finally break to the west into the low-lying plains forming the basin of the Godavari. A marked fall, scarped, and attaining a great altitude, in some places intersects the ground diagonally, constituting the western limit of the elevated plains above mentioned, and gradually becoming less abrupt to the south loses itself in the low irregular hills between the Indravati and Kotri rivers. The geological structure of this part of the country is of a varied and mixed kind, being composed of trap and varieties of sandstone and slate; the first occurs in the higher flat masses, while the two latter predominate in the lower hills and are distinctly separate from one another, a circumstance producing the bold, rugged and ever-changing scenery which would be pleasing but for the dull, heavy, sameness of the endless forest that completely clothes the ground from the plains to the summits of the highest peaks.

The climate of the plateau, though unhealthy during a greater part of the year, is by no means unpleasant in the hot months, and especially delightful in the months of December, January and a part of February, while the plains are tolerable during these latter months, but unbearable in the summer, the thermometer rising sometimes to 119° Fahr. under the awning of a tent. Drought is seldom, if ever, experienced in this part of the country, as the

rains commencing early in April, last till late in November, and not unfrequently, as it happened during the field season, to the end of January.

Several important streams drain the country, of which the chief are the Kotri, Nibra and Barda. The Kotri or Parlakot river is the largest, and forms for a great part of its course the boundary between Chanda and Bastar. It has the well-known villages of Pertabpúr and Parlakot situated on its banks, and after a considerable course through heavy forest in the plains, flows into the Indraváti at Bhámragarh. In the dry season these rivers are fordable at most points, containing little or no water, except where higher levels or other impediments obstruct the too rapid draining-off of their surplus water. In such localities the water obtains to great depths, which often offer serious obstacles to the Surveyor; and it is in these places that the most picturesque scenes are to be met with. The water is generally still and clear; the banks lined on either side by the most luxuriant foliage, with broken masses of rock scattered in wild confusion, and sometimes rising in a precipitous wall from the water's edge to great heights, all charmingly reflected in the calm limpid element below, make up a picture truly beautiful. Such are the favourite retreats of the larger game in the country, where the lord of the hills—the formidable bison—and his stately though less active compeer—the buffalo—withdraw during the heat of the day to refresh themselves, and where the "*pugs*" of the tiger follow on the track of his much-coveted prey whom he dares not attack openly.

In the greater part of this wild and hilly region, the villages are scattered and sparsely populated, and in many instances totally deserted for several miles in extent, the only portion worthy of notice being the taluk of Narainpúr, in which a few fair prospects, like oases in the desert, gladden the eye, and which is especially the case round and about the village of Narainpúr, itself situated on the plateau, surrounded by some of the finest patches of cultivated land in the country. It contains a mixed population of Murias and Halwis, of about 450 inhabitants, and lying on the route between Chanda and Jagdalpur, seems to be a prosperous and flourishing village. This village together with Pertabpúr, Antagar, Kolur, Amabera, Govadi, Parlakot, Dongar and Sonpur are about the principal villages in the season's work. Of these, Dongar perhaps is the next in importance to Narainpúr, and is situated also on the plateau at the foot of the rocky range of the same name; it contains about 290 inhabitants, and is remarkable for its numerous tanks in and without it, which are supposed to be 100 in number, each having a distinguishing name. These tanks, merely small ditches and ponds, most of them being omitted in the map owing to its small scale, give an importance to the village of which the people seem very proud, and to which no doubt some legend or historical event is attached.

The village of Pertabpúr is situated in the plains on the right bank of the Kotri; it is a respectable and apparently well-to-do place, the residence of a petty Raja, and the chief village in the Pertabpúr taluk. It would be as well to remark that the taluk of Pertabpúr, as well as the adjacent "mutah" of Antagar and the taluk of Parlakot, offer one of the finest fields for the sportsman. Tigers seem literally to abound here, Mr. Claudius having shot several of these destructive animals in the short space of time he was employed in it. Great damage is done by them to the cattle, and sometimes whole villages are deserted owing to their depredations. A somewhat unusual circumstance occurred during the field season in which some bullocks attached to the several Surveyors' camp were taken away in broad daylight and in the presence of their owners. Adventures with the tiger are of frequent occurrence in this part of the district, and a singular tale was recounted to me by Mr. Claudius who was close to the spot where it happened. A villager, while bathing at a stream, was startled by a noise at the back of him, and on turning round to ascertain the cause, to his great horror, beheld a tiger in the act of springing on him; his presence of mind, however, did not desert him, and picking up his wood-axe dealt the tiger a blow, burying the blade, which was about six or seven inches in length, in the animal's head; a short struggle ensuing, the man called out for assistance, and with the help of a few others despatched his enemy who was most probably in his death-throes at the time.

Parlakot is a small straggling village, also on the right bank of the Kotri and in the taluk of the same name. A petty Raja resides here who is of the Halwi caste, a very hospitable young man; he has always shown a willingness in assisting travellers on their way through his "*Ilaka*," which is about the poorest in the ground, embracing a large portion of the plains to the west and flanked by the rugged, broken and desolate hill tract to the east, has a most uninviting prospect, and is a fitter abode at present for the denizens of the forest than their more rational congeners, the semi-barbarous tribes that inhabit the district. The main routes giving access to the interior and to the capital of Bastar from the west are three in number. Starting from the station of Chanda, a road leads through Pertabpúr, Kolur and Narainpúr to Jagdalpúr, and the other two from Abiri, the one passing through Bhámragarh to Narainpúr, and the other through Parlakot, ascending a tediously long but easy ghát, leads to the same point. The first and last mentioned are practicable almost throughout to carts; other minor tracks branch from these and lead northwards to Dhamtari in the Raipur district and south to Byramgarh and Kutru, in the area surveyed last season. The tribes composing the population of the country are the Halwi and a section of the Gond family, called Maharias or Murias. The former seem to be a sect of Hindoos, settlers from the Central Provinces of Raipúr and Bilaspúr; they are an intelligent people, dress well, and are generally land-owners. Their language is a kind of Hindustani which sounds pleasant to the ear. Their customs and rites are simple and common to other Hindoo races, in which there is nothing remarkable. They barter for their wives, and their dead are usually burned. The Maharias of the hills or the Murias of the plains are in every respect like their brethren the Kois and Gotwars, having the same rites and ceremonies which are in some instances modified by contact with other races.

They are a hardy, simple race of people, extremely shy and reserved, which is especially the case with the hill Maharias, who, as Captain Holdich has remarked, make very untrustworthy guides, in which capacity their only object is to get rid of the traveller at the first village they come to, whether that village be on the proper route or not, and it was owing to this circumstance that communications were so difficult to maintain during the past field season. It was not an unusual thing for our messengers, who ignorant of the language spoken by this wild people, which is sometimes unintelligible even to those who have resided in the country for years, to be guided back to the place whence they started, after rambling about the country for a whole month and without having attained the object with which they set out, though the time it should have occupied them with proper guides ought not to have exceeded a couple or three days.

Among their festivals I witnessed a dance which is performed in celebration of the new year, and which takes place in the month of February. A number of men fantastically dressed for the occasion with peacocks' feathers, beads and parti-colored rags, and having small drums attached to their waists in front, form a ring round the women, who, with linked arms, sway to and fro, clapping their hands to a monotonous ditty, within the circle, while the men move round, oscillating with measured steps from side to side, something similar to the movement in the mazurka, with remarkable regularity and precision, which they vary at the command of one of them, who constitutes himself the master of the ceremony, beating their drums in accompaniment. This dance is, I believe, peculiar only to these people, as I have never heard of it in any other part of the Central Provinces. I also noticed a circumstance connected with their funeral rites, which has been mentioned in previous reports, but the truth of which was not established before. On several occasions I remarked the charred appearance of certain trees, and on enquiry learnt that the custom among the Maharias is to fasten their dead to a tree which is usually the "*Bassia latifolia*," and piling combustibles around reduce the body to ashes. Large rough slabs of stones buried perpendicularly by the roadside mark the last resting-places of the ashes of the deceased, and are the only memorials of the kind to the north of the Indravâti.

The produce of the country is the same as elsewhere in Bastar, and has been given in my notes of the country of last year. The teak of previous seasons has given place to the "sâl," which is to be found covering extensive areas, whilst the teak is met with in small isolated patches distinctly apart from the other, a remarkable feature in the distribution of these trees, the former preferring localities where the aqueous formation is apparent, and in the latter in soil composed of trap and other igneous and metamorphic rocks.

A few old forts curiously perched on the tops of hills and of very ancient date exist, one on a hill close to the village of Parlakot, and another on Binapal Hill Station. In the "mutah" of Antagar, with one or two others, are the only archæological remains the country possesses, of which nothing relative to their history was obtainable.

Extract from the Narrative Report of LIEUTENANT-COLONEL G. C. DEPREE, *Deputy Superintendent, in charge No. 4, or North-Eastern Division, Central Provinces Topographical Survey.*

The last Narrative Report.

Since, therefore, this narrative report of the No. 4 Topographical Party is the last which will be submitted, and since I have been associated with the party from its organisation up to the present time, a period of 22 years, I venture to think that a brief history of it may not be here out of place.

Organisation of the No. 2 Party, Ganjam Survey.

This party was organised by myself in 1856. The old Madras Topographical Survey quartered at Cuttack being divided into two parts, one-half the party became the nucleus upon which was formed a complete party called the No. 2 Ganjam Topographical Party, and it recessed at Cuttack.

Names of officers in charge.

The organisation having been completed early in the year 1856, Mr. John Dyer, Great Trigonometrical Survey, was deputed from Mussoorie to assume charge, and to take it to the field in the Sambulpur district. Mr. Dyer was however soon transferred to a civil appointment in 1857, and Captain G. H. Saxton on return from furlough held charge, from September to October 1857.

Captain G. H. Saxton.

From that time up to the present date I have held charge, with the exception of fifteen months in 1858 and 1859, and of two years from 1868 to 1870.

Quartered at Cuttack.

From 1856 to 1860 the party retained the old name and number, and remained quartered during the recess at Cuttack. It was constantly employed in detail surveying, except in 1858, when the state of the country consequent on the mutiny rendered it unadvisable to enter the Kolhan; it was instead ordered to lay out and observe a series of triangles for the purpose of defining the coast line of the Bay of Bengal, a work which had been abandoned by the Coast Series party of the Great Trigonometrical Survey.

Employed on the triangulation to define the coast line of Bengal.

Mr. J. O. Nicolson.

In the year 1858-59 Mr. J. O. Nicolson, Civil Assistant, was transferred from the Great Trigonometrical Survey and appointed to the charge of the party during my absence on sick leave.

Party transferred to Dorunda.

On my return the Cuttack Division having been completed and that of Nagpore being in progress the recess station was changed from Cuttack to Dorunda, the military station of Ranchi, and the name of the party was altered to the No. 4 Topographical Party, Chota Nagpore "Division Survey."

The detail survey of the Chota Nagpore Division, including the Tributary States belonging thereto, continued to be systematically mapped until completion in the year 1870.

Lieutenant M. T. Sale.

During the two years 1868-70, Lieutenant M. T. Sale, R. E., was appointed to hold charge of the party during my absence in England.

Party transferred to Mussoorie.

In 1870-71 the survey of the State of Sohagpúr of Rewah, and of the Mandla district, and of parts of the districts of Bálághat and Biláspur was taken in hand, the party being ordered to recess at Mussoorie.

Name changed.

The name of the Party was again changed to "No. 4 Topographical Party North-Eastern Division, Central Provinces Survey."

Transferred to Simla.

In 1876-77 the remaining area of the Central Provinces was completely mapped, and the party already reduced to nearly half strength, has been transferred to recess quarters at Simla, where it will be amalgamated with the No. 7 Topographical Party, and the name of the "No. 4 Topographical Party" will cease to exist from 1st October 1877.

Area of country surveyed during 1856—1877.

During the 22 years of its existence, the No. 4 Topographical Party has triangulated and mapped on a scale of one inch to one mile, a tract of country extending from the high-water mark of the Bay of Bengal at Balasore to a point nine miles east of Jubbulpore. This tract extends for nine degrees of longitude, and on an average for two degrees of latitude, and its area aggregates nearly 52,000 square miles.

Description of country surveyed.

This area consists of country hitherto unsurveyed, except only the States of Sohagpúr and Ramgarh, mapped on a small scale in 1841 by Major Wroughton.

Description continued.

The difficulties overcome have been of no ordinary nature; for the tract of country is a continuation of the Vindhyá range which crosses India from Bombay on the west towards Calcutta on the east and thence turns southwards to Madras, forming everywhere the watershed between the great river systems that run into either the Bay of Bengal or into the Indian Ocean about Bombay. The land is almost entirely a series of plateaux of one uniform height of between two and three thousand feet above sea level, the highest point rising to a little over 4,000 feet, and the lowest, the bed of the Nerbudda river near Jubbulpore, to about 1,300 feet. The whole tract is wild, hilly and inaccessible, for it is destitute of roads, and it is inhabited by an aboriginal population of Koles and Gonds, including many different minor tribes. Except where small communities have cleared spaces for cultivation around their villages, it is covered with heavy forest, where wild animals abound and malaria is ever-present.

Large-scale surveys.

In addition to the survey of country on the one-inch scale, eleven Government reserved forests have been mapped on the four-inch scale.

Names of divisions, districts and States surveyed.

Besides sundry outlying portions of the Cuttack Division and of the Central Provinces, the following States and districts have been surveyed :—

List of Districts and States surveyed by the No. 4 Topographical Party between the years 1856 and 1877.

Division.	District.	State—Perguunah.
Chota Nagpore	Singhbhoom	Kolhan.
		Kharsáwa.
		Porábát.
		Saraikela.
		Dhalbhoom.
Ditto	Chota Nagpore or Lohardugga ...	Chota Nagpore.
Ditto	Tributary Mehals	Bonai.
		Chang Bhokar.
		Gangpur.
		Jushpur.
		Korea.
		Udepur.
		Sirgoojá.
Raipur	Biláspur	Korba.
		Uprora.
		Mátim.
		Lafa.
		Churi.
		Pendra.
		Kenda.
		Kori.
		Pandariya.
		Kawarda.
Rewah	... ..	Sohagpúr.
		Singwara.
Nagpore	Bálághat	Kini.
		Bhânpur.
		Bijagarh.
		Chauria and others in part only.
Jubbulpore	Mandla.	
	Rámgarh.	

Alphabetical lists and villages.

Alphabetical village lists have been compiled of each State, areas calculated, and the number of houses counted, and the whole arranged in a compendious form as a Gazetteer for each of the Standard Sheets. The Chota Nagpore Division survey covers seventy-five Sheets of 30′ longitude by 15′ of latitude; and the North-Eastern Division, Central Provinces Survey forty-two. The full details of Sheets Nos. 1 to 23 have not been arranged with the completeness of subsequent Sheets, but total areas and numbers of villages, &c., have been calculated for the several States, *vide* printed Report, Geographical and Statistical, of the Chota Nagpore Division and Singhbhoom District by Captain G. C. Depree, dated July 1868.

Number of Standard Sheets of the Chota Nagpore Division and of the North-Eastern Division, Central Provinces Survey.

Names and nature of the country surveyed.

The country surveyed consisted principally of the Bálághat district, of a small part of Bilaspur on the south, and of Mandla district on the north. Without any exception, it was hilly, difficult and thinly inhabited; the part to the south contains only about 17 souls to the square mile. The Revenue Survey had previously surveyed all the low, well-cultivated country, the limit of their work being conterminous with the hilly, bad ground, which in consequence fell to the share of the Topographical Survey.

Pándra-tola forest.

The Pándra-tola forest was finally surveyed, thus completing the series of reserved lands in the Central Provinces, which have fallen within the area of ground undertaken by this party. These forests number eleven in all. The forest in question consists of a narrow strip of land bordering the left bank of the Wainganga river in the Bálághat district. It consists of small teak forest and of irregular ground, a good deal cut up with water-courses, and otherwise not susceptible of cultivation. The area is 4,817·0 acres or 7·5 square miles.

The water shed of India surveyed.

The country delineated on the south continues as a part of the backbone of India. In Sheets Nos. 33 and 34, &c., the streams on the north are affluents of the Nerbudda, and those on the south run into the Wainganga, which two rivers enter the sea on opposite sides of the Peninsula.

Definition of boundary between the Mandla and Bálághat districts.

The boundary line between the south-west of the Mandla district and the north of the Bálághat district has long been a standing difficulty, owing to its passing over a very difficult, deserted and inaccessible country. In 1875-76, a Deputy Commissioner and an Assistant Commissioner were deputed to define this boundary with permanent marks, but they eventually left the ground without effecting any thing. Meanwhile, the country in question had been finally mapped by this party, and the true boundary duly surveyed. In order that the opportunity of defining the boundary on the ground might not be lost, and to prevent further uncertainty, I offered to go over the boundary, and affix permanent marks. The Chief Commissioner, Central Provinces, was pleased to accede to my offer, and the work was accordingly carried out with an expenditure of nine days' labor. The boundary-marks thus fixed have been entered on the Survey maps.

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

The Vindhyá range runs generally east and west through the centre of the portion surveyed, and varies considerably in conformation, at one part being well marked and narrow, at another very precipitous and broad, and at another very much broken up. Throughout its length it is covered with forest jungle. This season nearly completes this remarkable range. It has been carried on to the west by the Khandesh Survey. A portion of it again enters our work further west. Three water falls, showing the abrupt nature of some part of the scarp, were met with this year in Mr. Hamer's and Mr. Wainright's portions. Two of them were measured by me and found to be 200 feet and 430 feet in actual drop, the rope for measuring the depth being only at arm's length from the point where the water fell. The rope, with stone attached went to the bottom without anywhere touching the rocky wall. The third was 350 feet deep, as measured by the falling of a stone to the water beneath. On looking from the scarp of the range to the south and over the valley beneath, it looks like one flat sea of a dense forest jungle, with but a few low hills to relieve the monotony; not another feature of any kind can be seen, not even does the Nerbudda anywhere show that it is in existence. The Valley of the Nerbudda to the north of that river surveyed this season, consists of flat country, covered with dense forest, tall trees, breaking up into deep ravines near the river-bank. That portion belonging to Dhar territory bounded on the east by the river "Khári" and on the west by the "Kánár" is exceptionally wild in its nature and almost uninhabited, and only frequented by wood-cutters that seem to come from all parts of the country when out of employ, to cut timber which they sell at Indore. There is only one outlet for them from this piece of wild country and that goes through "Kila Mohára" gate, where they have to pay toll to both the Indore and Dhar States on each bullock-load of wood. The forest does not appear to be in the least taken care of, and yearly the grass is burnt down to strengthen the new grass for grazing purposes during the rainy season. The fire must destroy all the young plants before they have time to grow.

The trees of these forests are tall: sometimes exceeding 110 feet: the names of some of the trees to be got there are:—

Ebony,	native name	"Tendu," yields a sweet fruit in May or April.
„	„	"Anjan," timber wood.
Teak,	„	"Sāgon," timber wood.
Bengal Quince	„	"Bel," fruit is medicinal.
„	„	"Mohwa," flowers fall in March; spirit extracted.
„	„	"Baher," the nuts yield a yellow dye.
„	„	"Al," yields a red dye.
Indian cotton tree	„	"Semal," tree yields a gum; part of the flowers are eaten by the natives; the cotton used for stuffing quilts.
„	„	"Gular," fig tree.
„	„	"Bija," timber tree.
„	„	"Sáj," ditto.
„	„	"Kohu," of little use.
„	„	"Kulu," of no use.
„	„	"Salai," pitch made from its resin; also "Khair," "Jamlasi," "Astra," "Phási," "Chironji" (fig), "Gorár," "Gubdi," "Malsajur," "Sájur" and others of less importance.

City of Dewas.

Dewas city has an area of about half a mile square, is divided into two divisions, belonging to Rájá Kishanrao Paowár and Rájá Náraindrao Paowár (or Bara and Chota Pánti), and is situated to the south and at the foot of an isolated hill north-east of, and 24 miles from Indore, and on the Great Deccan Road, between Bombay and Agra. The hill is remarkable as being a sacred shrine belonging to the goddess "Chámandi." A road is being laid down from Dewas to Sehore; a portion of it has been surveyed this season; the remainder had not been laid out when that part of the country was being surveyed. There is a post office and rest-house at Dewás.

Rivers.

A portion of the Nerbudda forms our southern boundary, and has in part been already described. Opposite the village of "Dhári" there is a considerable rapid having a drop of about 15 feet. There is also a waterfall near "Jinerám" village, having a drop of at least 20 feet; the whole volume of water here falls into a deep narrow channel, only a few yards wide. This river is, except at the ferries noted below, only navigable by canoes, each of which is cut out of a single tree. Other rivers are the "Khári" and "Kanár," east and west boundary of Dhar territory. The "Datni," "Chandkesur" and "Chural," all have their sources in the Vindhya range and flow into the Nerbudda.

Ferries and fords.

There is a ferry of one boat opposite the village of Rájodi. A much frequented ferry between Futegarh and Joga of three or four boats. This is the line of communication which connects the G. I. P. Railway Station of Harda with the Nimáwar pergunnah, and by which the surplus produce, chiefly grain and oil-seed, of that pergunnah is conveyed to Bombay. A ferry between "Dharanpur" and "Panghát." A ferry at Dhári above the waterfall, being the line of communication to Pánára. Ferries at Rampura and Bakatgarh; these ferries are used for conveying wood across from Pánára forest on south bank of the river. A ferry from Kotah to the well-known island of Unkárnáth. There are fords at several points of this portion of the river; but these are only fordable in the dry weather.

The inhabitants north of the Vindhya range are of the same class as those met with last season.

Product, soil and cultivation.

Opium is much grown north of the Vindhya range; also cereals of sorts. On the sandy islands of the Nerbudda a good deal of the castor-oil plant is grown. The portion of the valley of the Nerbudda surveyed this season is very scantily cultivated, and only sufficiently so for the consumption of the few inhabitants that live there.

Report on country triangulated by LIEUTENANT ST. G. C. GORE, R. E., *during Season 1876-77.*

The ground triangulated during season 1876-77 lies between the parallels of 22° 30′ and 23° 30′, and the meridians of 75° and 75° 30′. It comprises the greater portion of the Dhár territory, the Amjhera district of Gwalior territory, portions of the Ujain district of Gwalior territory, and part of the Ratlám and Selana territories.

Physical conformation.

The range of the Vindhya hills continues to form the southern boundary of the work. In most places they do not project above the level of the plateau to the north, and consequently when viewed from the plateau they merely present the appearance of a few small isolated hills. It is not until one is quite at the edge of the plateau that the broken character of the ground appears. Mid-way between the towns of Dhár and Amjhera there runs a low ridge which extends northwards some 30 miles. The point where this ridge emanates from the Vindhya range is the water shed of three of the river systems of India. On the south runs the Nerbudda. On the north-east rise the Chambal and Chamli rivers, which, uniting near Barnagar, run down into the Jumna. To the north-west rises the Mahi river, which, after running towards the north, bends round towards the south-west, and, after draining a large extent of hilly country, empties itself into the head of the Gulf of Cambay. The above-mentioned ridge is composed chiefly of basalt, and is remarkable for the number of constantly running streams which rise on its western slope and empty themselves into the Mahi. The country along the banks of the Mahi river is very much broken up, and in parts covered with heavy jungle.

The staple product is, as is usual throughout Malwa, opium. A fair quantity of grain is however grown, especially in the Dhar territory.

Cultivation.

A considerable quantity of the opium was this season entirely destroyed in certain districts by a heavy hail-storm which fell on the 7th February.

The only inhabitants who call for remark are the Bheels, who live in the broken ground on the banks of the Mahi. They are apparently very timid, and often desert their villages when one approaches. Their reputation for honesty is not great.

Inhabitants.

The only large towns which were met during the season were Dhar and Rutlám. Dhar is situated among a number of low hills, from which it is completely commanded. There is a well-built but very old-fashioned masonry fort flanked with numerous towers. It stands immediately to the north-east of the town on a small isolated hill. If properly defended, it would be impossible to take it by assault without previous bombardment and breaching. At present there is an unrepaired breach on the south-west face, which is however not quite practicable.

Principal towns.

Rutlám is a large and thriving town. The principal streets are broad, clean and well laid out. It is a very favorable specimen of an Indian town, and has a well-cared-for appearance, due I believe to the exertions of the Political Agent, Mir Shahamat Ali. The Holkar and Neemuch State Railway is to pass through Rutlám, and is in a fair way towards completion up to that point.

The cantonment of Sirdarpore also lies in the season's work. It is situated in the Amjhera district of Gwalior territory, and is the head-quarters of the Malwa Bheel Corps.

Extract from the Narrative Report of the Naga Hills and Lakhimpur Expedition Survey Party, by LIEUTENANT R. G. WOODTHORPE, R. E., *Assistant Superintendent in charge.*

On the 12th January 1877, Mr. Ogle and I left for the Tenga Pani. We arrived at the mouth of that stream the next day, and on the morning of the 14th reached Latao, the first Singpho village we had seen. It is a comparatively large one containing 30 houses, 8 or 10 being the general average. The headman we were told had gone across to Ningro Saman's village, Munglang, on the Noa Dihing, expecting to meet us there; but in his absence his wife did the honors of the village, and paid us a visit shortly after our arrival, dressed in her best, and attended by other women and several of the more important men of the village, and presented us with rice, fowls and eggs. We made enquiries about the hill, and were told it was close by, so we went off to see it. It turned out that the interpreter thought any little rise would satisfy us, and we found ourselves conducted to a low knoll, the end of a long spur from Manabum. Explanations ensued, and we learned that our best way of getting to the ridge was to go up the river about two hours' journey, when we should find a spur running down to the water's edge which would guide us to the highest point on the range. We left Latao the next morning, and found the spur as the Singphos had said and commenced to explore it; the thick canes and bamboo jungle impeded us much, and the tracks of wild animals crossing each other in every direction were very perplexing; so even with the counsels and assistance of our Singpho friends we made but little progress, and the evening found us still far from the hill, having only gone ¾ mile from the river. A Duania who was with us and a Khasia climbed up a tall rubber tree with surprising dexterity, but the highest part apparently only commanded a view of the neighbouring jungle, and they came down without any better idea of the direction we ought to take; so we returned to our camp on the river for that night.

The next day we resumed the trail, and at mid-day were rewarded by finding ourselves on the range, and water close by. Our coolies set to work; but several hours' hard work made but little impression on the thick bamboo clumps and trees of great girth that covered the hill; the next day we took up all our coolies with light baggage and encamped on the top, and there we remained for ten days, selecting and clearing points and building ladders up tall trees only to find, when we reached their topmost branches, that our labor had been vain, and that we must seek elsewhere for our stations. We had several good climbers among our coolies and klassies, and we used to send them up the highest trees to report on the view from them before commencing any operations. The range is nearly level along the top with no commanding points anywhere; it is sinuous, and covered everywhere with tall forest trees filled in with tangled undergrowth of bamboo and cane, through which we cut at the rate of 300 yards an hour, and much useless labor was expended by frequently following what seemed to be the ridge, but which turned out after a couple of hours' cutting to be only a spur. We found it would be impossible to get two suitable points for stations, and confined ourselves to one we had fixed upon at the first, and at which our coolies had been working for some time. When the platform had been built in a big rubber tree at a height of 108 feet from the ground, a magnificent view of all the hills surrounding the head of the valley was obtained; the lofty snowy peaks rising immediately behind the outermost ranges looked so close that we could almost fancy we could throw a stone on to them. Notwithstanding the fine elevation of our platform, we were still under the necessity of cutting down big trees a quarter of a mile off on obscure spurs before we could see all we wished. We got the mark up and all our observations finished by the 27th, when we again moved camp and went in to Sadiya on the 28th to make our arrangements for carrying on our work on the Noa Dihing and also to see Colonel Graham, the new Deputy Commissioner, who had gone to Sadiya for the "*mela*," which took place on the 31st January and 1st and 2nd February.

Our correspondence, observations, &c., detained us at Sadiya till the 6th, when we again left for Noa Dihing Mukh, where we had a godown built, and all the supplies we should require up to the middle of April, stored. From this place we went on to Wakidgáon, arriving there on the 10th February. Our intention now was to get up to Captain Samuell's points of Honkap and Máum and extend his triangulation eastward. Honkap was not visible from Sadiya or Manábum Hill Station, but Máum was; and this point we intended to connect with the two former. The headman of Wakidgaon was away, but his deputy gave us an empty house at once as a godown, and in this the "*russúd*" we had brought in our boats was stored, the boats being sent back to bring up the rest, as our journey was to be overland from Wakidgaon *viá* Bisa, for which place, taking one month's supplies with us, we left on the 11th, reaching it on the 12th. As it was still early when we arrived, and being unwilling to waste any time, we determined to push on to the Dihing. The headman Banka had accompanied Mr. Jenkins to the Nonyang lake in 1869, and I asked him for a guide to Honkap, which, together with the neighbouring Nágá villages, are under his rule. He said that the young men were all out in the fields then, and that he could not get them in before night, but he would give us a couple of guides in the morning. This seemed all right, and I gave orders for the camp to go on, telling the interpreter to remain behind till the morning for the guides, who could easily overtake our laden coolies. Shortly afterwards, on asking about the path to Honkap and the guides, Banka seemed to hesitate. I asked if he could give us men who knew the way, and the interpreter answered: "If the Rajah gives the order, a hundred men will go." I replied that we only wanted one man or, at most, two. Banka then said he had no parwanas, "not even from the Darogah, at Sadiya." I showed him those Major Clarke had furnished me with; but they were addressed to all Singpho and Khamti chiefs on the Noa Dihing and Tenga Pani rivers, and he laid stress on the fact that his village, though close to the Noa Dihing, was nevertheless on the Kheram Pani, and consequently the parwanas requiring chiefs to assist me did not apply to him. At last, however, he agreed to give a man, and immediately disappeared into a hut, and we saw him no more. I may mention that this was the only village where I found it necessary to produce my parwanas in order to procure assistance, which was generally most cheerfully given.

Next morning the guide overtook us at a village called Jagun, where he picked up another man, and we went on to the Namchik river and encamped at its junction with the Buri Dihing, the Namrup of the old maps, though why it was called so I am unable to say; the Khamties and Singphos insisting that that is not and never was its name, being known to them as the Namphuk or Jangtuk. My informant told me that Namrup was a name given to it by Mr. Jenkins; but this is evidently wrong, as Wilcox spoke of it as Namrup many years before. Our camp was close to the petroleum springs visited by Captain Hannay in 1845. He says of them: "the hills" (they are such slight undulations as hardly to deserve the name) "here are also intersected by ravines, and in one spot, an extensive basin; a hollow is formed at some height which contains muddy pools in a constant state of activity." The mud is of a pale grey color, through which the petroleum continually bubbles up, heaving up the mud in all directions, while the ground around is like a quicksand. Innumerable traces of elephants, tigers, deer and other animals are seen everywhere in the neighbourhood of these springs. In some places the petroleum is discovered floating in little pools of clear water among the rocks, and it is then of a bright brown color.

At our camping place, we found a party of Nágás engaged in a hunting expedition, and two of them, after a good deal of haggling, agreed to show us a shorter way to Honkap than was known to the Singphos. The elephants had got into trouble in the jungle through which our path had come, and did not get up to us that night. Some rice bags were torn also, which necessitated a stoppage, and the animals did not turn up till noon next day. We were told that elephants could not get any further, and so we lightened all our loads as far as possible, and started with coolies only. We had now to carry the police baggage, ammunition and supplies, as their only carriage was elephants; this brought rather a strain on our Khasia coolies, and we were only able to take away a few days' supplies with us. We camped that night on a small island-patch of grass and shingle in the Khatong stream. The leeches simply swarmed in these jungles, and the space was rather confined on the island, but one of our klassics amused us by saying,—when it was proposed to him by some friends of his to go to the mainland and encamp where there was more room,—"certainly not; on this little island there can only be a certain proportion of leeches to each individual, whereas on the main land there will be an unlimited number to each of us." The next morning, early, we came upon the Namchik again, and followed it up till the afternoon, when we commenced the ascent to Honkap. We arrived at the village about 5. P. M., and encamped near it in some old "jooms." Honkap is a wretched little village of nine or ten houses on a badly cleared site, small shrubs and stumps of trees standing about among the houses.

The next morning, early, we sent back 40 coolies to bring up more "*russúd*" from our depôt at Namchik Mukh. With the remainder and a few Nágás we went up to Honkap Hill Station and set about clearing it. We questioned the headmen as to the road to Máum. These hills are quite different to the Nágá hills further west; they are covered with very thick tree jungle. The villages are few, small, and far apart, the paths between them very obscure, and little or no cultivation to be seen except here and there near a village. The villagers evidently had no grain to spare for us, nor could they assist us in the way of carriage. The road to Máum was long and tortuous, and the hills to the east entirely uninhabited. To reach Máum, and clear, we should have to take at least a fortnight's supply with us; and this was utterly impossible with our small body of coolies, and elephants were

out of the question. The only thing we could have done would have been to halt every other day and send back our men to bring up the "*russid.*" In this way it would have taken us so long to reach Máum, that probably we should have exhausted our supplies before we had done any useful clearing. It was very reluctantly that we came to this conclusion, but it forced itself upon us, and we saw that, late in the season as it then was, the best, indeed only thing to be done in this jungle-ridden country in which no plane-tabling could be done, was to retrace our steps to the lower ground and determine by actual measurement the course of the Noa Dihing and other small streams hitherto unexplored, and fix the positions of the villages which we knew lay scattered about in the plains, but of which no sign was visible in the apparently unbroken mass of forest at our feet. As the Namchik and Namphuk flow on either side of Honkap ridge, and neither had been surveyed at all accurately, we separated on the 19th February, Mr. Ogle undertaking to survey the Namchik, and I the Namrup. I reached that river in the evening, and next morning commenced work from Namphuk village.

The survey of the river was difficult, as in many places it was too deep for wading, and the banks were impracticable at those parts, and we had to resort to rafts in some parts where long deep pools lay between precipitous rocky banks, along which, before we constructed rafts, it took us three hours to make a quarter of a mile of way. On the 26th, Mr. Ogle rejoined me at Jagun, and together we carried on the survey of the Dihing as far as Bisa, where we connected it with the Revenue pillar, or rather what was pointed out to us as its site, the pillar itself having long since disappeared under combined attacks of the village domestic animals and children. We reached Bisa early in the afternoon of the 27th, and remained encamped there till the next morning, when we went into Wakidgáon. Banka did not show himself while we were at his village, and I understood he was absent at a merry-making in the neighbourhood. I was therefore surprised to learn from the interpreter on starting that he had been in the village all the time, but had declined to go and see me unless I sent for him. Having no particular wish to see him, I told the "dobashi" to let him know that I should report his conduct to Colonel Graham, as it presented such marked contrast to the usual reception accorded to us by the Singpho and Khamti Chiefs generally.

We remained at Wakidgaon till the 7th, despatching correspondence, pay bills, &c., and making arrangements for sending a month's supplies round to Chaosamgaon on the Tenga Pani, to which place we intended to work our way round by different routes. Mr. Ogle, starting from Munglang, near which a Revenue Survey pillar gave him an initial point, was to follow up the Jengthu river, and crossing the Manabum range near its sources, proceed to Latoh,* while I tracked the Noa Dihing up from its junction with the Buri Dihing as far as possible, and then crossed to Latoh. We separated again on the 7th March, arriving at the point where the Noa Dihing bifurcates. I commenced on the 9th to survey down the river. The day was fine, and we had no difficulty in wading across the river where necessary, and by evening I had done about 4 miles. Next day was wet, and the rain hindered my work, so that we did not accomplish 3 miles. The river was rising slightly; and as I was dressing on the 11th I heard a commotion; running out of my tent I saw it was caused by a deer which attempted to cross the river above our camp, but had been carried away by the rising stream. The elephants were coming across from the opposite bank, and headed the deer towards a shallow part, and a crowd of coolies and klassies rushing in, seized and brought him on shore in triumph, when he was speedily killed and transferred to the larder. This day again was wet. We reached the Buri Dihing Mukh in the evening, and fortunately found a high bank for our camp, for heavy thunder-storms raged, and the river rose 3 feet during the night. The rain continuing with only short intervals of fine weather, we were detained at the camp for two days, as I found it impossible to get more than 1 mile done each day, the swollen state of the river necessitating my crossing and re-crossing my chainmen and flagmen at every few yards, a work of time, as I had only two boats with me, the remainder having been sent with the stores to Chaosamgaon. Several small streams fall into the Dihing near here, and these I explored for a certain distance up each. They are narrow and shallow in parts, but frequently we came across long deep pools, through which it is impossible to wade, and the jungly banks being almost impassable, our progress was rather slow. Had I followed up all these streams to their sources, no time would have been left for anything else, and being small, and of very little importance, I did not consider they were worth wasting a season on. Should an extension of the survey be made in these parts, and it is considered necessary to have a more accurate record of these streams, the survey of them should be entrusted to Native Surveyors, who would do them at a comparatively small cost in the driest part of the season before the early rains set in. I then returned up to the Noa Dihing to continue the survey of that river.

* Latora of the old maps.

Such was the result of the heavy storms which now raged almost daily, that it was difficult to recognise the river we had gone down so lately; what had then been perfectly dry channels, were now foaming torrents, and the places where we had waded little more than ankle-deep in water, could now only be crossed in boats. The Noa Dihing divides up into several big channels above the point of bifurcation, and the weather being against us, I did not reach the Pakan Pani till the 29th March, having made one digression to Namphai, a village about 5 miles south-west of Bishigaon. I was detained at this village for some little time, as the river again rose so suddenly one night that I could not cross my camp to go to Namphai; and as this was the last village in that direction, I was anxious not to leave it undetermined. The current here was so strong that the boats were swept down a quarter mile on casting loose, and the boatmen refused to run the risk of crossing coolies and baggage. From several observations I found that the stream was

running at the rate of 9 miles an hour, and this not at the rapids. The stream is full of "snags," and is exceedingly dangerous when full. Three houses were blown down in Bishigaon during a storm one night while we were there. Our camp was fortunately in rather a sheltered nook at the foot of a low hill, otherwise our tents and leaf huts would have stood a poor chance. Mr. Ogle's route brought him to within a few miles of Bishigaon while I was there, and we saw each other for a few minutes on the 25th March, parting again till the 4th April, when I rejoined him at Latoh. I was delayed longer than I had expected by having to halt on the Pakan Pani and send all the coolies to cut an onward path for several miles after leaving this stream, the old path having got quite choked with the tangled cane jungle which there grows most luxuriantly. From Latoh we worked down together (taking different portions of the stream) to Palumpangaon, a large Khamti village, where we arrived on the 6th. We halted on the 7th to do some work in the neighbourhood, and finding we were only two days' easy journey from the Brahmakund, we determined to pay this famous spot a visit, and see what facilities the country offered for an extension of the survey in that direction. We arrived there early on the 10th, a heavy storm having delayed us the day before.

This place has been so often described, that I should only be repeating by saying anything about it here, beyond the fact that we were much disappointed in it, and so indeed were most of the Hindus with us, with whom it had been the height of ambition to see the "Pansaram Kund" as they called it. Many utterly refused to believe for a long time that this dirty little pool among the rocks with a few red rags on long sticks rising out of it was really the sacred pool which had existed in their imagination as a most gorgeous place, marble bathing ghâts and fine temples towering above a large lake. On the 12th we again reached Palumpangaon, and on the 13th left again for Chaosamgaon, or Chankam as it is variously called, Mr. Ogle surveying the land route while I explored the river.

We halted at Chankam for three days for correspondence, &c., and had a visit from Lieutenant Harman, R. E., who had been to look at Manábum to ascertain its suitability for a Great Trigonometrical station, and hearing at Lathao that we were only a few hours' journey higher up, came on to talk over matters. On the 18th Mr. Ogle and I left Chaosamgaon to explore the Mora Tenga river, the Khaiki and other small streams flowing from Manábum into the Tenga Pani. We connected our work with the Hill Station on Manábum, and took our final observations from that place on the 27th. I had arranged with Lieutenant Harman to take the third angle from there of the triangle Sadiya, Saikwa, Manábum, and had sent heliotropers to the two former stations. Lieutenant Harman also said he would leave a heliotroper at Manábum till he had observed to that place from Sadiya and Saikwa. When we arrived at Manábum, we found that this man had left (under a misapprehension as we afterwards learnt), and concluded that the other two angles were secured. We could not get the heliotrope at Saikwa to show out at all for two days. On the third, when we were despairing of seeing it, and thought that at any rate the other two angles would be sufficient to check our position as fixed from the Sadiya base, we caught sight of a slight flicker among the trees. By dint of intent watching, we at last got the angle, and on the 28th April arrived in Sadiya. Mr. Ogle visited the Saikwa station to ascertain the cause of the heliotrope having shown so feebly from that place, and found that the line was not open to Manábum, and we had only seen the heliotrope from its being put on a lofty platform. The jungle was much heavier than Lieutenant Harman had anticipated, and the line was not fairly opened up last season. However, the angles we got will be quite sufficient to fix all our points satisfactorily.

On the 30th April we left Sadiya for Dibrugarh. We stayed for a day at one of his points near Pubha with Lieutenant Harman, whom we found exceedingly weak and ill from a sudden and severe attack of fever. One of his assistants, Mr. McCarthy, joined him in the evening, and as he was much better the next morning, we went on our way to Dibrugarh, arriving there on the 3rd. We left again on the 8th, and reached Shillong, Mr. Ogle on the 15th, and I on the 24th May.

The results of the season's work are as follows:—717 square miles of country have been mapped, and a large number of points fixed by triangulation, enclosing an area of 2,000 square miles. The positions of 37 villages not previously fixed have been determined, and 250 miles route survey and traverses been run. With the exception of the last mentioned piece of work, of which Mr. Ogle did about 140 and I about 110 miles, it is impossible, from the nature of the survey, to separate the work performed by each of us.

General description of the country, &c.

A glance at the map forwarded with my letter dated April 15th, from Chaosamgaon (*i. e.*, a trace of our work), will show that the Noa Dihing is the principal river in the country surveyed by us. This stream throughout the portion mapped by us is a succession of strong rapids and deep pools, and full of "snags,"—tall trees which have been rooted up and carried down in floods. These are so numerous as to make the river when at all swollen exceedingly dangerous to navigate. One day I passed up a certain portion, and noticed an immense bare tree whose trunk was fully 80 feet long lying in mid-stream. A few days afterwards, passing down again, a rise of a foot or so in the river had enabled it to carry this tree a couple of hundred yards lower down. Our boatmen used to excite our admiration by the skill with which they managed their frail "dug-outs" as we were carried down the stream; now dancing along over regular waves down a boisterous rapid, whose rush is so great as to form a trough in the centre down which we are swept, the water at the banks being above the level of our boats; now hurrying along a smoother, but still violent course; here and there huge columns of foaming water showing how angrily the stream resents the obstruction offered to its progress by the large roots of a fallen tree, round which a whirlpool rages, and into which it seems our boat

must inevitably be drawn, when, lo! a dexterous turn of the wrist by our steersman, and we have glided safely past the threatened destruction. It can readily be supposed that these "snags" accumulating in floods and blocking up the river divert it into other channels, especially where it emerges from the hills into the liberty of the plains, and finds nothing to prevent its choosing its own course. One new channel of several miles in length, the Noa Dihing has lately made for itself west of Bishigaon, the old and new channels forming a loop ¾ mile broad, the upper one, *i. e.*, the new one, running for a greater portion of its length through forest land at a higher elevation than the corresponding portion of the old channel, and indications are not wanting to show that it will probably soon take its course even south of the new channel again, and go wandering away altogether from its present bed, when its communication with the branch running past Wakidgaon may be cut off altogether. In Wilcox's time the whole volume of the Noa Dihing found its way to the Brahmaputra through this channel in the cold season: he says "the opening now called the New Dihing was very gradually enlarged by the influence of successive rains causing an equivalent diminution to the ancient Dehing, the old communication with which has no water in the cold season, and, indeed, the name of Buri Dihing might fairly be dropped in favor of the Namrup from which it derives its present supply."

Now, however, the case is the reverse. In 1841 Captain Vetch, Political Agent, Upper Assam, wrote:—"Visited point where the Buri and Noa Dihings break into separate rivers. I found the mouth of the latter just filling up with stones and drift-wood, and the Singphos seem to think this channel will close in a few years, and this will send the whole of the waters down the Buri Dihing." This has not happened yet, though 36 years have passed. My "dobashi" told me, though, that the Noa Dihing is gradually getting smaller, and its mouth will probably close ere long with the apparent tendency of the main stream to a more southerly course. When part of the Buri Dihing was surveyed by the Revenue Survey in 1872, a large portion of this river found its way into the Kheram Pani apparently; now the communication is closed, except occasionally in very high floods during the rains. The Kheram Pani now rises, I was told, from a small swamp, and nowhere is it more than a few inches deep.

On the Noa Dihing[a] west of Pakan Pani Mukh, are the sites of several now deserted villages which were flourishing in Wilcox's time, such as Nelong, Kasan, Gakhen, &c. In Kasan, near the Pen Pani Mukh, is an old tree on which I cut a broad arrow with 1877 underneath. This would make a good starting point for any fresh traverse up the Noa Dihing, which is called the Diun river by the Singphos, Dihing being an Assamese corruption of this name, according to my informant, a son of Bida, a very intelligent young fellow, whom I met by chance near the Dihing one day.

The Pakan Pani is the largest stream I saw flowing into the Dihing from the high hills. My route lay up its bed for about 7 miles. The violence of its stream in flood is evidenced by its wonderfully straight course from a high hill called Katoh, the width and bareness of its bouldery bed and its steady slope at first 2° gradually increasing to 3° and 4°. It is subject to very sudden and violent floods, and I was told of a party of 12 Singphos encamping at its mouth, one night being overtaken by one of these sudden rises, and all except one were swept away and drowned.

The rivers flowing into the smaller branch of the Noa Dihing are the Jengthu* rising on the west face of the Manâbum range, and the Tenga Pani on the east. This latter receives several streams from the same range, such as the Tenga Pani, Khaika, Kumlao, &c. The Tenga Pani is a very pretty stream, winding through tall forest; in some parts open forest, in others the rank undergrowth comes quite down into the water, spreading its lower foliage far out over the stream, and giving the impression that the vegetation is resting on the water and not growing from the banks. Here the tall, creeper-festooned trees, spring up from the low earth-bank; there a close fringe of cane or the broad leaves of tall grasses and large ferns clothe the banks, the trees rising up behind it, and in many places occur very pretty little islands, low patches of ground, only a few feet out of the water at their highest part. The upper ends of these islands are almost invariably bare of jungle, but covered with a short, soft, close grass passing into ferns and small shrubs, ending in big bushes and trees which clothe the rest of the islands. These must be mostly submerged during the rains; and the seething mass of waters at the upper ends of the islands, where the stream divides, tends to keep down the vegetation at these places. The Tenga Pani resembles this somewhat on a smaller scale near Chaosamgaon and below it, but the other streams, flowing through uninhabitable jungle, are blocked in many places with fallen trees or bamboos interlacing overhead; sometimes flowing in shallow rapids, again forming deep stagnant pools with soft muddy beds enclosed on either side with the coarse matted grass and tangled cane growing out of the mud and slime that compose the banks. It will be admitted, I think, that these were difficult to survey. We did as much as time admitted with regard to a due connection of our work and a fairly accurate knowledge of the country enclosed in our traverse. A few miles of some of these smaller streams have been unexplored; but their sources and general directions are known. Few human beings ever visit them, except when an occasional party of Singphos go up to cut Toko Pat leaves, which here attain magnificent dimensions; but as it was, we penetrated several miles beyond the point where such a party whom we met told us it would be impossible for us to go; they themselves having been obliged to turn back. Flowing, as these streams do, through low swampy ground, the fall of a tree is sufficient to divert them into new channels, many of which were pointed out to us as having been formed during the past year, while in many places we could foresee other speedy changes of course. Therefore, accurate measurement of these streams would be work thrown away;

* Described by Mr. Ogle. [a] See Appendix A.

the most exact map of this year would be utterly wrong the next. A curious feature in some of these streams is that on first leaving the hills they flow with a good body of water swiftly; following them down they gradually get smaller and at last disappear entirely in their sandy or pebbly beds. In the Tenga Pani above Tabum the river suddenly disappears for over a mile, and then as suddenly re-appears, flowing as briskly as ever.

In carrying on our surveys in these rivers we found canes very useful for making measurements instead of the ordinary heavy chain. The canes were light and floated on the water, being easily pulled out straight. I tried them across strong rapids, and found the results wonderfully good when tested by triangulation. We were indebted to Mr. A. W. Chennell for this idea. It had struck him when working in very similar country in the Dhansiri valley in 1873-74, and he had proved the advantages of working with light canes. Chains could not have been used in rapids, or indeed in any water, with the slightest approach to accuracy; ropes are very unreliable, and neither could have stood the wear and tear of the rough boulders of the Noa Dihing and Pakan Pani. The canes of course were frequently tested with accurately measured 10-foot rods (dry male bamboos).

An idea of the general character of the country surveyed will have been gleaned from the foregoing paragraphs. The Manábum hills were the only break in the general dead level of the country, and their height was only about 500 or 600 feet above the surrounding plains. They are formed of soft sandstone, and are precipitous to the west, but slope away very gradually on the east to the Tenga Pani. The climate was pleasant in January and part of February, but from early in March we had an immense amount of rain accompanied by fearful storms of wind and hail. I note from my diary that out of the 53 days between the 6th March and 28th April we had only 23 days of fine weather, the remaining 30 being wet. The maximum and minimum thermometer gave readings as in the margin. The maximum reading of course could only be taken during a halt; the minimum thermometer was read almost every morning.

Date.			Place.	Thermometer.		Remarks.
Month.	From.	To.		Maximum.	Minimum.	
January ..	1	12	Sadiya	70°	38°	
,,	12	17	Tenga Pani	,,	44°	
,,	17	27	Manabum Hill	67°	50°	Camp on Hill 850 feet, but forest trees surrounding it kept it warm.
February..	1	6	Sadiya	70°	51°	Rainy.
,,	7	10	Noa Dihing ...	,,	53°	Do.
,,	10	15	Disa and Namchik ...	,,	45°	
,,	15	18	Honkáp ...	76°	46°	7,000 feet.
,,	18	28	Namphuk and Buri Dihing	80°	50°	Average 500 feet.
March ..	1	31	Dihing	85°	56°	,, 600 feet.
April ..	1	8	Tenga Pani	,,	56°	Thermometer broken in high wind on the 9th.

The Singphos and Khamtis have been repeatedly described, so that it would be merely a vain repetition to do so here. I may however mention a few ceremonies which we witnessed, and make a few remarks on the Nágás we came across.

At Wakidgaon in the early part of March we witnessed a religious ceremony, which was also performed generally among the Singphos at the same season. The day previous, at certain spots near the headman's house, large posts were put up in the shapes of St. Andrew's Cross, intersected by an upright cross, having as finials, small funnel-shaped baskets containing leaves. In front of these again were tufts of tall grass planted in a rectangle of about 8 feet by 4 feet. Early on the morning of the ceremony, little platters on curved legs containing offerings of cloths, flowers, fruits, &c., were brought out and arranged alongside the tufts. Then a couple of buffaloes were brought and secured strongly to posts hard by, and finally about 10 o'clock, the celebrants took their places on low stools in front of the grass, and with long green wands in their hands, which they moved about from time to time to attract the attention of their deities, they commenced a chant, with the same intonation as used by Catholic priests in reciting long prayers. This chant, the burden of which is an invocation to their gods to visit them, bless them, their families and villages, and keep all sickness or evil from them, they kept up without ceasing till past noon, when a pig was brought out and its head severed with one blow; then a long string of bamboo was taken from the nearest buffalo to the headman's house and into the innermost recess; this was to intimate to the household god that the sacrifice of the buffalo was about to take place and to show him the way out to it. After a few more incantations the officiant threw some powdered ashes out of a leafy funnel on to the animal's neck; the beast was then hobbled and thrown, and its neck being cut slightly as a guide, a man with a sharp "dâo" severed the head with two strokes. The women then filled some bamboos with blood, and walked in procession to the other cross, where a few prayers were said, the bamboos deposited, and they returned. The second buffalo was then speared to death, its agonies being prolonged by the endeavour to send the spear always into the same spot exactly, which could only be done when the poor beast came to a stand-still after each effort to break loose. The animals were then cut up, and the flesh thrown into huge cauldrons over blazing fires and cooked, as also an immense quantity of rice. When ready to be eaten, large mats were spread near, and fresh plantain leaves laid over them, in which the contents of the cauldrons were deposited, and the meat cut up into convenient-sized pieces; these, with a proper proportion of rice, were then made up into little parcels in green leaves and put into baskets, which were then carried round the village for distribution, all our people coming in for their share, or at least such as would take it. The Singphos were evidently rather hurt by the somewhat contemptuous refusal of our Hindus to accept the proffered food, another instance of the difficulties which caste prejudices among his followers throw in the way of a surveyor among

these wild tribes. The headman presented us with a couple of bottles of Singpho liquor (exceedingly like Scotch whiskey in taste and appearance) and some of the young buffalo steaks, and exceedingly good they turned out to be, though we had had our doubts about them at first. This distribution of food took place about 5 P. M., and after that, contrary to our expectations, although a good deal of liquor was drunk, not the slightest disturbance took place; the women came as usual at dusk to sit round our fire and listen to the musical box (for which the ladies always asked at every village we went to) and imbibe small doses of "anisette," a liqueur I had bought especially for such purposes, and which they relished very much. When we went to dinner they left, and after that everything was perfectly quiet.

The other festival we saw was the Khamti celebration of the Behu, which took place at Palumpan and Chaosamgaon while we were at these villages. Over a small well dug in the ground boarding was placed, and on this all their marble and gilt idols were ranged, interspersed with brass vases filled with sprays of leaves. In the centre rose a big bamboo about four feet high, pivotted above and below; from this several small bamboo tubes projected upwards from various points, being connected together at their ends and to the centre bamboo by colored threads. These small tubes were pierced with holes in several places throughout their length. The well with the idols, &c., were all enclosed and covered in by a pretty ornamental lattice-work of fine bamboo, above which stood beautiful miniature temples made out of the brown pith of some grasses, and at the corners of the enclosure rose coloured umbrellas on tall poles and on streamers of red and white cloth, thoroughly Burmese in appearance. Water at times was poured, while reciting prayers, into a trough full of leaves, whence it flowed into the centre bamboo above mentioned, and finding its way out through the holes in the small arms, caused the whole to revolve, on the principle of the turbine, rapidly watering all the gods impartially as they sat calmly beneath. People came at intervals throughout the day to fill the trough. The young women went about with "chungas" full of water, emptying them over all who came in their way, irrespective of age, sex or condition, and groups of both sexes were to be seen in the river all day long, engaged in furious splashing matches. The boys made big bamboo squirts, which they used most effectively whenever opportunity offered. All was done with the most perfect good humour, and not a soul lost his or her temper. At night the youths had an entertainment, in which character-dances found a prominent feature.

The Nágás of Honkap and the neighbourhood all seem to be subject to a certain extent to the Singphos. In almost every village of the latter along the Dihing we saw several Nágás who live with the Singphos for a certain period every year, receiving free quarters and food, for which, in return they go into the jungles and cut rubber for their masters, by whom they are allowed to keep one-third of what they collect. They also help the Singphos in various ways, such as cultivation, &c. The Singphos have several fields of opium along the Dihing, but in the Tenga Pani villages we did not see any; there is a field near Chaomang. This village is on the Tenga Pani, I believe, but we did not come across it, and I dare say there are others off the line of survey which we did not see. These Honkap and other Nágás do not differ much in their appearance, dress, style of building, &c, from those we have met further west, except that their villages are small, and they themselves a dirty, poverty-stricken looking race, with little of the fine physique or air of independence seen among their western neighbours.

In the event of exploring the Patkoi range and Nonyang lake, Namphuk would make a good depôt. Bishigaon would be the best depôt for a party clearing Miaobum (called originally "Dapha Bum." a mistake of some men who first gave us names of hill peaks from Sadiya). The path to Nonyang lies between Maum and Miaobum. There is a path to the latter hill from Bishigaon.

Extract from letter dated Shillong, the 13th July 1877, from Mr. M. J. Ogle, *Surveyor, No. 6 Topographical Survey, to* Lieut. R. G. Woodthorpe, R.E., *Assistant Superintendent, Topographical Survey.*

Your instructions were to start work from the Revenue Survey Pillar near Munglang, carry a traverse up the Jengthu river, and then taking it on by village-paths to join you somewhere on the Noa Dehing, when we should decide as to the most feasible route across the Manabum range.

After making out our reports, disposing of general correspondence, and the arrangements for the removal of stores to Chaosam had been completed, we left Wakidgaon on the same day (7th March) with a month's supplies, suitable establishments, &c.

My first march was down the Noa Dehing to the village of Modai. I traversed up the river bearing the same name, a clear shallow stream running over a rocky bed; the next day I also traversed up it as far as where it was joined by another small stream. Here we met a party of Singphos who were busy in clearing a site for a new village; it was fortunate that we met them as they showed my coolies a direct path to Modai, thus avoiding the necessity of wading back some four miles through water.

On the next day we left Modai and accomplished a very hot and fatiguing march. The way led along the sandy bed of the Noa Dehing which was frequently crossed, the water in it being very shallow there. On arriving at Munglang I sent for Ningro Saman, the Raja, and asked him for guides to point out where the Revenue Survey Pillar was; he sent two boys who showed me the place, otherwise it would have been difficult to find it, as it was in dense forest about 50 yards from the bank of the river. The pillar was in a very bad state, no mortar having been used; the bricks were kept in their places by stakes being driven round: these had rotted and more than half the pillar had tumbled down.

On the 10th I started work from this pillar and carried it along the bed of the Noa Dehing as far as the Khamti village of Rangagura, when I left it and followed the path to Nallamgaon, which led through forest for about a mile and then struck the Jengthu river; two miles further up was Nallamgaon where we encamped for the night. The next day the work progressed as far as Inthem, to which we shifted camp. The Rajah of this place was particularly civil, and after some conversation asked permission to allow the women to come and see me,—a request I very readily granted. His wife presented me with a fowl, eggs and rice, and I was sorry that I could not return the compliment in a manner that would have been more befitting and pleasing to the female mind than the bestowal of a bottle of rum and a few four-anna and two-anna pieces. After the women left, I started off for work, the Rajah accompanying me. He very soon got disgusted and expressed surprise at my undergoing such great inconvenience; he however did not desert, but returned to camp with me late at night. On the 13th I left the village, presenting the Rajah with powder and shot and a bottle of rum for all his civility.

It was now no easy matter traversing along the bed of the river, as rain had set in from the 10th, causing the river to rise considerably; we were frequently up to our waists in water, the chainmen being often up to their necks, and the rapidity with which the water was flowing rendered it difficult to make way against the current; progress was consequently very slow.

On the 15th we passed the village of Sanglai and encamped about a mile above it. There was very heavy rain on the 14th and the two following nights, and the river rose to such an extent that we were obliged to leave it and cut lines along the bank. The undergrowth and cane-jungle was so dense that not more than a mile a day could be accomplished. On the 18th it was cloudy but no rain fell, and the water in the river subsided a good deal, but it was still much swollen and rapid, not so much however as to prevent our wading through it. On the 19th clear weather set in, but a new obstacle rendering rapid progress impossible presented itself. I should mention that the channel is kept clear of snags and fallen bamboos up to Sanglai and a little beyond for the passage of boats; three years ago it was kept clear as far as Nao, but now the river was choked up with these impediments, and they had either to be cut through or we had to take to the bank till they were passed.

On the 21st Thingba was reached. At this place the survey along the bed of the river was abandoned, the village-paths being chained as the river kept close along them and was frequently crossed, a fortunate thing, as heavy rain accompanied with hailstorms commenced and caused the river to rise again very suddenly. The next day a route survey was carried into Nao on the Modai river, about 2½ miles to the west of Thingba and consequently off the direct line of march.

While engaged in carrying on the survey into Nao, I deputed four coolies with a klassie to clear the line into Manan, about ¾ of a mile from Thingba on the direct road to the Noa Dehing. On my return to camp I was surprised to see these men. They said that the people had turned them back, and had told them in the best Assamese they could muster up and by gestures that they would not allow the survey to pass their village. Through my Dobasha I found this to be true, but on my arrival at the village the people denied having sent my men back, saying that it was owing to the mutual ignorance of being able to explain matters to one another that the misunderstanding occurred. However this might be, the inhabitants did not show that attention and civility which we experienced in almost every other Singpho village through which we went. I passed the hut where the Rajah was; he made no attempt to recognize me, but kept on in his gambling game. We proceeded to Inring and pitched camp there.

Near this village there is an extensive clearing, and it was the first place since leaving Wakidgaon that I got a view of the hills at all. By taking bearings to a few peaks on the Mavalum range, I managed to fix them and determined the source of the Jengthu (which is called the Modai here) with its principal tributaries. The Inring Rajah accompanied me to the clearing and gave me some valuable information regarding the sources and names of these rivers and peaks.

The next march was to the deserted village of Ndong situated on the right bank of the Noa Dehing. We arrived at this place on the 23rd, and the next morning after taking theodolite observations to Honkap and several other peaks for the adjustment of my traverse which had now progressed about 45 miles without a check of any kind, I carried the route survey into Khagam, and the next morning I met you at Phupgaon.

Enquiries from the Singphos elicited the information that elephants could be taken across the Manabum range by following the path up the Melep river; you therefore deputed me to take that route and survey across the hills and down the Tenga Pani as far as Latoh where you would join me. I left Khagam the same day that we parted and proceeded up the bed of the Melep river and succeeded in doing 2 miles of route in the afternoon, the weather luckily being fine. We followed the course of this stream next day also and encamped at the foot of the hill, just near its ascent. On the following morning I sent men up the ridge in advance to report on the road; they returned with the disheartening intelligence of the impracticability of it for elephants: the sides of the hill near the top they said were a great deal too steep for the animals to get a footing. I did not heed them however, but went up to judge for myself. I certainly did find the sides precipitous but not quite so bad as to prevent unladen elephants making the ascent. I therefore sent down word to get the coolies to bring up all the baggage and rice; this they did in three or four trips, carrying heavy loads each time; the

elephants followed and arrived safely. The descent on the opposite side was on the back of a spur having a very easy gentle slope. I carried the survey about 1½ miles along it and pitched camp on a level bit of ground, water being fortunately found about ½ a mile below.

On the 28th I went back to the summit and cleared enough to get in some topography; this was the first day I had an opportunity of setting up my plane-table since leaving Wakidgaon and I was able to do so frequently afterwards. After we crossed the range and entered the low flat country again, the bamboo jungle was so thick that I saw it was impossible for laden elephants to get through, and I was anxious about them as we had lost all traces of them; having no guide I was in dread of their going astray and wandering about those terrible forests. We, however, came upon them in the bed of a large dry stream along which the path now lay to its junction with the Tenga Pani, they had gone down a small ravine which joined the former. I found my camp pitched in a dry spot on the Tenga Pani near the small village of Tabom.

On the 29th, I was obliged to retrace my steps to the point where the path joined the dry stream. Such heavy rain had fallen during the night that a considerable body of water was now flowing down it. On my return to camp I found a Mishmi Chief and two headmen from Tabom waiting for me with presents.

The next day I traversed down the river to near Ndong and on the following day carried a rough route by pacing into Insha about 6½ miles to the north-east of Ndong and situated near the foot of the Kamfai range of hills. On the morning of the 1st April the widow of the former Rajah (she still had some authority in the village) accompanied by others, men and women, came out to our camp to see me, and after some conversation I retraced my steps to Ndong and carried on the route survey to within 2 miles of Latoh, I might mention here before proceeding that Ndong is beautifully situated on the high right bank of the Tenga Pani and a good view of the Manabum range is obtained. The next day the survey was completed to Latoh and another route was carried by pacing to Tangsang about a mile from the former village; the Chief of which accompanied me there having donned his best attire for the visit. The headman of Tangsang came out to meet me and invited me to his house,—an offer I gladly accepted as a heavy storm was brewing which came down in torrents shortly after.

I should not fail to let you know of the civility with which I was received by the Chief of Latoh. On my arrival late in the evening he came down to camp and was most assiduous in his attentions towards me. During our stay of four days in his village, he either sent through his son or brought down himself something for me; his wife also presented me with fowls, &c. and I was glad of your presence there to have it in my power to reward her more suitably than I could the Inthem Chief's wife.

On the 3rd I surveyed down the Teng Pani for 4 miles, accompanied by two men from Latoh, whom the Rajah deputed with me to point out villages that were inland and also to show me the path back. On the following day I traversed up the Lapang pani, a narrow rapid stream, for some 3 miles, and on coming out again upon the Teng Pani I met you and we returned to camp together. From the 5th we worked in conjunction till our labors were closed at the trigonometrically fixed station on Manabum; it is therefore unnecessary for me to continue this narrative, and I shall therefore conclude with a few remarks on the country traversed by me.

The only rivers of importance in the tract I was engaged upon are the Jengthu, Teng Pani and Tenga Pani; but as the two latter I presume, have been described by you I shall confine myself to the former. From the village of Inthem the Jengthu river has water in it from bank to bank, and has an average width of about 30 yards, almost up to the village of Inring. Below Inthem there are short sandy reaches and the river has a comparatively straight course, but about that place it is most tortuous, and winding and rapids occur. Near the village of Thingba the river bifurcates and from that point, the eastern and main branch is called the Jengthu and the other which joins the Noa Dehing near the village of Modai is called the Modai Pani. Throughout their whole course they flow through dark rank jungle unrelieved by anything picturesque, and we were seldom even favored with a glimpse of the sky above. It was most dispiriting.

The clearings about the villages are very insignificant. From no place in the Jengthu valley but Inring could a view of the hills be obtained at all, owing to the immense walls of forest all round. Poppy cultivation was seen in places, but the largest I saw in the whole of the Singpho country was on the road to deserted Ndong, from Inring. The paths from Munglang to the villages on the Jengthu are very narrow and do not seem to be much used, but those from Nao to Thingba, and from there on to the villages on the Noa Dehing, are wide and kept in good order, rendering elephant travelling very easy.

Extract from the Narrative Report of LIEUTENANT E. P. LEACH, R. E., *Offg. in charge No. 7 Topographical Party, Rajputana Survey.*

Description of ground triangulated.

The triangulation extended over an extremely desolate and sandy tract lying between Bickaneer and Sirsa in British territory ($\frac{28° 0'}{29° 0'}$. $\frac{73° 30'}{75° 0'}$).

Both surveyors reported great scarcity of water for drinking purposes, and few villages.

Approaching the borders of Hissar and Sirsa, the ground falls rapidly, and the sand ridges covering the southern and western portions of the area brought under triangulation dis-

appear. The sub-soil is a mixture of clay and gravel, and the surface of the country uniformly level.

An imaginary line drawn between Hissar on the east and Nagore in Marwar on the west, prolonged southwards to the Luni river, would form an approximate boundary to the Bickaneer desert proper. This tract is covered by low sand ridges, and is almost entirely devoid of surface vegetation or water, except immediately after the rainy season.

A substratum of clay underlies the sand at a depth varying from a few feet to several hundred; and in all cases the wells have to be carried down to the clay level. The direction of the sand ridges, as might be expected, is at right angles to the prevailing north-east and south-west winds, and in places the clay bed becomes completely exposed. Where this is the case, small excavations, called "*tobas*," are made, and the rainfall is collected. These "*tobas*," or tanks, last a few months, but dry up at the end of January, and the inhabitants are then entirely dependent upon their wells, which are more or less brackish according to the depth of sand through which they have been driven. A small supply of drinking water can usually be obtained from large villages, where the rainfall is stored in underground masonry reservoirs or "*tonkas*." These are scrupulously concealed, and their existence often entirely ignored till a little pressure has been brought to bear upon the proprietor.

In the cold weather the brackishness of the well water seems to have little effect upon natives. The party has enjoyed extremely good health, and the monotony of the country is its principal drawback.

In an ordinary season, the only difficulties a surveyor has to contend against are the distance from which his water has to be carried, and the scarcity of grass for his horses and forage for his camels.

The former thrive well upon husked "*moth*," or vetches; the latter, upon the leaves of a small thorny bush, a kind of wild plum, which at a certain season are carefully stored and sell at almost as high a price as the grain of the district.

The effect of a dry season is therefore to create an almost entire absence of the stunted grass with which the sand is partly covered, and to raise the price of the stored fodder or "*pálá*" immensely.

A few isolated groups of hills appear upon the Standard Sheets of the year, the last to be met with northwards to the banks of the Sutlej.

Country plane-tabled.

The country plane-tabled was similar in all respects to that described in my Narrative Report last year, well populated, and almost entirely cultivated for light crops during the rainy season. The soil sandy, with no drainage lines, and little or no surface water. The inhabitants are well-to-do, and a considerable trade exists between the Hissar and Delhi Districts and the large towns of Sujangarh in Bickaneer, and Didwáná, Nagore, and Mirta, in Marwar.

The large town of Kuchawan in the south-east corner of Degree Sheet XI, upon the borders of the Sámbhar Lake, has an extremely picturesque fort in a good state of preservation, towering some 500 feet above the city below, and covering the summit of an isolated mass of sandstone rock.

In its neighbourhood are the marble quarries of Makrána, from which large quantities of stone are exported into the Jeypore and Ajmere Districts. Further west lies the old town of Katoh, at the foot of a low group of hills, largely quarried for building purposes; and in the centre of the same sheet the large town of Didwáná, where an inferior kind of salt is manufactured from a salt lake of similar formation to those at Sámbhar and Kuchawan.

Nagore, a city of considerable historical celebrity in the annals of Marwar, falls within the area surveyed, but will not appear in the sheets published this year. It is the head-quarters of one of the largest pergunnahs in Marwar, and is enclosed by a bastioned wall in good repair. The following description is abstracted from Mr. Kelly's report: "Nagore is situate about 80 miles north-west of Ajmere, and the same distance north-east of Joodhpoor, the capital of Marwar. Bickaneer lies to the north at a distance of 68 miles, and Sujangarh to the north-east, 64 miles distant. It is built upon slightly rising ground, in the hollow of the surrounding country, so that its fine tanks, six in number, are always full. A high stone wall, three miles in circumference, encloses the city, strengthened at every 60 yards by bastions, surmounted with old, rusty, field-pieces.

City of Nagore.

"The wall, like the ramparts of the fort, which is in the heart of the city, is in good condition and of considerable antiquity.

"Five hundred and fifty-five villages are included in the pargunnah of Nagore. Of these, 391 are '*khalsa*' or crown, 191 '*jaghir*' or fiefs, the remainder '*udik*' or gifts to the Brahmins.

"The population is about 21,000; Mahomedans being in the proportion of 2 to 5. Before the famine year 1868-69 its inhabitants numbered more than 26,000.

"Nagore mints its own copper coin, and has a cutcherry subordinate to Joodhpoor.

"A local post runs between Joodhpoor, Bickáneer, Sujangarh, and Didwáná, and there is a Government branch office connected with Ajmere and Mirta.

"Its imports consist of salt from Phalodi and Didwáná, sugar from Beani, and wheat and other grains from the neighbouring villages. Its exports are wools, cloths, saltpetre, and large number of iron and brass vessels. The revenue of Nagore is Rs. 7,000; of the pergunnah Rs. 29,000."

Water is good and plentiful, and the district is celebrated for its breed of cattle: the soil is extremely fertile, and the assessment in consequence higher than in other parts of Marwar.

As an instance of the utility of the heliotrope as a signalling instrument in dry districts, it may be mentioned that a flash telegraph, worked with ordinary looking glasses, is in constant communication with Ajmere, and is carried northwards as far as Bickaneer.

The stations usually on the sites of old survey points are from 15 to 20 miles apart.

Each signaller works from three different points on the hill or range forming his particular station, and transmits his flash from one or the other, according to the fluctuations of the Calcutta market, and the original telegram received at Ajmere; the right-hand point representing prices rising, the left falling, the centre stationary. No other attempt at a code is attempted, but the rapidity with which the flashes are transmitted is wonderful, and worthy of a professional heliotroper. The expenses of the telegraph are defrayed by the various banking firms *en route*, and the subscription to the fund is Rs. 50 a month.

The border of Bickaneer to the north of Nagore marks the re-commencement of the sand ridges, which here rise to a considerable height, and stretch almost up to the capital of the district—the city of Bickaneer.

The survey of this portion of Rajputana hereafter by the Geological Survey will, no doubt, lead to some interesting theories concerning the lost rivers of "Rajput celebrity." Bickaneer itself stands upon a bed of conglomerate, overlooking what at a distance has all the appearance of a broad river-valley. The formation is very similar to the hills round Joodhpoor where the upheaval of the boulders has been much more violent, but the same evidence of the existence in past centuries of a considerable river exists.

For some distance along this valley, east and west of the city, the ground is hard and stony, and the imaginary bed continues; but at a distance of 10 miles all trace of it is lost in the sand, and the ridges again rise one behind the other with the same uniform regularity as over the country to the north and south.

The capital presents few points of interest. There are no natural features as at Joodhpoor to add to the picturesqueness of a few temples and mosques surrounding the city, and the bastioned wall and palace show considerable decay and want of repair.

It is the residence of the Maharajah and head-quarters of the Sujangarh agency.

From various accounts the country lying between Bickaneer and Bhawalpore, which remains for survey, will present no great difficulties during the cold season. It is uninteresting to a degree, but it is during the hot months, before the rainy season sets in, that it is unhealthy.

Major Walter, the Political Agent at Joodhpoor, last year marched from Nagore westwards to Jeysulmeer, and describes the country through which he passed as very similar to the tract I have described.

Extract from the Narrative Report of CAPTAIN J. R. MCCULLAGH, R. E., *in temporary charge No. 8 or Mysore Topographical Survey Party.*

Captain G. Strahan left Bangalore to take the field on the 4th of December, accompanied by Messrs. McNair, White and Fleming, to undertake the survey of the Kankanhalli State Forest. Mr. McNair undertook the reconnaissance and triangulation of it, and finished it by the 24th December, fixing 55 points by observations at eight stations, based on the Great Trigonometrical sides of Banatmari to Kopabetta and Banatmari to Devarabetta, the majority of points being fixed by more than two rays and having their heights also measured. The signals were for the most part red and white flags on trees, as the hills are covered with dense forest, and poles were found to be of little use.

Captain Strahan, assisted by Messrs. White and Fleming, meanwhile traversed the boundary of the forest 35 miles in length, and on the 22nd December, having finished the field work, commenced the computations thereof. By the 1st January all the computations of triangles, latitudes and longitudes, heights, and traverses were finished, and the four boards on which the detail survey was to be laid down mounted and projected and made over to Messrs. White and Fleming. The scale of the survey is 4 inches to the mile in accordance with the wishes of the Forest Departmental authorities, and eye contours at 50 feet vertical intervals have been inserted as nearly as is practicable without resorting to actual levelling operations. The numerous heights given by the triangulation rendered this comparatively easy. Messrs. White and Fleming have worked well, and accomplished satisfactorily a somewhat troublesome and difficult piece of work.

Captain Strahan then returned to Degree Sheet VIII, and observed at some stations in Sheets 41 and 42 which had been reconnoitred and prepared the previous season in anticipation of its being found impossible to proceed with 37 and 38. This with Mr. Stotesbury's and Mr. Knight's help was computed then and there and the boards projected. He then reconnoitred and observed the northern half of Degree Sheet XII, and brought the season to a close on the 1st April.

In entering into the detail of work performed by the Surveyors, Assistant Surveyors and Sub-Surveyors during the past field season, I quote verbatim from the memoranda left by Captain Strahan; and as regards the office duties, I would beg to add that I have found one and all of the assistants most attentive and diligent in the discharge of their duties. The unfortunately, but yet unavoidably, disconnected and incomplete state of the field work naturally led to a certain amount of difficulty in distributing for any length of time together the various duties to be performed in office, but every change has been met with cheerfulness and a desire to please, which has given me much satisfaction.

"Mr. Chew left Bangalore on the 28th November, and reconnoitred Sheets 35, 36, 39, 40, and commenced observing on 29th January. He carried on his observations till 4th March, when he was forced to retreat by the prevalence of virulent cholera in that district; and in order to employ the time till field work was no longer possible, completed the reconnaissance of Sheet 42, and also a portion of Sheet 46, and returned to Bangalore on 5th April."

The country worked over is of the same general character as appertains to the greater part of Mysore, being chiefly undulating, varied by hills, sometimes in groups, sometimes isolated, of great diversity of shape and size. In the more level portions, moving about is comparatively easy, but in the hilly tracts locomotion is most difficult, and can only be accomplished with the aid of pack-bullocks or coolies.

The chief towns and forts within the areas surveyed are Bangalore, the seat of government of the Mysore Province, which is so well known as to need no description, Tumker, the head-quarters of the district bearing that name, and the hill fort and sanitarium of Nundydroog. This latter is situated at an elevation of 4,800 feet above sea level, and was at one time a place of considerable strength until taken by the British troops. The fort is now more or less in ruins, but the hill is resorted to in the hot weather months by a few of the residents of Bangalore.

The field season was one of short duration, but owing to the great scarcity of the necessaries of life, food and water, was of a peculiarly trying nature, and it proved to be so unhealthy as to tell severely on the members of the party, both Europeans and Natives. Messrs. Farrell, Kitchen, Barker and McNair all suffered from sickness, which prevailed in one form or other over nearly the whole country. There were five deaths from cholera amongst the Native establishment and camp followers, and much illness in the shape of fever and bowel complaints. The Native establishment, with the exception of the Hindustani element (15 men lent from No. 7 Topographical Party, who have since been returned), does not appear to have worked well or given satisfaction. Out of an average strength of 132 men there were no less than 39 desertions, and 7 others were discharged for misconduct during the space of three months, and at the close of the season another lot of 50 men were not considered worthy of being kept on the rolls. With such materials it is evidently impossible to carry on work in a satisfactory manner, but I hope to be able to introduce for next season the same class of men who have done so well in No. 9 party, should work in the usual manner be found practicable.

Extract from the Narrative Report of CAPTAIN J. R. MCCULLAGH, *in charge No. 9 Mysore Topographical Survey Party for season 1876-77.*

In proceeding to make a few remarks on the country through which the operations were carried, I would premise that being so well known to the European officers of the Government, there seems no need to enter into details of appearance, products, people, &c., the most minute information on all these matters being doubtless in the possession of the Statistical Department. I will therefore confine myself to observations from a professional point of view. The part of the country included in Degree Sheets I and II is for the most part hilly, though comparatively level ground is also to be met with. Large tracts of dense forest are a source of much inconvenience and delay to the surveyor, who is first obliged to clear hill tops for his stations of observation and for intersected points, as a groundwork for subsequent traverse operations, previous to the sketching of the ground.

In the more jungly portions the villages are widely scattered and are small in size; in fact they are in some places little more than a collection of hamlets of a few houses in each; it is, in consequence, more difficult to get about and to procure assistance in the way of labor and supplies than in other more open and populated parts of the country.

In Sheets XI and XIV the ground is comparatively open, with numerous isolated hills of all shapes and sizes; but though well adapted as regards position, they are very often of a most inconvenient description for stations of observation, their summits being crowned with a collection of sharp-pointed rocks sufficiently high to obstruct the view, and yet too narrow to admit of an instrument being set up on them. Along the western margin there is a strip of almost impenetrable jungle, and here also the population is scanty and the villages few and small.

The part of the country topographically surveyed in sheet IV is open and populous; the hills are mostly isolated, and in places very precipitous; the rest of the ground is extremely undulating to the eye; but the swells are not of sufficiently marked character to admit of delineation as a rule on so small a scale. The numerous water-courses, however, show the general slope and fall of the ground.

The only towns and forts of importance met with were those of Mysore and Seringapatam; the former has a population of about 57,000, and is the residence of His Highness the Maharajah of Mysore, whose principal Palace is within the *enceinte* of the fort. Of the fort itself, there is little to be said beyond that whatever it might have been in former days, its strength has departed in the face of modern ordnance, and it is completely commanded within effective range. The importance of Seringapatam, I think, may be said to lie only in the historical associations connected with the place. A moderate-sized village is contained within the defences, which are in a ruinous condition; and as far as I saw, there is not a single gun mounted or dismounted on the ramparts. There is no garrison of any sort, unless a few of the rural police may be considered such. Opposed to modern ordnance, the fortress appears to me incapable of resistance for a single day.

APPENDIX E.

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

Statement showing the nature of the work performed, and the progress made from 1st October 1876 to 30th September 1877, twelve months.

Maps.	Scale. Miles. Inch.	Remarks and Progress.
India—Standard original in 6 sheets (outline).	32 = 1	Additional materials from the several surveys current, reduced and inserted.
India—6 sheets (outline). ...	32 = 1	Blue print reproduction of the above Standard. Sheet 3 (Rajputana) in progress. Sheet 5 (Madras) completed for engraving; under examination. Sheets 1 and 4 engraving.
India No. 3.—4 sheets (outline) ...	64 = 1	Reduced from the above Standard. The hill drawing in progress and well advanced towards completion.
Bengal—Standard (outline) in 2 sheets.	16 = 1	Engraving. The principal names (new spelling) inserted on dry prints of the outline for a preliminary issue.
Bengal—Trade map of ...	16 = 1	Drawn on blue prints of the Standard 16 mile compilation, for Photozincography. For the Bengal Government.
Bengal—Postal map of ...	16 = 1	A new Postal map of the Bengal Circle, 1878, under preparation for the Post Master General of Bengal, from information being supplied from time to time by the Postal Department. Completed as far as received. In progress.
Assam—Standard compilation in 8 sheets.	8 = 1	Sheets 1 and 2 being Lithographed. Additional materials to date inserted in sheet 3, (Lakhimpur and Sibsagar districts, with surrounding country of the various hill tribes); waiting further additions to complete. Sheets 4, 5, 7 and 8 (in one), completed.
Sind—The Province of ...	16 = 1	Hills drawn on a dry print proof for Lithography.
Rajputana Agency—2 sheets (outline).	16 = 1	Standard projections made for engraving on copper. Compiled and drawn in outline from recent surveys as far as received; subject to yearly additions to complete on receipt of further survey materials. Under examination.
Central India Agency—2 sheets (outline).	16 = 1	
Central Provinces—2 sheets (outline).	16 = 1	Standard projection made for engraving. Under compilation in outline from recent surveys; in progress and well advanced.
Kelat—The Khanate of—or Baluchistan.	16 = 1	Further additions and corrections made to date, and last proofs revised and completed for press order.
Bhutan—Preliminary map of ...	8 = 1	Further additions and corrections made to date for a new edition.
Countries between Hindustan and the Caspian Sea.	64 = 1	Further additions and corrections made to date, and last proofs of outline revised and completed for press order. Hills drawn on a dry print proof complete for Lithography.
District Maps.		
Chittagong District, ...	4 = 1	Hills revised for a new edition.
Hoshangabad District, ...	4 = 1	Pargana Borda, transferred to this district, added on original compilation.
Cawnpore District, ...	8 = 1	Drawn for Gazetteer, North-Western Provinces.
Ajmere District—6 sheets, ...	1 = 1	Prepared and completed with boundaries, &c., from the 1 inch sheets of the Rajputana Survey.
Mhairwara District—4 sheets...		
Districts,—		
Bahraitch, Monghyr, ...	4 = 1	Extracted from the Atlas of India, and prepared and completed for publication with the latest information to date.
Balasore, Mozufferpore, ...		
Barabanki, Partabgarh, ...		
Darbangah, Puri, ...		
Fyzabad, Rai Bareli, ...		
Gondah, Sitapur, ...		
Hardui, Sultanpoor ...		
Kheri, Unao, ...		
Lucknow,		
Index Maps.		
India—No. 2, ...	128 = 1	Two copies prepared for Departmental Reports of 1875-76 and 1876-77, representing the various surveys completed and in progress.
India—No. 3, ...	64 = 1	Showing the portions surveyed, published, and in course of publication by the Topographical Trigonometrical, and Revenue Surveys under the control of the Surveyor General of India, and Superintendent, Great Trigonometrical Survey to 1877, prepared for the Intelligence Committee; 2 copies, one for record.
India—Sketch map of ...	32 = 1	Additional information supplied by Captain Collen, of the various passes, military roads, bridges, &c., throughout India, embodied in two copies, one for the Military Department, the other for record.
Index to the sheets of the Atlas of India.	128 = 1	Three copies prepared, showing the state of the engraving and publication for 1876 and 1877 (one for the Intelligence Committee).

Maps. (*Continued*).	Scale.	Remarks and Progress.
Index to the sheets of the Gwalior and Central India Survey. Khandesh and Bombay Native States Survey. North-Eastern Division, Central Provinces Survey. Central Provinces and Vizagapatam Agency Survey. Bhopal and Malwa Survey. Khasi, Garo and Naga Hills Survey. Rajputana Survey. Mysore Survey.	32 miles = 1 inch.	Revised for seasons 1875-76 and for 1876-77, to illustrate the publication of the sheets, and progress of the several Topographical Surveys named.

Cantonments.—Boundaries of the following Cantonments reduced and inserted, to complete the recorded set of office Atlas Sheets which show them, *viz.*, Aligarh, Bannu, Cawnpore, Dehra, Dera Ghazi Khan, Dera Ismail Khan, Ferozepore, Jhansi, Jullundur, Jutog, Kasauli, Lahore, Lucknow, Meean Meer, Meerut, Murree, Nagode, Nowgong, Peshawur, Rawalpindi, Sealkot, Sultanpoor, Umballa.

SHEETS OF THE ATLAS OF INDIA, 4 MILES = 1 INCH.

Sheets 12 (four quarters), 13 (four quarters), 18 (four quarters), 34 S. W., 36 N. E., 37 S. E., 71 N. E., 92 S. W., 94 S. E., 130 N. E., 131 N. E. and S. E.	Points projected on dry prints of the sheets named.
„ 12 N. E.* and S. E.* ...	*Parts of Cutch and Kattywar, drawing in outline from recent surveys*, completed of S. E. and N. E. drawing in progress.
„ 17 full plate ...	Part of Bhawulpore reduced from the sheets of the Revenue Survey.
„ 18 N. W.* ...	Drawing completed of 17; 18 N. W., drawing in progress.
„ 22 S. W. and S. E. ...	Part of Kattywar. Drawing in outline from recent surveys completed of S. W.; S. E. in progress.
„ 23 N. W.	Part of Kattywar. Hill drawing in progress.
„ 33 S. E. and S. W.* ...	Parts of Ajmere and Jeypore, 33 S. E., drawn complete with hills. S. W. drawing in progress.
„ 34 N. E., N. W. and S. W. ...	Parts of Ajmere, Oodeypore and Jodhpoor. N. E., N. W. and S. W., drawn complete with hills.
„ 35 N. E. and S. E.	Parts of Jhalawar, Neemuch, Oodeypore, &c. Drawing in outline from recent surveys completed of N. E.; S. E, drawing in progress.
„ 36 S. E. and N. E.* ...	Parts of Khandesh and Native States in Central India. Drawing in
„ 37 N. E. and S. E.* ...	outline from recent surveys made to date. In progress.
„ 52 N. W. and S. W. ...	Parts of Native State in Central India. N. W. and S. W., drawn complete with hills.
„ 66 full plate ...	Parts of Kumaon and Garhwal. Drawing in outline completed to
„ 67 „ ...	extent of materials received from the Great Trigonometrical Survey.
„ 71 N. E. and S. E.	Parts of Mandla. Drawing in outline of additions from recent surveys, to complete. In progress.
„ 74 full plate ...e ...	Part of Ahiri zamindary added, and hills drawn complete.
„ 90 S. W.	Parts of Mandla and Raipur, Central Provinces. Drawn in outline from recent surveys. Hills wanting; in progress.
„ 91 N. W.* and S. W.* ...	Parts of Raipur, Balaghat and Mandla, Central Provinces. Drawn in outline. Hills wanting; in progress.
„ 92 N. W. and S. W. ...	Parts of Raipur, Chanda and Bastar, Central Provinces. Drawn in outline. Hills wanting; in progress.
„ 93 N. W.	Parts of Bastar and Godavari Taluks. Additions of new material from recent surveys, compiled and drawn in outline to complete. Hills wanting; in progress.
„ 95 N. W.*	Part of Masulipatam, Madras Presidency. Recent work of the Madras Revenue Survey, reduced and drawn complete for re-engraving.
„ 113 full plate	Hills drawn complete on a dry print proof of the added portion of Hazaribagh.
„ 124 N. E., N. W., S. W., S. E. ...	Parts of Goalpara, Darrang, Kamrup and Nowgong. Remaining outline and hills compiled and drawn complete.
„ 125 S. E.	Parts of Sylhet and Cachar, revised and blank portions compiled and drawn with hills complete from recent surveys.
„ 130 N. W. and S. W. ...	Part of the Naga Hills, Nowgong, Lakhimpur and Sibsagar. Further additions to date made from recent surveys; complete with hills.

*The sheets marked thus * are new sheets.

STANDARD SHEETS OF THE TOPOGRAPHICAL SURVEY, RE-DRAWN FOR PHOTOZINCOGRAPHY.

	Miles. Inch.	
Chota-Nagpore Division Survey.		
Sheet 54½	1 = 1	Corrections and additions made for a second edition.
Ganjam and Orissa Survey.		
Sheets 30, 31, 32, 33, 46 and 48 ...	2 = 1	Fair drawn from the original field sheets.
„ 41, 43, 52	1 = 1	Projected and fair drawn from the original field sheets.
„ 62, 63, 64, 65, 66 and 67 ...	1 = 1	Projected and in progress in various stages.

MAPS. (*Continued*).	SCALE.	REMARKS AND PROGRESS.
Central Provinces and Vizagapatam Agency Survey.	Miles. Inch.	
Sheets 12 and 14	1 = 1	Projected and in progress in various stages.
Rewah and Bundlekund Survey.		
Sheets 12 and 32	1 = 1	Corrections and additions made for a second edition.
Simla and Sutog Survey.		
20 sheets	1 = 24	Insertion of estate boundaries, and examination and revision of originals for a new edition to 1876. The remaining 8 sheets completed.
Rajputana Survey.		
Sheets 26 and 31	1 = 1	Corrections and additions made for a third edition.

MISCELLANEOUS MAPS.

INDIA, Military map of ...	60 = 1	Showing disposition of the army, army corps, &c., &c. Six copies revised for the Military Department and returned.
Country within a radius of 20 miles round Umball aand from Umballa to Kalka.	1 = 1	A trace made on vellum cloth from the original one-inch sheets of the Revenue Survey, for reproduction.
Districts Ellichpur, Akola, Amraoti, Bassim and Yeotmal, with part of Hyderabad.	1 = 1	Traces made on vellum cloth of parts of Hyderabad and the districts named, from the original field sections of the Hyderabad Survey, for the use of the Forest Department.
District Rohtak.	1 = 1	Tracing made on Vellum cloth of the pargana boundaries of this district for the Settlement Officer.
District Mainpuri.	2 = 1	Two copies made for the Settlement Officer, one showing the principal villages only, the other showing all the villages of the district.
The Portuguese Territory of Goa. ...	1 = 1	A trace made on vellum cloth of the Goa Territory, for the Marine Survey Department.
Palni Hills. Sketch map of the. ...	4 = 1	Extracted from sheet 62 of the Indian Atlas for re-production.
Sundarbans Survey.		Extracts made from various old field books, sections and maps of this survey, bearing on lots 100 and 104, and areas of the same taken out for the High Court and the Superintendent, Revenue Surveys.
Soondoor Jaghir, Madras Presidency, season 1842.	2 = 1	Copy of the same made on vellum cloth for the use of the Collector of Bellary.

Charts of Triangulation, 4 miles = 1 inch, of the

Chota Nagpore Division Survey seasons 1862 to 1865. Rewah and Bundelkund ,, ,, 1865 ,, 1866. Jhelum and Rawal Pindi ,, ,, 1855 ,, 1859. Ganjam and Orissa ,, ,, 1858 ,, 1859. South Parasnath series ,, ,, 1850 ,, 1852.	Extracts on vellum cloth made from these charts, and a synopsis of latitudes, longitudes and heights of the several points therein, prepared for the Superintendent, Revenue Surveys.

Blank projections for a map of Afghanistan, in Degree Sheets,	4=1	Forty-six single Degree Sheets on the scale of 4 miles=1 inch, between the parallels of 28° and 38°, and meridians of 61° and 71°, and the same area in four sheets on the scale of 16 miles=1 inch, projected with card scales for the projection of points on the same, for Major J. Brown, R. E., Mooltan.
The same in 4 sheets, ...	16=1	

Examination, corrections and additions to original survey sheets, maps, charts, &c., } 238 original sheets examined, corrected and touched up for re-production and engraving.

Examination, corrections and additions to engraved, lithographed and photozincographed proof maps. Various. } Blanks filled up, railways, boundaries, territorial names, headings, foot-notes, titles, &c., inserted, examined, completed and corrected in 5,271 sheets.

Atlas Sheets and engraved maps colored—4,969 sheets.
Lithographed and photozincographed maps and plans, colored—23,769 sheets.

J. F. BANESS,
Surveyor and Chief Draftsman,

J. O. N. JAMES,
Assistant Surveyor General, in charge Drawing Branch.

10th December 1877.

APPENDIX F.

ENGRAVING BRANCH, SURVEYOR GENERAL'S OFFICE.

Annual Progress Report up to 31st December 1877.

Atlas Sheet No.	23 S. W. ...	New sheet completed full up to margin.
,,	52 N. W. ...	Ditto ditto.
,,	72 N. W. ...	Ditto ditto.
,,	72 N. E. ...	Ditto ditto.
,,	93 S. E. ...	Ditto ditto.
,,	93 S. W. ...	Ditto ditto.
,,	105 S. W. ...	Ditto ditto.
,,	124 S. E.	Ditto ditto.
,,	124 S. W. ...	Ditto ditto.
		NEW SHEETS TO WHICH LARGE ADDITIONS FROM FRESH SURVEYS HAVE BEEN MADE, OR ARE IN PROGRESS.
,,	33 S. E. ...	Large addition of new survey, outline writing and hills up to margin; plate finished.
,,	34 N. E. ...	Large addition of new survey, outline writing and hills up to margin; plate finished.
,,	53 S. E. ...	Large addition of new survey, and outline writing done up to margin; hills just commenced; in progress.
,,	130 S. W. ...	Outline and writing of new survey done; hills 1-10th completed; in progress.
,,	131 S. W. ...	Hills of new survey commenced; plate put down for more urgent work.
,,	125 S. E. ...	Taking out old work and re-engraving new survey; outline writing and hills finished.
,,	91 S. E. ...	Taking out and re-engraving; new additions finished.
		NEW ATLAS SHEETS IN HAND.
,,	12 S. E. ...	Border and projections done; outline of new survey one-fourth done; in progress.
,,	22 S. W. ...	Border and projections done; outline of new survey half done; in progress.
,,	22 S. E. ...	Border and projections done; outline done as far as drawing; writing just commenced; in progress.
,,	23 N. W. ...	Outline and writing done full up to margin; transfers for preliminary edition have been taken; waiting drawing for hills.
,,	34 N. W. ...	Outline and writing up to margin completed; transfers for preliminary edition have been taken.
,,	34 S. W. ...	Outline and writing up to margin done; transfers for preliminary edition have been taken; hills in progress; one-eighth completed.
,,	35 N. E. ...	Outline done up to margin; writing just commenced.
,,	35 S. E. ...	Outline done as far as drawing; ditto ditto.
,,	36 S. E. ...	Ditto ditto ditto ditto.
,,	37 N. E. ...	Ditto ditto writing half done; in progress.
,,	52 S. W. ...	Outline and writing up to margin done; transfers for preliminary edition have been taken; hills just commenced; in progress.
,,	72 S. W. ...	This quarter sheet was cut out of, and made up from, the old full Degree Sheet 72; heavy additions done.
,,	90 S. W. ...	Outline and writing up to margin completed; transfers for preliminary edition will be taken as soon as examined.
,,	92 S. W. ...	Outline up to margin done; writing half completed; in progress.
,,	93 N. W. ...	Outline up to margin in progress.
,,	95 N. W. ...	Ditto ditto done; writing half completed; in progress.
,,	124 N. W. ...	Taking out old work and engraving new survey; outline and writing done; hills will be put in hand as soon as possible.
,,	124 N. E. ...	Outline and writing done; transfers for preliminary edition have been taken; hills will be put in hand as soon as possible.
,,	125 N. W. ...	Outline and writing done; hills almost finished; plate put down on account of sickness of the hill etcher.

Atlas Sheet No.	130 N. W.	... Outline and writing up to margin done; copies of preliminary editions taken from the plate; hills in progress; plate put down for a short time on account of more urgent work.
,,	91 N. W.	... Outline up to margin half done; in progress.
,,	91 S. W.	... Ditto ditto ditto ditto.

OLD PLATES TO WHICH LARGE ADDITIONS HAVE BEEN MADE, OR ARE IN PROGRESS.

,,	17	... Large additions of new survey outline; writing and heavy sand-hills done; jungle in progress; almost done.
,,	31	... New survey outline, writing, sand-hills, &c., finished.
,,	73	... Heavy additions of new survey outline, writing, hills and jungle done; plate finished.
,,	74	... Heavy additions of new survey outline and writing done; hills half completed; in progress.
,,	94	... Hills of heavy portion of new survey done; repairing hills to match the new work in progress.
,,	103	... Heavy alterations; re-engraving parts taken out of outline; writing, &c., finished.
,,	108	... Outline, writing and hills of new survey done; repairing old work; plate put down for other work.
,,	113	... Heavy additions of new survey outline and writing done; hills will be commenced as soon as possible.
,,	119	... Heavy additions of new survey done; outline, writing, hills and jungle done; plate finished.
,,	121	... Heavy additions of new survey of the Sunderbuns outline; writing done; jungle in progress; plate put down for more urgent work.
,,	106	... Heavy additions and corrections almost finished; plate put down for a short time.

SHEETS REPAIRED TO WHICH SMALL ADDITIONS AND CORRECTIONS HAVE BEEN MADE, OR ARE IN PROGRESS.

Atlas Sheets 1 N. E.; 1 S. E.; 2 S. E.; 2 S. W.; 3 N. E. 3 N. W.; 3 S. E.; 5 S. E.; 5 N. E.; 6 N. E.; 6 S. E.; 8 S. E.; 8 S. W.; 9 N. E.; 9 S. E.; 9 S. W.; 10 S. E.; 10 N. W.; 10 N. E.; 11 N. E.; 11 N. W.; 11 S. E.; 11 S. W.; 27 N. E.; 27 S. E.; 32 S. E.; 32 N. E.; 32 S. W.; 33 S. W.; 33 N. E.; 34 S. E.; 44 N. W.; 45 S. W.; 45 N. W.; 51 S. W.; 51 N. W.; 51 N. E.; 51 S. E.; 52 N. E.; 53 N. E.; 53 S. W.; 69 N. W.; 69 S. W.; 69 S. E.; N. E. and N. W.; 70 S. W.; 70 S. E.; 70 N. W.; 71 N. W.; 72 S. E.; 86 S. W.; 87 N. W.; 87 S. W.; 87 S. E.; 87 N. E.; 92 N. E.; 92 S. E.; 93 N. E.; 105 N. E.; 105 S. E.; 105 N. W.; 125 N. E; 126 S. W.; 126 N. W.; 126 N. E.; 126 S. E,; 127 N. E.; 127 S. E.; 127 N. W.; 127 S. W.

SLIGHT ADDITIONS AND REPAIRS TO OLD SHEETS.

,,	4	... Slight additions, price, &c.
,,	7	... Ditto ditto.
,,	16	... Ditto ditto.
,,	24	... Slight additions, railways, boundaries, price, &c.
,,	25	... Ditto ditto ditto.
,,	26	... Repairing, writing completed.
,,	30	... Slight additions, price, &c.
,,	38	... Ditto ditto.
,,	39	... Ditto names, railways, roads and title done.
,,	40	... Ditto ditto ditto ditto.
,,	41	... Repairing outline, in progress; thee-fourths completed.
,,	43	... Ditto writing completed.
,,	46	... Slight additions, price, &c.
,,	47	... Ditto repairing, writing in progress.
,,	48	... Heavy sheet ditto ditto.
,,	49	... Taking out and re-engraving railways; corrections and writing done.
,,	50	... Engraving railways; station names, and corrections completed.
,,	56	... Repairing outline and writing; in progress.
,,	57	... Ditto ditto completed
,,	58	... Ditto ditto in progress.

Atlas Sheet No. 60 ...	Outline repaired; writing being recut; in progress.
,, 61 ...	Repairing outline and writing completed.
,, 62 ...	Ditto ditto plate put down for other work.
,, 63 ...	Ditto ditto and writing completed.
,, 76 ...	Ditto ditto ditto half done.
,, 79 ...	Ditto writing completed.
,, 95 ...	Ditto ditto.
,, 102 ...	Engraving; district names, price, &c., completed.
,, 104 ...	Slight additions, price, &c.
,, 114 ...	Repairing writing; about one-fourth done; in progress.
,, 115 ...	Ditto ditto ditto.
,, 116 ...	Slight additions, price, &c.
,, 118 ...	Ditto ditto.
,, 120 ...	Ditto ditto.
,, 129 ...	Ditto ditto.
,, 138 ...	Ditto ditto.

THE FOLLOWING ATLAS SHEETS HAVE BEEN PROJECTED AND BORDERS CUT.

Atlas Sheets 18, 19, 20, 75, 76; all four quarters; 94 S. E. and 108 N. E. In all 22 plates; and borders cut only to five blank plates.

GENERAL AND MISCELLANEOUS MAPS AND OTHER WORK COMPLETED AND IN PROGRESS.

Map of India in 6 sheets; scale 32 miles=1 inch, sheet 1.	Outline and writing completed as far as first orders.
Map of India in 6 sheets; scale 32 miles=1 inch, sheet 4.	Outline done; writing well advanced.
Map of Sind, 16 miles=1 inch.	Outline and writing completed; map published, preliminary edition.
Map of Bengal in 2 sheets, 16 miles=1 inch.	Sheet 1, outline done; writing nearly completed as far as first orders.
Map of Bengal in 2 sheets, 16 miles=1 inch—sheet 2.	Ditto ditto done as far as first orders.
Map of India, scale 96 miles=1 inch, skeleton.	Outline done; writing just commenced.
Map of Assam, 16 miles=1 inch.	Outline and writing completed; corrections and additions in progress.
Map of Oudh, 16 miles=1 inch.	Finished and published.
Map of Central India in 2 sheets; scale 16 miles=1 inch.	Border and projections done.
Map of Rajputana, in two sheets, scale 16 miles=1 inch.	Border and projections just commenced.
Large Graticule Brass Plate. ...	For the Trigonometrical Survey—completed.
Commission plate for the Military Department.	Taking out old work, and engraving new wording for commissions of native officers; completed.
Skeleton map of the Punjab, scale 32 miles=1 inch.	Heavy additions and alterations completed up to date.
Map of India, 80 miles, in 2 sheets	Outline done; writing just commenced.
Anemograph scale.	For the Mathematical Instrument Department; finished.

GAZETTEER MAPS.

Bhagulpur Division... ...	Finished.
Chota-Nagpore Division. ...	
Rajshahi and Kuch Behar Division.	
Patna Division.	
Chittagong Division ...	
Map of Orissa.	Corrections completed.
Four sheets, plan of Calcutta 'Simms.'	Slight additions completed.
Steel Gunge.	Engraved for the use of the Telegraph Department; finished.
Scales of latitudes and longitudes for the use of the Indian Atlas.	A new scale engraved; finished.
Ten scales of 2½ chains to the inch or 32 inches to the mile.	Engraved for the Mathematical Instrument Department; finished.

1 Large tint of dots	For transfers for printing in colours ; finished.
5 Small do. ...	Ditto ditto ditto.
Rain scale in 100ths of an inch ...	Engraved for the use of the Mathematical Instrument Department.
Six plates of imprints, ...	With new additions and alterations of dates.

NUMBER OF PLATES IN HAND.

1877	... ...	230

COPPER-PLATE PRINTING.

Proofs, ...	... ...	1,129
Transfers,	... ...	691
Impressions,	... ...	9,687
	TOTAL IMPRESSIONS ...	11,507

C. W. COARD,
Supdt,, Engraving Branch,
Surveyor General's Office.

JOHN O. N. JAMES,
Assistant Surveyor General,
In charge Engraving Branch.

SURVEYOR GENERAL'S OFFICE,
Calcutta, 31st December 1877.

APPENDIX G.

From CAPTAIN J. WATERHOUSE, *Assistant Surveyor General, in charge Photographic Branch, to the Surveyor-General of India, No. 483 P., dated Calcutta, 15th December 1877.*

I have the honor to forward the usual tabular statements showing the amount and progress of the work performed in this branch of your, office during the past year from 1st October 1876 to 30th September 1877.

2. AMOUNT OF WORK.—The amount of work performed during the year under report, as compared with the previous year, is shown in the following table :—

	Ordinary Work.				Cadastral Maps, North-Western Provinces.			
	1st October 1875 to 30th September 1876.	1st October 1876 to 30th September 1877.	Difference	Difference in square feet.	1st October 1875 to 30th September 1876.	1st October 1876 to 30th September 1877.	Difference.	Difference in square feet.
Originals	955	1,244	+289	...	1,270	2,009	+739	...
Negatives ...	1,441	1,565	+124	...	3,133	4,334	+1,201	
	2,776·4 s. f.	3,046·76 s. f.		+270·36	6,800·50 s. f.	11,211·44 s. f.	...	+4,410·65
Silver prints ...	1,204	871	−300		.....	.....	...	...
	1,621·289 s. f.	1,361·22 s. f.		−260·06				
Photo. Transfers	1,207	1,603	+396		3,363	4,350	+987	
	2,280 s. f.	3,208·64 s. f.		+928·64	7,102·04 s. f.	11,046·44 s. f.		+4,544·4
Transfers to zinc or stone ...	518	672	+154	...	1,337	2,021	+684	...
Number of pulls ...	136,858	144,184	+5,326	...	56,200	*97,000	+40,800	...
Ditto sheets ...	175,218	148,665	−26,553	...	56,200	97,000	+40,800	...
Ditto copies ...	160,935	133,318	−27,617	...	29,700	66,900	+36,200	...
Carbon prints of life convicts	1,840	3,132	+1,292	...	.....	.....	...	...

* 1,490 sheets printed off.

3. PROGRESS.—The number of original subjects received as the ordinary work of the office shows a considerable increase, though the out-turn of the presses is less. As will be shown further on, considerable progress has been made in the reproduction of the Cadastral maps of the North-Western Provinces, and the out-turn is very much larger than in the previous year. A very large amount of work has been done for other Departments, the details of which are shown in the accompanying table.

4. EXPENSE OF WORKING.—The expense of working the office during the financial year 1876-77 is shown, as far as materials are available, in the following table :—

	Rs. As. P.	Rs. As. P.	
Superintendent's salary from April 1876 to 31st March 1877	13,050 0 0		
Sanctioned Establishment	22,096 14 6		
House-rent	4,188 3 0		
Contingencies	2,066 0 3		
		41,401 1 9	
Cadastral Establishment, North-West Provinces ...	9,789 8 3		
Cadastral Contingencies	1,564 3 3		
Cadastral Contingencies additional for construction of glass-house,* &c.	248 11 0		* Rs. 4,000 was paid on this account from Grant of 1875-76.
Cadastral extra work	4,638 10 7		
		*16,241 1 1	
Chemicals and stores received from England as far as known	31,447 11 6 †		† These sums include cost of materials, &c., received for the Cadastral work.
Chemicals received from Government Medical Stores ...	303 9 0 †		
Stores and Materials received from other Government Departments	570 4 6 †		
Cost of paper	18,121 3 1 †		
		50,442 12 1	
GRAND TOTAL ...		1,08,084 14 11	

5. The expenditure on the office establishment and contingencies has been less by upwards of Rs. 2,000 than it was last year. The expenditure for the Cadastral establishment was much larger than the previous year, owing to the increase of establishment; and the expense of chemicals, paper and stores received from England was also largely increased by the requirements of the Cadastral Surveys. These items, however, do not affect the Departmental Budget.

6. The expenditure upon the reproduction of the Cadastral Survey maps of the North-Western Provinces during the financial year 1876-77, amounting, as shown in the foregoing table to Rs. 16,241, was met from the grant of Rs. 20,000 given by the North-Western Provinces Government for that purpose, but during the greater part of the year the full establishment was not engaged. With a few exceptions the full establishment has now been entertained as follows:—

3 Photographers; 5 Assistant Photographers, (2 Vacant); 2 Glass cleaners; 5 Labourers; 4 Negative retouchers; 1 Zincographer; 7 Zinc printers (1 vacant); 20 Pressmen; 4 Zinc grainers; 8 Zinc correctors; 1 Head Assistant (vacant); 1 Store-keeper and Accountant; 1 Writer; 1 Record-keeper; 1 Carpenter and 1 Farash, or a total of 65 men, and the cost of it will be met from the grant given by the Government of the North-Western Provinces, amounting for the present financial year to Rs. 28,000.

7. Some of the posts have not yet been filled up, because I have been unwilling to entertain the full establishment until I was in a position to turn out the full number of sheets required and estimated for. That time has now arrived, and I shall take steps to complete the establishment to full strength, and to strengthen it further in those branches which experience has shewn to be too weak to deal with the work they have to do.

8. Personnel.—With the exception of the resignation of his appointment on the Cadastral Establishment by Mr. A. Madge, no changes took place in the European Staff of the office during the period under report; but Mr. G. G. Dempster, who was transferred to this office from the Great Trigonometrical Survey Office, in consequence of reduction of establishment, joined the Cadastral Staff in place of Mr. Madge on the 1st October. The senior assistants, Messrs. J. Mackenzie, B. Mackenzie, Watson, Harrold and Marshall, have continued to give every satisfaction in the discharge of their respective duties, and the junior assistants, Sergeant George, Messrs. Lagnier, Leroy and LeFranc have made good progress in learning the work connected with the reproduction of the Cadastral survey maps. A great deal of heavy work in bringing up the store accounts devolved upon Syud Ishmael, the store-keeper, and he and the native assistants have done well.

9. Cadastral Maps of the N.-W. Provinces.—Considerable progress has been made in the work of reproducing these maps during the year, and, 1,940 sheets have been printed off. The presses indented for specially for this work were received from England in October 1876, but the large cameras, lenses and apparatus did not arrive till the months of June and July 1877, and all arrangements were completed for commencing work with them about the middle of August. Before the arrival of the special presses and cameras from England, a great deal of the cadastral work had to be done as extra work out of office hours and paid for extra, as shown in the table in paragraph 4, under the item "cadastral extra work," because the photographic and printing plant at my disposal did not admit of the work being done in any other way, and I was anxious to make some progress with the work, to utilize the chemicals and stores received for it, and to get the young hands trained. There is now no necessity for extra work, except in cases of urgency, and it has therefore been stopped.

10. The large lenses by Dallmeyer are splendid instruments, and notwithstanding their large size and length of focus, they scarcely require more exposure than some of the lenses in use with the smaller cameras—a great advantage in dull weather. There has not been much difficulty experienced in working plates of the large size of 34″ × 24″ and it is easy to secure the required out-turn daily from the two cameras. On the whole I consider that the plan of photographing complete sheets of these maps has proved satisfactory and saves considerable time and labour, while the expense is little, if at all, greater.

11. The introduction of the large plates and transfers has necessitated a great many new arrangements in the working rooms, but these are now nearly all complete. Full supplies of paper, chemicals and printing materials required for turning out these maps have been received, so that there is no difficulty or delay on that score, and as far as establishment and material are concerned, the work is now fairly started; and were it not for the defects and incompleteness of many of the original drawings, and the consequent necessity for more correction than was at first anticipated, there would be no difficulty in regularly turning out the 12 sheets a day estimated for, or even more, but at present we are only doing 10. The Revenue Survey Office are, however, making every effort to improve the sheets before sending them for reproduction, and I hope that after this month present difficulties will be removed, and the estimated out-turn produced with regularity. It must be remembered that a large new establishment of photographers, draftsmen and printers has had to be found and trained, and it will necessarily take some time for them to become thoroughly efficient. The superintendence of this new work has taken a large share of my time during the year.

12. Processes. *Negatives.*—On further trials with the ferrid-cyanide of lead intensifier described in my last report, it was found that, though undoubtedly a good and valuable method of intensifying, it did not answer so well for large work as the usual bichloride of mercury and hydrosulphate of ammonia, chiefly owing to a tendency for the lines to choke up and the film to disintegrate. It has therefore been abandoned. Mr. J. Mackenzie, the head photographer, has found that old mercury-stained glasses may be quite freed from these stains by soaking them for some hours in the solution of nitrate of lead and ferrid-cyanide of potassium. This is an important discovery, because it enables glasses to be used over and over again without producing fogged images in the parts stained by previous use.

13. When intensifying the large plates for the cadastral maps it has been found useful after fixing the plate to flow it with a solution containing—

Nitrate of silver	...	...	...	...	4 parts,
Citric Acid ...	...	...	...	...	2 „
Water ...	...	...	...	...	100 „

and then re-develope with the usual iron developer. By this means a considerable increase of density in the silver deposit is easily gained, and the subsequent intensification with mercury is facilitated and shortened.

14. *Photo.-transfer.*—Sergeant Harrold has worked out a modification in the method of preparing the photo.-transfer prints which has caused a considerable improvement in the results.

15. The paper is prepared as usual with two coats of gelatine and bichromate of potash. It is then put away for a few days for the gelatine surface to become hard and insoluble, and when required for use it is again coated with the gelatine mixture and then exposed to light, inked and washed in the usual way. In the hot weather it was found that the sensitive paper required to be kept three days before giving the final sensitive coating. In the cold weather six days and upwards are required before the coating becomes sufficiently hard. This time may, however, be shortened by laying the paper face downwards on a board, and allowing the light to act on the back surface for a minute or two. This may be done, either after the print has been obtained from the negative, or just after the preliminary coating has been given to the paper. The action of the light set up by the sunning continues in darkness, and thus hardens the film to the required extent in a very much shorter time than would be necessary in the dark alone. It has also been found that the addition of 2 or 3 grains of either glucose, alum or chrome alum to the ounce of the gelatine and bichromate solution used for the preliminary coating of the paper, hardens the gelatine sufficiently to allow the paper to be used within 2 or 3 days in the cold weather.

16. The advantage of this method is that a base of hard-insoluble gelatine remains on the paper and retains the finest lines, while the fresh and easily soluble final coating preserves the clearness of the ground. It is necessary that the gelatine should be thoroughly hardened otherwise the transfers stick to the zinc plate in transferring, and are difficult to remove; the soft gelatine is also apt to spread over the lines and prevent their transfer.

17. Another advantage is, that warm water is not required for the development of the prints, and the ink is not so liable to become pasty as in the usual way of working. The lines are found to keep crisp and the spaces between them clear and free from scum, thus giving much clearer and sharper transfers.

18. It was hoped to get even better results by inking-in the transfers with a gelatine roller as recommended by Captain Abney for his papyrotype process, and thus avoid the risk of washing off the finer lines, but practically this plan was not found so satisfactory as inking-in in the usual manner with the press.

19. We have as yet not had an opportunity of working this new method throughout the year and so determining the modifications necessary at the different seasons; but next year I hope to test it thoroughly and perfect it.

20. *Pigment Printing.*—348 negatives of convicts were received from the Jail Department during the year, and 9 copies of each were printed off with fair success, part of the tissue used being made in the office. No intimation has been given of any work of the kind being required this year, and I believe the experiment of photographing the convicts is not to be continued.

21. *Photo.-engraving.*—During the year I have made some experiments on a process of photo-engraving similar to that recommended by Messrs. Geymet and Alker in their treatise on "Gravure Heliographique." Gelatine pigment tissue, similar to that used for the Autotype, or pigment-printing process, is sensitised in the usual way, exposed to light under a *reversed* negative, then transferred for development on to a highly polished copper plate, which for convenience in the after processes of electrotyping may be silvered with a solution of nitrate of silver in cyanide of potassium. When the gelatine image has been fully developed a 'grain' is given to it by flowing over the plate an alcoholic solution of tannin about five per cent. This at once removes the water from the gelatine film, and leaves it with a most delicate granulation. This giving the grain is an important point in the process, because without it the ink could not be retained in the hollows of the copper plate when printing. Geymet and others obtain the grain in an entirely artificial manner by impressing the sensitive film with the image of a fine woven tissue, or with engraved ruled or stippled tints, all of which present an unpleasant regularity. The method I have adopted gives a sufficient but almost imperceptible grain, with the effect of a very fine chalk drawing. The solution of tannin has, however, some defects which make it necessary to try to find some other efficient substitute for it.

22. When the gelatine image has thus received the grain, the surface is metallised, or rendered capable of receiving a deposit of copper by the electrotyping process. I have found that the most efficient means of effecting this is to wash the image with a solution of chloride of gold in ether, or in a mixture of alcohol and ether, in the proportion of about one part of chloride of gold to 50 parts of solvent. A short exposure to light completely reduces the gold. The bare portions of the copper plate are cleaned with a little of the silvering solution, and the image is then black-leaded in the usual way with plumbago which has also been treated

with the ethereal solution of chloride of gold. A copper connecting band is soldered to back of the plate, which is then coated with asphaltum varnish, and when this is dry the pl is ready to be placed in the depositing trough of the electrotyping apparatus. If the gelati has been rendered thoroughly conducting, the deposit of copper covers the whole surfac within a few minutes, but it generally happens that the thicker parts of the image, which represent the deep shadows, swell up in the copper solution and do not readily take the deposit, thus causing irregularities in the deposit which may spoil the result. The deposition is allowed to go on till a plate of sufficient thickness has been obtained. The electrotype is then separated from the matrix in the usual way, and after the edges have been trimmed, and the surface cleaned, the plate is ready for printing in the copper-plate press.

23. One or two excellent plates were obtained by this method, but as success depended upon the working of two processes of which my knowledge was limited, a great many difficulties arose, both in the obtaining of the gelatine matrix and in the electrotyping, which I have not yet been able to overcome, though I hope to do so in the course of next year. The results already obtained show that the process is practical, and if it could be successfully worked would be of value, especially as it has the advantage over collotype that a good plate once obtained, it can be further multiplied by electrotyping; or if protected with a surface of iron, thousands of equally good copies can be taken from it in the ordinary copper-plate press. The plates, moreover, can be put by for future use in the same manner as any other engraved plate.

24. Cadastral Maps of Bengal.—The demands of the North-Western Provinces cadastral maps, besides the ordinary office work, have allowed but little progress to be made with the re-production of these maps, and only 137 sheets have been reproduced during the year. No ordinary means will suffice to cope with this immense work, and, as I reported last year, until steps are taken to provide special establishment, plant and accommodation for this purpose, it is hopeless to expect any material advance to be made by this office, however anxious we may be to meet the urgent wants of the Irrigation Department.

Abstract of Work performed in the Surveyor General's Office, Photographic Branch, from 1st October 1876 to 30th September 1877.

	Sections or sheets.	Negative plates.	Carbon prints.	Silver prints.	Photo-transfer prints.	Transfers to zinc or stone.	Number of pulls.	Number of sheets.	Number of complete copies.	Remarks.
Topographical Maps ...	163	281	...	252	249	100	20,525	20,655	20,655	
Revenue Survey Maps ...	487	535	...	...	522	127	23,460	19,100	19,100	1,430 Anastatic.
District Maps ...	5	20	...	...	12	4	7,914	6,334	2,997	
General Maps ...	55	192	...	46	208	57	10,559	7,829	5,291	620 Anastatic.
City and Cantonment plans	30	62	...	66	144	37	5,442	5,142	1,992	
Miscellaneous Maps, &c.	367	475	...	507	528	180	63,551	82,455	79,783	
Zincographic and Anastatic Transfers ...	...	...	...	...	...	30	...	...	...	
Proofs	...	...	..	...	...	...	5,883	...	...	
Cadastral Survey, Bengal	137	...	...	...	...	137	6,850	6,850	3,500	
Photographs of life convicts	...	...	3,132	...	...	...	...	...	...	
Total ...	1,244	1,565	3,132	871	1,663	672	1,44,184	1,48,665	1,33,318	
Cadastral Survey, North-Western Provinces ...	2,009	4,334	..	...	4,350	2,021	97,000	97,000	65,900	
Grand Total ..	3,253	5,899	3,132	871	6,013	2,693	2,41,184	2,45,665	1,99,218	

SURVEYOR GENERAL'S OFFICE,
Photographic Branch;
Calcutta, 15th December 1877.

J. WATERHOUSE, *Captain,*
Asst. Surveyor General.

Statement showing the work done for other Departments.

Names of Departments.	Number of Sections.	Number of Negatives.	Number of complete copies.	Number of silver prints.	Carbon prints of life-convicts.	Price.	Remarks.
						Rs. As. P.	
Foreign Department	2	6	1,980	...	...	182 1 3	
Home Department	...	...	195	...	...	88 8 0	
R. A. C. Department	3	3	165	...	...	20 13 6	
Military Department	20	12	4,312	...	...	1,660 6 3	
Bengal Secretariat	8	11	2,635	...	...	200 3 6	
Government of Bengal, P. W. D. ...	12	41	2,700	...	...	538 13 9	
Government of Punjab, P. W. D. ...	2	29	1,319	...	...	1,122 10 8	
Government, N. W. P., Irrigation Branch	15	15	11,250	...	...	191 9 8	
Quarter Master General	24	39	13,395	...	...	1,165 4 4	
Adjutant General	5	3	525	...	...	35 0 0	
Inspector General, Military Works ...	1	2	250	...	...	40 0 4	
Military Transport Committee ...	48	29	2,194	3	...	265 4 4	
Consulting Engineer to Government of India, Railway Department ...	17	8	1,426	...	...	85 4 5	
Superintendent, Garrison Instruction ...	3	6	246	...	...	23 13 0	
Ordnance Department	2	2	945	...	...	46 8 8	
Consulting Architect to the Government of Bengal	2	2	...	15	...	38 14 0	
Archæological Survey	3	1	5,688	...	...	258 12 6	
Sanitary Commissioner, Central Provinces	2	2	620	...	...	150 15 10	
Superintendent, Forest Surveys ...	...	...	604	...	...	47 4 6	
Executive Engineer, Fort William ...	2	8	32	...	...	38 5 10	
Marine Survey Department ...	18	52	6,350	...	...	1,979 0 11	
Master Attendant	8	38	452	...	...	228 5 3	
Mint Master	...	...	220	...	...	53 2 3	
	...	...	...	34	...	170 0 0	
Gazetteer, N. W. P.	3	2	550	...	...	32 13 8	
Superintendent, Government Printing ...	1	1	49	...	...	10 6 4	
Post Master General	...	...	330	...	...	114 3 6	
Trustees, Indian Museum	1	1	310	...	...	15 12 9	
Meteorological Department	3	3	2,410	...	...	103 4 7	
Talboys Wheeler, Esq.	1	1	20	...	...	3 2 0	
Jail Department, Alipore	...	...	...	...	3,132	783 0 0	348 negatives were received from the Jail Department.
Total ...	206	317	61,172	52	3,132	9,593 13 7	

SURVEYOR GENERAL'S OFFICE,
PHOTOGRAPHIC BRANCH;
Calcutta, 15th December 1877.

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

APPENDIX H.

From CAPTAIN R. V. RIDDELL, R.E., *Assistant Surveyor General, in charge Lithographic Branch, to the* SURVEYOR GENERAL OF INDIA,—*No.* $\frac{249}{L}$, *dated Calcutta, the 4th December 1877.*

I have the honor to submit returns showing the amount of work completed in the Lithographic Office between the 1st October 1876 and the 30th September 1877. From a comparison of these with similar returns of former years, it will be seen that the general out-turn in all the branches, is good.

2. Twenty-one sheets of the Revenue Survey maps (double Royal size) have been drawn on transfer paper and transferred to stone, and five city plans on various sizes. The hills in chalk, on the map of the Province of Sindh and those on a map transcribed for the Foreign Department, are the subjects of that class specially worthy of notice.

3. Good progress has been made in the preparation of District maps transferred from the engraved sheets of the Atlas of India on the scale of 4 miles = 1 inch. These District maps seem to be generally appreciated.

4. Statement B shows the amount and value of work done for other departments; the number of subjects treated amounts to about half that of those of the Survey Department; but the number of impressions or the lithographic press work, is about double that of the regular departmental work, as represented by 1,62,716 pulls for other departments, against 88,159 for the regular work. The cost of this work done for other departments is Rs. 11,888-10-3.

5. The heaviest of these jobs is the Geological Map of India on the scale of 64 miles = 1 inch. This map, which is now about $\frac{3}{4}$rds completed, is in four sheets, each bearing 8 to 10 colors, will probably be completed by March next, and gives promise of being a highly creditable production.

6. Messrs. Jevezy, Niven and Lepage have worked steadily and well throughout the year, and I have great pleasure in bringing their names to your notice. Most of the native draftsmen have also been regular in the performance of their duties.

A.

Statement of Departmental work done by the Lithographic Branch, Surveyor General's Office, between the 1st October 1876 and 30th September 1877, for the Survey Department.

Description of Maps.		Scale of Maps.	Size of each sheet.	No. of sheets.	No. of colored Copies.	No. of uncolored Copies.	Total No. of Copies.	Remarks.
NEW MAPS, &c., DRAWN & PRINTED DURING THE YEAR.								
General Maps.								
Map of Territories of his Highness the Khan of Kelat of Baluchistan ...	Chalk hills and corrections done only.	16 miles = 1 inch ...	Double Elephant ...	2	...	...	...	Not yet published.
Revenue Survey Maps.								
District Sonthal Pergunnahs, Sheet, No. 12	.....	1 mile = 1 inch ...	Double Royal ...	1	...	...	...	Do.
Do. Dinajpoor, Sheet No. 2	.....	„ „ ...	Do. ...	1	...	312	312	
Do. Dinajpoor, Sheets Nos. 3, 4, 5, 8, 9, 11 and 13 ...	.....	„ „ ...	Do. ...	7	...	...	...	Do.
Do. Rungpoor, „ „ 2, 3, 4, 5, 6, 7, 8, 10, 12 and 13 ...	.....	„ „ ...	Do. ...	10	...	...	..	Do.
Do. Beerbhoom, Sheet No. 4	.....	„ „ ...	Do. ...	1	...	...	...	Do.
Do do. do. 7	.....	„ „ ...	Do. ...	1	...	312	312	
Plans.								
Plan of Calcutta, Northern Section	.....	6 inches = 1 mile ...	Double Elephant ..	1	...	...	...	Do.
Do. the Sudder Station of Goalpara	.....	16 „ = 1 „ ...	Antiquarian ...	1	...	202	202	
Do. the Station of Nugger Golaghat	.....	8 „ = 1 „ ...	Imperial ...	1	...	162	162	
Do. the City of Oudh or Ajoodhia, District Fyzabad	.....	10 „ = 1 „ ...	Double Elephant ...	1	..	262	262	
Do. the City of Bahraich	.....	8 „ = 1 „ ...	Atlas ...	1	...	...	...	Do.
MAPS TRANSFERRED FROM THE ENGRAVED SHEETS OF THE ATLAS OF INDIA AND FROM STANDARD STONES.								
General Maps.								
Map of India, No. 3	Corrections and additions drawn only.	64 miles = 1 inch ...	Double Elephant ...	2	451	307	758	
Do. the Province of Sindh	Chalk hills and sand drawn only.	16 „ = 1 „ ...	Do. ...	1	...	...	...	Do.

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Do. do. do (without hills)	Corrections and color stones prepared.	„ „ ...	Do. ...	1	154	102	256		
Do. North-East Frontier, Peshawar to Cabul	Do. ...	4 „ =1 „ ...	Do. ...	2	210	112	322		
Atlas of India, Quarter Sheet No. 23 N. W.	Color stones prepared	„ „ ...	½ Sheet Atlas ...	1	...	...	...		Do.
Do. do. do. do. „ 23 S. W.	Do. ...	„ „ ...	Do. ...	1	102	102	204		
Do. do. do. do. „ 34 „	Do. ...	„ „ ..	Do. ...	1	105	102	207		
Do. do. do. do. „ 34 N. W.	Do. ...	„ „ ...	Do. ...	1	..	...	...		Do.
Do. do. do do. „ 52 S. E.	Do. ...	„ „ ...	Do. ...	1	215	102	317		
Do. do. do. do. „ 52 N. W.	Do. ...	„ „ ...	Do. ...	1	254	204	458		
Do. do. do. do „ 53 N. E.	Do. ..	„ „ ...	Do. ...	1	204	102	306		
Do. do. do. do. „ 72 N. W.	Do. ...	„ „ ...	Do. ...	1	102	101	203		
Do. do do. do. „ 72 S. W.	Do. ...	„ „ ...	Do. ...	1	208	102	310		
Do. do. do. do. „ 93 S. E.	Do. ...	„ „ ...	Do. ...	1	152	100	252		
Do. do. do. do. „ 93 N. E.	Do. ..	„ „ ...	Do. ...	1	...		...		Do.
Do. do. do. do. „ 124 S. E. ... — ...	Do. ...	„ „ ...	Do. ...	1	211	100	311		
Do. do. do. do. „ 130 N. W.	Do. ...	„ „ ...	Do. ...	1	156	102	258		
DIVISIONAL MAP.									
Map of Presidency Division	Corrections, boundaries, margin lines, &c., drawn.	8 miles = 1 inch ...	Double Elephant ..	1	209	100	309		
DISTRICT MAPS.									
District Chittagong, Sheets Nos. 2 and 3	Chalk hills added ...	4 miles = 1 inch ...	Imperial ...	2	...	203	203		
Do. Saruu	Corrections, boundaries, margin lines, &c., drawn, and color stone prepared.	„ „ ...	Atlas ...	1	150	100	250		
District Mozufferpoor	Do. ...	„ „ ...	Do. ...	1	...	...	...		Do.
Do. Durbhunga	Do. ...	„ „ ...	Do. ...	1	...		...		Do.
Do. Monghyr	Do. ...	„ „ ...	Do. ...	1	186	102	288		
Do. Pooree	Do. ...	„ „ ...	Do. ...	1	152	100	252		
Do. Burdwan	Do. ...	„ „ ..	Double Elephant ...	1	157	152	309		
Do. Lucknow	Do. ...	„ „ ...	Super Royal ...	1	262		364		
Do. Oonao	Do. ...	„ „ ...	Imperial ...	1	...	...	...		Do.
Do. Barnbunkee	Do. ...	„ „ ...	Super Royal ...	1	202	102	304		
Do. Fyzabad	Do. ...	„ „ ...	Do. ...	1	...	306	306		
Do Roy-Barielly	Do. ...	„ „ ...	Do. ...	1	204	102	306		
Do. Sooltanpoor	Do. ...	„ „ ...	Do. ...	1	...	...	...		Do.
MAPS, &c., DRAWN PREVIOUSLY; BUT PRINTED DURING THE PRESENT YEAR.									
DIVISIONAL MAPS.									
Map of Dacca Division	Color stone prepared	8 miles = 1 inch ...	Double Royal ...	1	258	100	358		
Do. Chittagong Division	Do. ...	„ „ ...	Atlas ...	1	150	100	250		
Carried over ...	.....	.....	.....	64	4,454	4,457	8,911		

Description of Maps.		Scale of maps.	Size of each sheet.	No. of sheets.	No. of colored copies.	No. of uncolored copies.	Total No. of copies.	Remarks.
Brought forward ...	.....	.....	.....	64	4,454	4,457	8,911	
District Maps.								
District Balasore	Color stone prepared	4 miles = 1 inch ...	Atlas ...	1	204	100	304	
Renenue Survey Maps.								
District Sonthal Pergunnahs, Sheets Nos. 4, 6, 7, 8, 9, 10, 11, 13, 15, and 16	.....	1 mile = 1 inch ...	Double Royal ...	10	...	3,120	3,120	
Do. Beerbhoom, Sheet Nos. 1, 2, 3, 5, and 6...	.....	„ „ ...	Do. ...	5	...	1,410	1,410	
Do. Dinagepoor, Sheet No. 1	.....	„ „ ...	Do. ...	1	...	312	312	
REPRINTS.								
General Maps.								
Map of India, No. 1	Color stone prepared	256 miles=1 inch ...	Foolscap ...	1	200	100	300	
Do. do. No. 2	Do.	64 „ =1 „ ...	Double Royal ...	2	451	205	656	
Do. do. No. 1, without names	.....	.....	Foolscap ...	1	...	204	204	
Do. do. No. 2, showing the progress of the Imperial Survey ...	Color stone prepared	128 miles=1 inch ...	Imperial ...	1	360	...	360	
Map of British Burmah, Pegu Division, Sheet No. 3	.....	4 miles=1 inch ...	Double Elephant ...	1	...	104	104	
Do. do. Sheet No. 4	.....	„ „ ...	Do. ...	1	...	104	104	
Skeleton map of Punjab and surrounding Countries	.....	32 miles=1 inch ...	Atlas	1	...	408	408	
Map of Assam, Sheet No. 5	.....	8 „ 1 inch ...	Imperial ...	1	...	25	25	
District Maps.								
District Chittagong (without hills)	.....	4 miles=1 inch ...	Imperial ...	3	...	232	232	
Do. Noakholly	.....	„ „ ...	Super Royal ...	4	...	202	202	
Do. Bhauguipore	Color stone prepared	„ „ ...	Double Royal ...	1	102	...	102	
Do. Bogra	Do.	„ „ ...	Super Royal ...	1	102	...	102	
Do. Cuttack	Do.	„ „ ...	Atlas	1	104	...	104	
Do. Maldah	Do.	„ „ ...	Imperial ...	1	100	...	100	
Do. Jessore	Do.	„ „ ...	Double Royal ...	1	104	...	104	
Do. Moorshedabad	Do.	„ „ ...	Imperial ...	1	104	...	104	
Do. Pubna	Do.	„ „ ...	Super Royal ...	1	102	...	102	
Do. Nuddeah	Do.	„ „ ...	Atlas ...	1	102	...	102	
Do. Patna	Do.	„ „ ...	Super Royal ...	1	102	...	102	
Do. Rajshahye	Do.	„ „ ...	Imperial ...	1	102	...	102	
Do. 24-Pergunnahs	Do.	„ „ ...	Atlas	1	205	...	205	

INDEX MAPS.							
Index to the sheets of Gwalior and Central India Topographical Survey No. 1 Party	Corrections and color, stone prepared ...	.....	¼ sheet Super Royal	1	502	102	604
Index to the sheets of Khandeish and Bombay Native States Survey, No. 2 Party	Do.	.....	Foolscap ...	1	502	102	604
Index to the sheets of Ganjam and Orissa, &c., Topographical Survey, No. 3 Party	Do.	.....	½ sheet Double Royal	1	502	102	604
Index to the sheets of North-East Division Central Provinces Topographical Survey, No. 4 Party	Do.	.....	Foolscap ...	1	502	102	604
Index to the sheets of Bhopal and Malwah Topographical Survey, No. 5 Party	Color stone prepared	.....	Foolscap ...	1	502	102	604
Index to the sheets of Khasi, Garo and Naga Hills Topographical Survey, No. 6 Party	Do. ...	.....	½ sheet Double Royal	1	502	102	604
Index to the sheets of Rajpootana Topographical Survey, No. 7 party ...	Do. ...	.....	Do. ...	1	502	102	604
Index to the Indian Atlas, showing the state of the Engraving to 1st October 1876, with three tints	Do. ...	.....	Foolscap ...	1	380	124	504
Index to the sheets of the Atlas of India	Do. ..	.....	Imperial ...	1	204	...	204
Do. do do.	Do. ...	... ..	Foolscap ...	1	524	...	524
Index to the sheets of District Sonthal Pergunnahs	.....	.....	½ sheet Double Royal	1	...	304	304
REVENUE SURVEY MAPS.							
Map of Oudh, sheet No. 40	.....	1 mile =1 inch ...	Double Royal ...	1	...	25	25
Do. do. „ „ 41	.....	„ „ ...	½ sheet Double Elephant	2	...	25	25
Do. do. „ „ 42	.....	„ „ ...	Do. ...	2	...	25	25
PLANS.							
Plan of Simla and Jutog, sheets Nos. 1, 2, 3 and 4, (with hills) ...	.....	8 miles=1 inch ...	Atlas	4	...	200	200
Do. Port Blair, Andaman Islands	.....	4 „ =1 „ ..	Foolscap ...	1	...	25	25
Do. the Town of Calcutta	.....	3 inches=1 mile ...	Super Royal ...	1	202	300	502
Do. Calcutta (old one)	.....	6 „ =1 „ ...	Double Elephant ...	1		22	22
CADASTRAL MAPS	.....	.....	Imperial ...	132	...	6,864	6,864
FORMS	.....	.....	Various sizes ...	50	...	27,545	27,545
MISCELLANEOUS DRAWINGS	.....	.....	.....	15	...	4,223	4,223
TOTAL ...	.....	.....	.....	328	11,722	51,379	63,101

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B.

Work done for other Departments.

For what Department.	No. of maps.	No. of sheets.	No. of sheets colored.	No. of sheets uncolored.	No. of copies.	No. of impressions.	Value. Rs. A. P.
Home Department	5	5	3	4	9,908	18,744	571 0 9
Foreign „	10	12	4	12	1,957	6,067	1,381 6 11
Military „	25	25	1	24	2,788	2,820	405 9 5
Department of Revenue, Agriculture, and Commerce	6	6	1	5	765	1,189	128 2 8
Telegraph Department	3	3	.....	3	2,501	2,978	185 15 3
Bengal Secretariat	14	14	2	13	5,784	7,074	711 10 8
Marine Survey Department ...	2	2	1	1	403	539	316 3 0
Sanitary Commissioner	7	7	7	.....	7,680	22,819	912 12 4
For W. W. Hunter Esq., L. L. D., Director General of Statistics ...	5	5	5	.....	11,181	38,280	2,124 4 0
Quarter Master General ...	19	19	.....	19	2,086	2,086	283 5 4
Meteorological Reporter to the Government of India	5	5	3	2	2,536	6,280	408 11 10
Archæological Survey of India ...	26	26	.....	26	19,926	19,926	1,091 15 9
Geological Survey Office ...	6	7	4	3	5,929	18,215	1,335 14 3
Miscellaneous Drawings ...	30	32	3	30	13,708	15,699	1,941 10 1
Total ...	163	168	34	142	87,152	1,62,716	11,888 10 3
Total of Departmental work from Statement A	.....	328	.....	.....	63,101	88,159	.....
Grand Total ...	.....	496	.....	.....	1,50,253	2,50,875	.....

Abstract of Drawing and Printing executed at the Surveyor General's Office, Lithographic Branch, from 1st October 1876 to 30th September 1877.

Subject.	No. of sheets.	No. of copies.	No. of impressions.
District and General Maps, &c.	56	11,789	30,908
Index Maps	11	5,764	11,242
Revenue Survey Sheet Maps, scale 1 mile=1 inch	23	5,541	5,591
Plans	10	1,375	1,884
Cadastral Maps	132	6,864	6,864
Miscellaneous Drawings	15	4,223	4,425
Forms	50	27,545	27,845
	297	.....	.....
Maps drawn, but not printed	31	.....	.....
Total ...	328	63,101	88,159
Work done for other Departments.			
Miscellaneous Maps	66	31,495	82,903
Ditto Plans and Sketches, &c.	83	49,728	61,598
Geological Maps	7	5,929	18,215
	156	.....	.....
Maps drawn, but not printed	12	.....	.....
	168	87,152	1,62,716
Total of Printing in Lithographic Branch ...	496	1,50,253	2,50,875
Type Branch.			
Departmental orders	27	2,686	3,036
Memoranda and Forms for use of the Department	256	1,19,922	1,66,726
Forms for Topographical and Revenue Surveys	49	75,724	2,18,906
Transfers of Headings, Foot-notes, References, &c., to published Maps ...	3,614	12,493	12,493
	3,946	2,10,825	4,01,161

Statement of expenditure of the Lithographic Branch, Surveyor General's Office, from 1st October 1876 to 30th September 1877.

	Rs.	A.	P.
Permanent Establishment	33,527	0	10
Contingent expenses	4,950	0	5
Total Rupees ...	38,477	1	3

R. V. RIDDELL, *Capt., R.E.,*
Assistant Surveyor General,
In charge, Lithographic Branch.

SURVEYOR GENERAL'S OFFICE,
LITHOGRAPHIC BRANCH,
Calcutta, the 4th December 1877.

APPENDIX I.

List of Revenue Surveys executed from 1845-46 to 1876-77.

Division or Commissionership.	District.	Season of Survey.	Area in square miles as surveyed.	Cost.	Rate per square mile	Remarks.
	BENGAL.					
Burdwan ...	Burdwan	1855-57	2,693	71,885	26 8 1	
	Bankoora	1854-56	1,349	38,654	28 10 5	
	Beerbhoom	1848-52	3,114	85,587	27 7 9	
	Midnapore	1872-77	5,328	3,03,417	67 15 2	Includes 192 square miles of District Balasore, and excludes 44 square miles of jungle mehals remaining to complete District Midnapore in 1875.
	Hooghly	1869-73	2,020	1,46,839	72 11 1	
Presidency ...	24-Pergunnahs	1846-52	2,243	1,12,625	49 7 4	
	Nuddea	1849-55	3,578	1,17,820	32 14 10	
	Jessore	1855-59	3,141	92,151	34 15 9	
	Moorshedabad	1848-53	2,634	73,317	27 13 4	
Rajshahye ...	Dinagepore	1857-61	4,586	2,02,028	44 0 10	
	Rajshahye	1848-53	3,035	1,04,244	34 5 6	
	Rungpore	1855-59	4,948	1,28,029	25 1 3	
	Bogra	1852-53	818	26,141	31 15 4	
	Pubna	1853-55	1,739	67,013	32 12 6	
	Darjeeling	1861-67	1,234	1,13,810	92 3 8	
	Julpigoree	1864-68	1,879	1,11,478	59 4 9	
	Oooch Behar Native State ...	1866-70	1,312	83,875	63 14 10	
	Ditto Topographical ...	1858-60		17,276	13 2 8	
Dacca ...	Dacca	1857-60	3,421	1,07,378	31 1 6	
	Furreedpore	1858-60	1,417	39,202	27 10 7	
	Backergunge	1850-53	4,439	1,43,975	32 6 11	
	Mymensingh	1850-57	6,454	2,31,415	35 2 1	
	Tipperah	1861-64	2,054	69,105	33 9 2	
	Ditto Hills	1863-64	2,879	43,004	14 14 11	
	Dearah Survey	1863-69 and 1874-77	8,620	4,44,213	51 8 6	The survey extends from Buxar on the west to Burrisal on the east.
Chittagong ...	Noakholly	1863 65	2,174	72,956	33 8 11	
	Chittagong Hills	1861-66	6,881	1,32,435	19 3 11	
Patna ...	Patna (*Cadastral*) ...	1876-77	119	32,102	269 12 3	
	Shahabad	1844-46	4,403	50,858	11 8 9	The Cadastral Survey of the irrigable area in Districts Shahabad and Patna will be completed in 1877-78.
	Ditto (*Cadastral*) ...	1874-77	935	3,00,626	321 8 5	In these two Districts the Cadastral Survey has been confined to the irrigable area.
	Tirhoot	1846-50	6,114	99,108	16 3 6	
	Sarun	1843-47	6,394	96,986	15 2 8	
	Chumparun					
	Gya (*Cadastral*)	1875-77	456	1,16,299	255 0 8	
Bhagulpore ...	Monghyr	1836-47	3,593	97,195	27 0 9	
	Bhaugulpore	1842-50	7,804	1,14,404	14 10 8	
	Purneah	1844-48	5,712	1,02,587	17 15 4	
	Maldah	1840-50	1,463	32,684	25 5 9	
Chota Nagpore ...	Hazarebagh	1868-72	7,014	1,59,105	22 10 11	
	Lohardugga Sub-Division Palamow.	1863-69	4,270	2,67,736	60 5 9	
	Manbhoom	1861-67	5,552	2,44,024	43 14 4	
	ASSAM.					
Assam ...	Goalparah	1843-54	2,556	72,192	28 3 11	
	Ditto	1873-75		1,31,425	51 6 8	
	East Dooars	1867-69	1,570	81,759	51 12 6	
	Kamrup	1865-69	3,631	2,14,528	59 1 4	
	Darrang	1871-74	3,418	1,81,803	53 3 0	
	Nowgong	1860-72	3,066	1,88,549	55 3 2	
	Sibsagar	1862-72	2,897	2,03,905	70 6 2	
	Lakhimpur	1868-74	5,318	4,04,602	76 1 8	
	Sylhet	1860-06	4,981	2,13,906	42 15 3	
	Cachar	1864-68	1,722	1,51,245	87 13 1	Includes 425 square miles of reconnoissance (based on triangulation) of the Lushai Hills, south.
	BRITISH BURMAH.					
British Burmah ...	Akyab	1858-61	10,975	2,32,538	21 3 0	
	Ramree (Island)	1868-70	558	82,605	148 0 7	
	OUDH.					
Lucknow ...	Lucknow	1861-63	1,417	45,345	32 0 0	
	Bara Banki	1862-64	1,296	43,398	33 7 10	
	Unao	1860-62	1,369	59,220	43 4 1	

Division or Commissionership.	District.	Season of Survey.	Area in square miles as surveyed.	Cost.	Rate per square mile.	Remarks.
	OUDH—*continued.*					
Rae Bareli ...	Rae Bareli	1861-63	1,381	40,322	29 3 2	
	Sultanpur	1862-64	1,575	45,670	28 15 11	
	Partabgarh	1859-62	1,848	82,556	44 10 9	
Fyzabad ...	Fyzabad	1862-65	2,418	1,08,802	45 1 5	
	Gonda	1867-71	3,014	1,85,066	61 8 5	
	Bahraich	1865-70	2,693	1,52,250	56 8 7	
Sitapur ...	Sitapur	1863-65	2,340	86,473	38 2 6	
	Hardoi	1863-66	2,293	88,652	38 10 7	
	Kheri	1865-69	2,992	1,60,532	53 10 5	
	NORTH-WESTERN PROVINCES.					
Rohilkhand ...	Bijnour	1868-71	1,973	1,12,963	57 4 1	
	Moradabad (*Cadastral*) ...	1871-77	2,527	4,54,304	178 15 10	Including Pargana Kashipur of District Tarai.
	Bareilly	1868-72	3,234	1,39,535	43 11 10	
	Bareilly, Tarai and Kumaon ...	1848-54	2,039	1,17,393	57 9 2	
	Rampoor State	1864-66	898	19,860	22 1 10	
Agra ...	Agra (*Cadastral*)	1872-76	2,190	3,50,552	160 1 1	
	Muttra (*Cadastral*) ...	1871-76	1,360	2,53,358	186 1 1	
	Bharatpore Native State ...	1855-58	1,974	92,417	46 13 1	
Allahabad ..	Banda (*Cadastral*) ...	1874-77	1,895	3,17,811	167 7 2	Survey still in progress.
	Hamirpur	1872-76	2,296	2,93,174	127 11 0	
	Ditto Native States ...		448	26,908	60 1 0	
	Azamgarh (*Cadastral*) ...	1874-76	441	1,22,159	277 0 1	Only Parganas Sikandarpur and Bhadaun.
Benares ...	Gorakhpur	1854-57	490	31,242	63 12 2	
Jhansi ...	Jalaun...	1853-60	6,912	1,91,738	27 11 10	
	Jhansi					
	Native States					
	Lalitpur	1860-62	1,947	48,392	24 13 8	
	CENTRAL PROVINCES.					
Nagpur ...	Nagpur	1857-60	6,111	2,25,713	36 15 0	
	Chanda	1864 75	9,664	4,46,079	46 2 6	
	Bhandara	1858-72	3,938	1,81,729	46 3 3	
Chattisgarh ...	Bilaspur	1872-74	1,945	77,379	39 12 6	
	Raipur	1868-72	9,481	3,05,264	32 3 2	
Jubbulpore ...	Jubbulpore	1854-57	4,301	2,19,017	50 14 9	
	Sangor	1854-64	4,060	1,74,304	42 15 2	
	Damoh	1863-66	2,510	1,02,889	40 15 10	
	Seoni	1865-69	3,038	1,93,336	51 4 5	
Nerbudda ...	Narsingpur	1861-63	1,910	56,961	29 11 8	
	Hosangabad	1862-68	3,415	1,33,850	39 3 1	
	Nimar	1867-73	3,625	1,92,095	52 15 10	
	Chindwara	1868-72	3,009	1,75,519	58 5 5	
	Betul	1872-74	1,727	1,03,139	59 11 8	
	PUNJAB.					
Delhi ...	Delhi	1872-74	1,295	69,306	53 14 9	
	Gurgaon	1873-76	2,007	1,11,134	55 6 1	
	Patandi Native State (*Cadastral*)	1875-76	53	7,596	143 5 1	
	Karnal	1870-73	2,361	1,32,191	55 15 10	
Hissar	Rohtak	1875-77	1,809	1,08,752	60 1 10	The Survey of District Sirsa is now in hand
	Native States and Jagirs ...	1861-63	3,448	63,064	18 7 5	
	Umballah	1846-48 / 1850-51	1,965			
	Ludhiana	1847-50	1,550			
	Thanesur	1846-47 / 1848-49	2,324	1,94,442	12 8 3	
	Ferozepore	1848-51	2,813			
	Cis Sutlej Native States ...	1846-51	6,870			
Jullundur ...	Jullundur	1846-48	1,911	65,205	34 1 11	
	Hoshiarpur	1847-50	2,203	75,132	34 1 8	
	Kangra	1848-51	2,724	92,899	34 1 8	
Amritsar ...	Amritsar	1851-53	2,168	62,798	28 15 5	
	Gurdaspur	1850-52	1,572	67,934	43 3 5	
	Sialkot	1851-53	1,459	48,983	33 9 2	
Lahore ...	Lahore	1851-54	2,971	79,984	26 14 9	
	Gujranwala	1852-55	3,605	83,716	23 3 7	
Rawalpindi ...	Gujrat	1853-54	2,113	46,105	21 5 0	
	Shahpur	1854-55 / 1857-59	4,028	53,178	13 3 3	
Mooltan ...	Mooltan	1854-58	6,030	1,10,849	18 6 1	
	Jhung	1853-56	5,233	53,361	10 3 2	
	Montgomary	1853-56	5,748	93,702	16 5 0	
	Muzaffergarh	1855-56	2,255	30,759	13 10 3	

Division or Commissionership.	District.	Season of Survey.	Area in square miles as surveyed.	Cost.	Rate per square mile.	Remarks.
	PUNJAB,—*continued.*					
Derajat ...	Leia	1855-60	9,452	1,09,661	11 9 7	The survey of the Derajat is still in progress.
	Dera Ismail Khan, Dera Ghazee Khan and Bannu.	1855-61	19,226	2,14,252	11 2 4	
	Ditto Ditto ..	1870-77	12,113	5,34,255	44 1 8	
Peshawur ...	Peshawar	1863-70	2,467	1,15,250	46 11 6	
	Hazara	1865-69	3,260	2,23,506	68 9 0	
	Bhawulpur Native State ...	1860-75	17,285	4,13,709	23 14 11	
	RAJPUTANA.					
	Ajmere and Mairwara ...	1847-48	2,661	41,623	15 10 3	
	Jawad Nimach Native State ...	1854-56	1,180	45,062	38 3 0	
	SINDH.					
Karachi ..	Karachi	1855-56 1858-59 1863-64	5,370	1,00,461	18 10 10	
	Sehwan	1862-64	3,624	55,683	15 5 10	
	Jhirruk	1858-59 1863-64	2,952	28,529	9 10 8	
	Shahbunder	1867-70	4,197	79,669	18 15 9	
Shikarpur ...	Jacobabad	1858-59	2,000	27,157	13 8 8	
	Shikarpur	1857-58	1,238	35,838	28 15 2	
	Rohri	1856-58	4,380	63,228	14 8 0	
	Larkana	1850-60 1861-62	3,116	67,725	21 11 9	
	Mehar	1861-62	1,948	28,533	14 10 4	
	Khyrpoor Native State ...	1860-61	6,109	45,990	7 8 5	
Hyderabad ...	Naushahra	1860-63	3,067	41,448	13 8 3	
	Hyderabad	1863-64 1865-66	417	8,985	21 8 9	
	Hala	1862-65	2,558	43,303	16 14 10	
	Mahomed Khan's Tanda ...	1865-68	3,177	86,170	27 1 11	
	Thar Parkar	1862-69	12,729	1,04,587	8 3 6	
	BOMBAY.					
Bombay ...	Deccan Districts	1871-77	16,337	6,02,618	36 14 2	The Deccan Survey in 1871-72 was on 8″ scale with exception of 35 square miles. In 1872-73 it was partly on 2″, 4″, and 8″ scale. From 1873-74 only the 2″ scale has been employed Survey still in progress.

D. C. VANRENEN, *Major-General, R.A.,*
Superintendent of Revenue Surveys.

Superintendent of Revenue Survey's Office,
Calcutta, 5th January 1878.

GENERAL REPORT

ON THE

Topographical Survey of India,

AND OF THE

SURVEYOR GENERAL'S DEPARTMENT,

FOR SEASON

1876-77.

BY

MAJOR-GENERAL 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:
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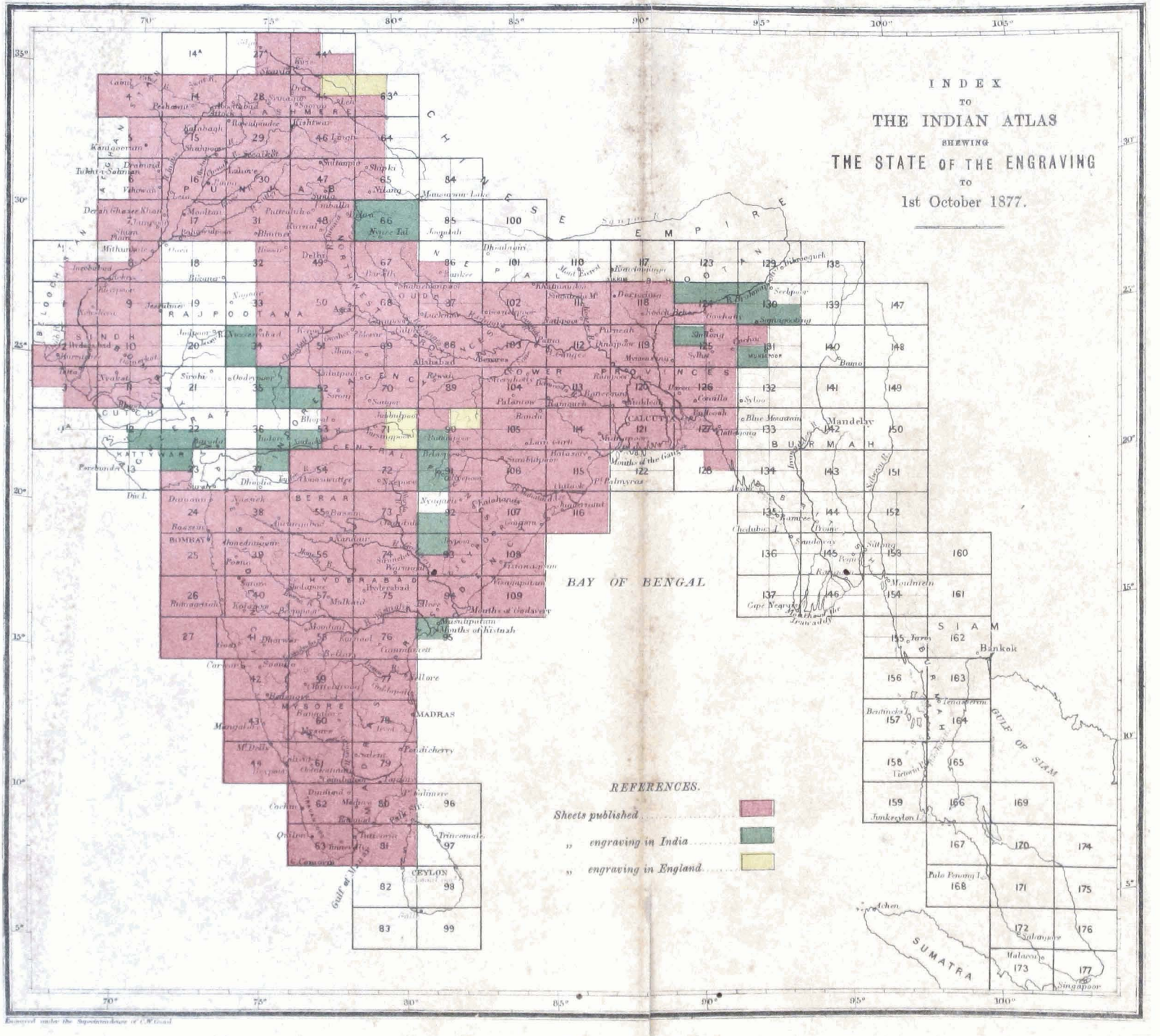
1878.



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No. 3 PARTY

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INDEX TO THE SHEETS

OF THE

GANJAM AND ORISSA

(OLD SERIES,)

AS WELL AS OF THE

VIZAGAPATAM AGENCY & CENTRAL PROVINCES

(NEW SERIES,)

TOPOGRAPHICAL SURVEY.

Executed from Season 1850 by Colonel G. H. Saxton, Captain G. C. Depree, Mr. J. Dyer, Mr. J. O. Nicolson, and Captain T. H. Holdich, R. E.

CHOTA NAGPORE DIVISION TOPOGRAPHICAL SURVEY

N.E. DIVISION C. PROVINCES TOPOGL SURVEY.

CENTRAL PROVINCES REVENUE SURVEY

HYDRABAD TOPOGRAPHICAL SURVEY

MADRAS REVENUE SURVEY OF THE BAY OF BENGAL

BELASPUR SUMBULPUR BARAR BASTAR ZEMINDARIES OF CHANDA OTHER ZEMINDARIES & AHEREE & CHANDA

Ratanpur, Champa, Sakti, Raigarh, Hingir, Maelda, Padampur, Lehera, Kolabira, Suadi, Bonai, Katangi, Sonakun, Sarungarh, Kharsel, Palsar Sirigidao, Deogarh, Baraka, Raipur, Raoria, Phuljar, Nawagaon, Suarmal, Barpali, Bindra, Rampur, Bodasamar, Loising, Sonpur, Boad, Hondapa, Unqul, Churu, Tarnot, Patna, Torbao, Jumlager, Diagaon, Noagarh, Kunnuna, Khajurpara, Daspalla, Nayagarh, Sihoa, Daramgara, Karial, Konkair, Prolapur, Borai, Ojara, Asurgar, Nowgaon, Gulleri, Banskol, Raigurh, Deobog, Bundesur, Junagar, Ombadola, Kotgarh, Korada, Russelkonda, Gumsur, Purlakot, Narainpur, Makri, Omorkot, Poragar, Amrati, Rimar, Aheree, Chota Dongar, Marthapal, Jaitgiri, Karenga, Moulpatna, Mandibis, Kasipur, Bisamkattak, Bissamgiri, Berhampur, Chitrkot, Motanpal, Bastar Old, Kotepad, Naorangpur, Jugdulpur, Bastar, Tikriabola, Gumuram, Saora Hills, Purlah Kimidi, Bhopalpatnam, Sironcha, Vyapur, Dantewara, Pakanar, Jeypur, Ramgiri, Alamanda, Pallakonda, Kowakonda, Lingari, Potikul, Salmi, Sogaruo, Bobili, Panchmentah, Chintulnar, Sunkom, Malkangiri, Amada, Nagar, Kotapali, Albaka, Cheria, Beji, Poreh, Kondakamberu, Ugampa, Kasipuram, Chichacol, Vizianagram, Madagul, Bimlipatam, Annagudam, Guddum, Bhadrachellam, Rakapalli, Rampa, Redrala, Kothapilli, Linagumpuru, Vizagapatam, (Rajamundry), Bamanhatti, Majimara, Mangarhatti, Kulkapasad, Daspur, Karipada Mohrsahi, Jelasor, Keonjur, Musakoi, Udepur, Jakarmunda, Bardanga, Balasor, Nilgiri, Kebtapada, Tankapada, Podam, Sarkonanda, Palasuni, Sukinda, Bhadrak, Jajpur, Dhenkanal, Gatgarh, Cuttack, Banki Garh, Mahanadi R., Jugarnath Puri, Lake, Bhanpur, Old Series, New Series, Topographical Survey, Limit of Standard Sheets

REFERENCES.

The figures represent the published Sheets

Sheets Surveyed but not yet published

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and Longitude are numbered thus: 24

The figures represent the limits and numbers

of the Engraved Atlas of India, thus: 93

Note: The Sheets 10, 12, 13, 14, 15, 22, 24 to 33, 46, 47, 48 & 50 are Surveyed only on the ½ inch to the Mile scale.

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147-B2

Published under the direction of Colonel H. L. Thuillier, C.S.I. F.R.S., *Surveyor General of India.*

Surveyor General's Office, Calcutta, December

INDIA

SHEWING THE PROGRESS OF THE IMPERIAL SURVEYS.

To 1st October 1877.

Scale of English Miles

REFERENCE

TOPOGRAPHICAL SURVEYS, ... Completed
..... do. ..... do. ..... In progress
..... do. ..... do. ..... Executed under the Trigonometrical Dept.
..... do. ..... do. ..... do. ..... in progress
REVENUE SURVEYS ..... Completed
..... do. ..... do. ..... In progress
PEGU SURVEY under the local administration, and old Topographical Survey of NIZAM'S DOMINIONS.
REMAINING FOR SURVEY.

REFERENCES

British States ..... Pink
Dependent & subordinate Native States. ..... Yellow
Independent States. ..... Green
Railways opened ..... ▬▬
Railways not opened ..... ▬▬
Roads. High. ——— Minor ———
Telegraph stations ..... ⊥
The numerals denote the height above sea level in feet

Nos, 8 & 9 PARTIES.

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On the Scale of 1 Inch = 1 Mile.

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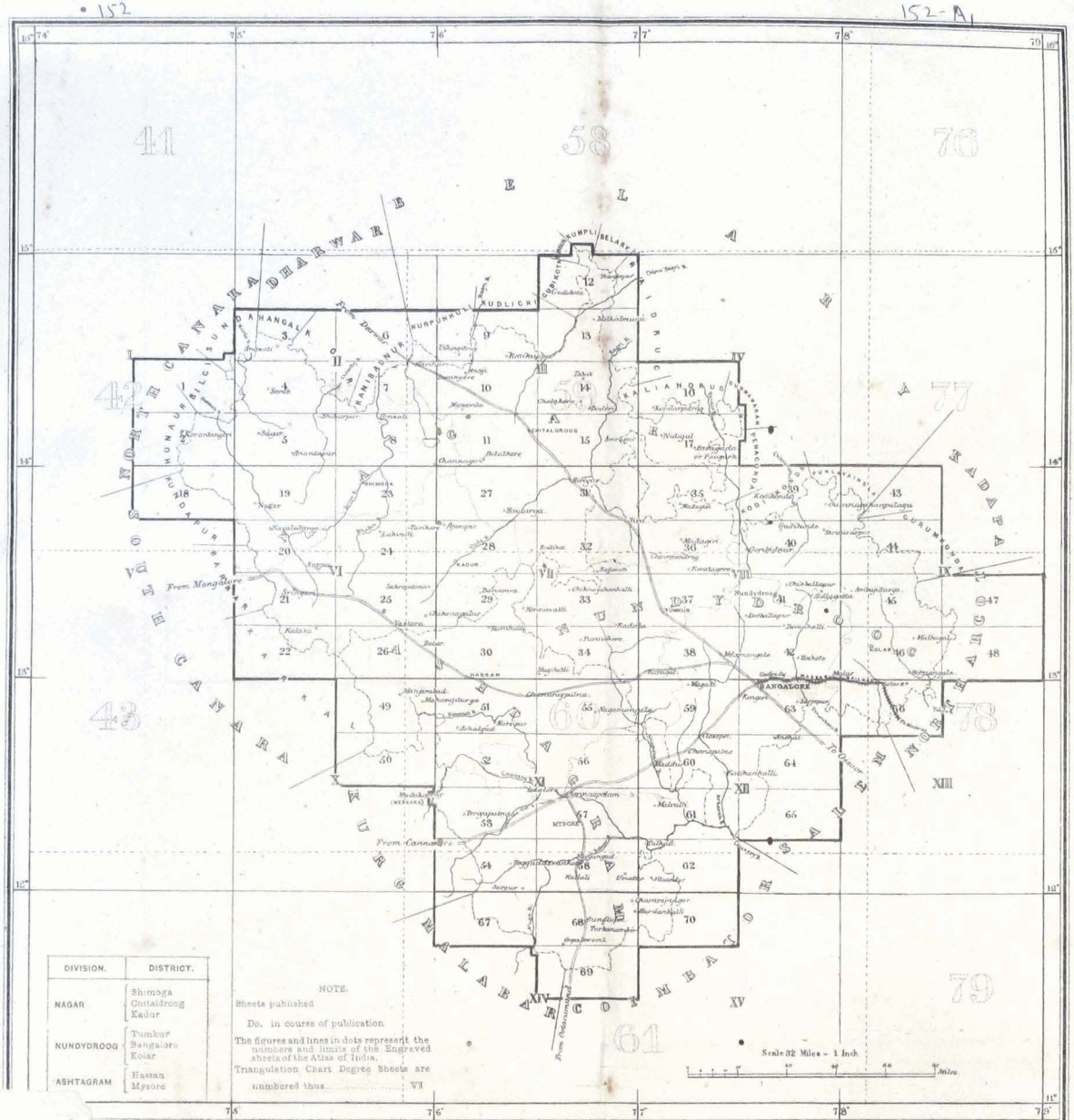

DIVISION.	DISTRICT.
NAGAR	Shimoga Chitaldroog Kadur
NUNDYDROOG	Tumkur Bangalore Kolar
ASHTAGRAM	Hassan Mysore

NOTE.

Sheets published

Do. in course of publication

The figures and lines in dots represent the numbers and limits of the Engraved sheets of the Atlas of India.

Triangulation Chart Degree Sheets are numbered thus..... VI

Photolithographed under the Superintendence of Capt. J. Waterhouse.

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152-A3

Published under the direction of Colonel H. L. Thuillier, C.S.I. F.R.S., *Surveyor General of India*,

Surveyor General's Office, Calcutta, January

1877.