

Survey of India.

GENERAL REPORT

FOR 1923-24.

From 1st October 1923
To 30th September 1924.



PREPARED UNDER THE DIRECTION OF
Colonel E. A. TANDY, R.E.,
SURVEYOR GENERAL OF INDIA.

Printed at the Photo.-Litho. Office,
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COLONEL CHARLES HENRY DUDLEY RYDER, C.B. C.I.E. D.S.O. R.E.

Surveyor General, 1919-1924.

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CONTENTS.

	PAGE.
PART 1.—GENERAL REMARKS—	
I.—INTRODUCTION—	1
II.—ADMINISTRATION AND PERSONNEL—	3
PART 2.—WORK OF FIELD PARTIES, &c.—	
I.—TOPOGRAPHICAL SURVEYS.—	5
TABLE I.—Progress since 1905	5
TABLE II.—Out-turns and costs	6
Northern Circle	10
Southern Circle	12
Eastern Circle	14
Burma Circle	17
II.—FOREST SURVEYS.—	20
Northern Circle	20
Southern Circle	20
Eastern Circle	20
Burma Circle	20
III.—CANTONMENT AND LARGE SCALE SURVEYS.—No. 20 Party	23
Cantonments	24
IV.—GEODETIC BRANCH.—	25
Astronomical Latitudes	25
Pendulum Observations	27
Triangulation	29
Tidal Operations	29
Levelling	32
Base Lines	32
PART 3.—OFFICE WORK—	
I.—HEAD QUARTER OFFICES.—	33
Map Publication Office	33
Map Record and Issue Office	37
TABLE III.—Publications during the year	38
No. 1 Drawing Office	39
Engraving Office	43
Photo.-Litho. Office	44
Mathematical Instrument Office	46
II.—DEHRA DŪN OFFICES.—	47
Computing Office	47
Magnetic Survey	48
No. 2 Drawing Office	48
Forest Map Office	52
Photo.-Zinco. Office	53
III.—CIRCLE AND LOCAL DRAWING OFFICES.—	55
PART 4.—WORK FOR LOCAL GOVERNMENTS AND OTHER GOVERNMENT DEPARTMENTS—	
APPENDIX.—Colonel C. H. D. Ryder, C.B., C.I.E., D.S.O., R.E.	i

INDEX MAPS (bound at end of Report).

1. Modern survey and publication.
2. Publication of modern one-inch series.
3. " modern half-inch series for India.
4. " " quarter-inch " "
5. " 'India and Adjacent Countries' series, scale $\frac{1}{1,000,000}$
6. " Indian sheets of "La Carte Internationale du Monde," scale $\frac{1}{1,000,000}$.
7. " 'Southern Asia' series, scale $\frac{1}{2,000,000}$

Survey of India.

GENERAL REPORT,

1923—24.

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PART 1.—GENERAL REMARKS.

I.—INTRODUCTION.

1. The main parts of this report, as shown in the "Contents" on the opposite page, are *Part 2—Work of Field Parties, &c.*, summarising the operations of the field parties, grouped under appropriate headings; and *Part 3—Office Work*, which gives a brief account of the year's progress in the head-quarters and other offices.

2. An abstract showing the progress of the topographical programme assigned to the department in 1905, will be found in Table I on page 5. From this it will be seen that the out-turn of topographical survey during the current year was 65,673 square miles; and that this brings the total progress since 1905 to 753,890 square miles, leaving 1,067,710 square miles still to be done.

3. The first Index map, at the end of the report, shows the progress of the topographical programme both in survey and in publication, while the remaining six indexes show the progress in publication of the various series of maps appertaining to the scheme.

4. Table III on page 38 gives a list of the new publications of the Calcutta Offices during the year. Lists of new maps are published monthly.

5. The main events of the year are summarised below:—

- (a) His Excellency the Viceroy paid a short visit to the Head-quarters Offices, Calcutta, on the 18th December 1923.

GENERAL.—INTRODUCTION.

- (b) There was a further increase in the out-turn of the topographical survey, 65,673 square miles being completed. This was due to the inclusion of an unusually large proportion of half-inch survey and revision survey.
- (c) The geodetic operations were partially resumed, observations of the intensity and direction of gravity (pendulum and latitude) being taken up.
- (d) Aero-photo surveys were undertaken in the Irrawaddy Delta and in Waziristān.
- (e) There was a decrease in the issue of maps to Government officials; the issues to the public, however, showed a steady increase.
- (f) Detachments were sent to the Khyber and Tānk on the N. W. Frontier.
- (g) Surveyors were deputed to accompany the Deputy Commissioner, Nāgā Hills, the Mount Everest Expedition, and the Chitral Reliefs. Their services were greatly appreciated.
- (h) A map reproduction staff was lent early this year to work with the Anglo-Persian Oil Co., Ltd., Muhammareh.
- The survey detachment which was lent to them in September 1923 returned to India in June 1924.
- (i) Two upper subordinate officers were deputed to assist the Burma Oil Co., Ltd., on the gravity survey with the Eötvös torsion balance in Sind. Their assistance was much appreciated.
- (j) The Waziristān Survey Detachment was disbanded in June 1923.
- (k) A considerable amount of minor work was done in connection with Artillery Survey. Short courses of instruction to Artillery officers were held and the fixing of points in some artillery practice camps was carried out.
- (l) A conference was held at the Geodetic Branch Office in October 1923, and again at Delhi in April 1924, to discuss the question of co-operation between the Royal Artillery and the Survey of India in peace and war. As a result the surprinting with a one-minute mesh of modern topographical maps for military use was introduced to facilitate map references. This mesh differs from the "grid" used in England in being a sub-division of the spherical graticule.

- (m) The branch map issue office at No. 5, Esplanade East, Calcutta, was removed permanently to the Government Central Book Depôt, No. 8, Hastings Street, Calcutta.
- (n) The Trigonometrical Survey of the Survey of India is now designated the Geodetic Branch of the Survey of India, and the title of Director was adopted for officers in administrative charge of circles, &c.
- (o) The Maymyo Drawing Office and the Northern Circle Office were made into executive charges, the former being designated No. 7 Drawing Office; the number of executive charges reserved for Class II officers was thus raised from 11 to 13, of which 4 are temporary for the present.

II.—ADMINISTRATION AND PERSONNEL.

6. The actual cost of the department for the financial year ending 31st March 1924 and of the two previous years is shown below:—

	1921-22.	1922-23.	1923-24.	REMARKS.
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	
Gross actual cost ...	62,01,542	54,80,867	51,06,338†	* Includes an unusual charge of over Rs. 9,00,000 debited to the department on account of Europe stores.
Deduct receipts and credits	19,88,588	25,20,447	21,26,831†	
Net actual charges ...	42,62,954	29,10,420	29,79,507†	† These figures are not final.

7. Colonel C. H. D. Ryder, C.B., C.I.E., D.S.O., R.E., administered the department up to 27th March 1924 when he proceeded on leave preparatory to retirement, and was succeeded by Colonel E. A Tandy, R.E.

8. *Class I Officers*:—Colonels C. H. D. Ryder, C.B., C.I.E., D.S.O., R.E., and W. M. Coldstream, C.I.E., R.E., retired. A summary of Colonel Ryder's distinguished services is attached as an appendix to this report.

Mr. E. G. Hardinge who is on deputation with the Government of Assam, and Messrs. Hanuman Prasad, R.S., and Dhani Ram Verma, R.S., were promoted temporarily from the Class II Service.

Mr. T. A. Ferrier, O.B.E., Officer in charge, Mathematical Instrument Office, retired.

Class II Officers:—Mr. Asmat-ullah Khan, K.B., retired.

Captain V. P. Wainright was placed on foreign service with the Rangoon Development Trust; Mr. W. H. Strong, M.B.E., who had been on foreign service with the 'Iraq Government was placed on foreign service with the Anglo-Persian Oil Co., on the 23rd September 1923.

Messrs. J. McCracken, M.B.E., and A. F. Murphy reverted from foreign service with the Anglo-Persian Oil Co. Mr. N. N. Chuckerbutty reverted from deputation under the Government of the United Provinces.

Captain F. E. R. Calvert who resigned his appointment in February 1920 was reappointed.

Mr. Chuni Lal Kapur was promoted from the Upper Subordinate Service.

Messrs. Seth Ram Gupta, B.A., J. C. Berry, T. M. C. Alexander, and Muhammad Nazir Ahmad Hashmi, B.A., were appointed during the year.

Upper Subordinate Service:—Mr. Sarat Kumar Mukerji retired, Messrs. Gopal Lal Mitra and Mauji Ram Sharma and three probationers resigned. Messrs. Sher Jang, K.B., and Sijawal Khan reverted from foreign service with the Anglo-Persian Oil Co. Four officers were promoted from the Lower Subordinate Service.

Total strength of the department at the close of the Survey year was 55 Class I, 93 Class II and 78 Upper Subordinate officers, besides specialists, clerks, lower subordinates and menials.

9. No. 4 Party was placed under the administrative control of the Director, Eastern Circle, on the 1st October 1923.

On suspension of magnetic operations, except at the Dehra Dūn observatory, the designation of No. 18 (Magnetic) Party was changed to No. 18 (Aero-Photo) Party, and the party was placed under the administrative control of the Director, Burma Circle, on the 1st April 1924.

No. 20 (Cantonment) Party was transferred to the administrative control of the Director, Northern Circle, on the 1st September 1924. The designation of the party was changed to No. 20 (Cantonment and Special Surveys) Party, the party having taken up a special 4-inch survey of certain parts of the lower Sutlej Valley, Punjab, in connection with the Sutlej Irrigation scheme.

An independent detachment, designated the Settlement Survey Detachment, was formed on the 1st June 1924 for settlement survey operations in the Peshāwar and Attock districts.

10. The following honours and rewards were conferred during the year:—

Companion of the Order of the Indian Empire	... Colonel W. M. Coldstream, R.E.
Special Silver MacGregor Memorial Medal for 1923	... Surveyor Hari Singh Thapa.
Volunteer Long Service (Silver) Medal	... Mr. C. F. Oddy, (Sergeant, Auxiliary Force, India), Ofg. Manager, Photo. Photo.-Litho. Office, Calcutta.

Mr. B. T. Wyatt, Extra Assistant Superintendent, was promoted to the rank of Lieutenant in the Auxiliary Force.

PART 2.—WORK OF FIELD PARTIES, &c.

I.—*TOPOGRAPHICAL SURVEYS.*

11. The two following tables show respectively the progress of the topographical programme assigned to the department in 1905 and the out-turns and costs of different parties during the year under report. They are followed by brief descriptions of the work of each topographical party.

In 1913, the Secretary of State sanctioned a scheme for the reduction of the scale of survey of certain sparsely populated areas of India. This will greatly reduce the area of survey on the one-inch scale and consequently accelerate the rate of progress of topographical surveys shown in Table I below. In order to give a better idea of what work actually lies before the department, it may be remarked that of the area remaining for survey about 500,000 square miles are likely to be surveyed on the half-inch or smaller scales.

Table I.—Progress of Topographical Surveys since 1905.

Survey year.	Scales of Survey.	Northern Circle.	Southern Circle.	Eastern Circle.	Burma Circle.	TOTALS.
		<i>Sq. miles.</i>	<i>Sq. miles.</i>	<i>Sq. miles.</i>	<i>Sq. miles.</i>	<i>Sq. miles.</i>
1905-18	Mostly 2-inch and 1-inch.	150,856	80,810	27,551	57,042	315,259
1918-14	Mostly 1-inch and $\frac{1}{2}$ -inch.	25,052	15,844	7,291	7,599	55,786
1914-15	ditto.	12,334	19,286	2,448	2,608	36,676
1915-16	ditto.	8,168	17,243	2,279	4,652	32,342
1916-17	ditto.	11,689	11,833	3,560	6,163	32,750
1917-18	ditto.	4,202	12,181	3,596	4,800	24,779
1918-19	ditto.	509	7,263	1,764	4,412	13,948
1919-20	ditto.	9,145	11,891	4,311	5,117	30,464
1920-21	ditto.	14,411	14,275	5,766	5,509	39,961
1921-22	ditto.	11,528	21,596	5,970	5,510	44,604
1922-23	ditto.	26,199	20,823	9,144	5,492	61,648
1923-24	ditto.	18,544	28,160	11,363	7,606*	65,673
Total areas completed to date.		292,137	260,210	85,043	116,500	753,890
Approximate areas for the whole topographical programme.		750,000	542,800	262,925	265,875	1,821,600
Approximate areas remaining for survey.		457,863	282,590	177,882	149,375	1,067,710

* Excludes 10 square miles surveyed in 1922-23 on 1-inch scale and 1,440 square miles of original air-photo. survey on 3-inch scale.

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1923-24.

PARTY AND LOCALITY.		OUT-TURNS OF PLANE-TABLING.		COSTS OF SURVEY INCLUDING MAPPING.		REMARKS.
		Areas on each Scale of each Class.	Totals of areas on all Scales.	Total Costs.	Cost-rates.	
		Sq. miles.		Rs.	Rs. per sq. mile.	
						NORTHERN CIRCLE.
No. 1 Party—United Provinces and Central India.						
<i>Undulating hills densely wooded.</i>	Half-inch Revision Survey ...	2,168	6,462	89,642	13·9	
<i>Cultivated plains, congested with villages, and low hills thinly wooded.</i>	One-inch Revision Survey ...	4,268				
<i>Allahābād & Environs.</i>	Four-inch Revision Survey ...	81				
No. 2 Party—Central India, Gwalior, Rājputāna and United Provinces.						
<i>Jungle-clad hills, undulating forests and cultivated plains.</i>	Half-inch Original Survey ...	8,568	9,663	1,16,890 (a)	12·1	(a) Excludes Rs. 4,729 cost of training pupils.
<i>Jungle-clad hills and cultivated plains.</i>	One-inch Resurvey ...	589				
<i>Cultivated plains, with some isolated hills.</i>	One-inch Revision Survey ...	538				
<i>City and Cantonments and Environs.</i>	Six-inch Revision Survey ...	28				
No. 3 Party—United Provinces.						
<i>High wooded hills.</i>	Half-inch Revision Survey ...	2,419	2,419	82,996 (b)	26·0	(b) Excludes cost of settlement survey, experimental 4-inch survey under No. 23 Party and Khyber surveys.
TOTALS, NORTHERN CIRCLE:—		18,544 sq. m.	Rs. 2,69,528		Cost-rate 14·5	

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1923-24.

PARTY AND LOCALITY.		OUT-TURNS OF PLANE-TABLING.		COSTS OF SURVEY INCLUDING MAPPING.		REMARKS.
		Areas on each Scale of each Class.	Totals of areas on all Scales.	Total Costs.	Cost-rates.	
Character of Country.	Scale and Class of Survey.	Sq. miles.		Rs.	Rs. per sq. mile.	
No. 5 Party—Central India and Central Provinces.						SOUTHERN CIRCLE.
<i>Well cultivated plains and jungle clad hills and plains.</i>	One-inch Original Survey ...	2,994	5,495	1,09,016 (c)	19·8	(c) Excludes Rs. 253 debitab to the Commandant Royal Artillery, Southern Command.
	One-inch Revision Survey ...	1,206				
	Half-inch Original Survey ...	1,295				
No. 6 Party—Madras and Hyderabad States.						
<i>Partly undulating cultivated country and partly densely wooded hills.</i>	Half-inch Original Survey ...	7,767	8,777	1,58,578	18·1	
	One-inch Original Survey ...	1,010				
No. 7 Party—Madras, Mysore and Hyderabad States.						
<i>Undulating, with patches of cultivation and numerous rocky outcrops and rocky hills covered with low scrub.</i>	One-inch Original Survey ...	8,168	4,945	1,12,089	22·6	
	Half-inch Original Survey ...	1,152				
	One-inch Revision Survey ...	680				
No. 8 Party—Bombay Presidency and Hyderabad State.						
<i>Portions of the Western Ghats, the undulating plains, interspersed with outcrops of rocky low-lying hills, of the Deccan trap, and the open and cultivated plains of Hyderabad States.</i>	One-inch Revision Survey ...	8,154	8,943	1,42,029 (d)	15·8	(d) Includes cost of fair-mapping and scattered auxiliary heights.
	One-inch Revision Survey ...	34				
	One-inch Original Survey ...	17				
	One-inch Original Survey ...	738				
TOTALS, SOUTHERN CIRCLE:—		28,160 sq. m.	Rs. 5,21,707	Cost-rate 18·5		

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1923-24.

PARTY AND LOCALITY. Character of Country. Scale and Class of Survey.		OUT-TURNS OF PLANE-TABLING.		COSTS OF SURVEY INCLUDING MAPPING.		REMARKS.
		Areas on each Scale of each Class.	Totals of areas on all Scales.	Total Costs.	Cost-rates.	
		Sq. miles.		Rs.	Rs. per sq. mile.	
<p>No. 4 Party—Bengal, Bihār & Orissa.—(Rāniganj coalfields.) <i>Mostly open undulating ground, intersected by three large rivers, cultivated except in vicinity of the collieries with a few wooded areas and enclosed on the north, west and south sides by outcrops of low hills covered with scrub jungle.</i></p>		410	410	1,09,826 (e)	266.6	<p>EASTERN CIRCLE.</p> <p>(e) Includes cost of transfer from Mussoorie to Hazāribāgh and of levelling, but excludes Rs. 1,846 cost of levelling in advance for future surveys.</p> <p>(f) An area of 1,351 square miles of reconnaissance survey on the half-inch scale has been included in the out-turn but the area and cost (borne by the Assam Government) have not been used in calculating the cost-rates.</p>
<p>No. 9 Party—Bihār & Orissa. <i>Partly wooded hills, and partly cultivated open wooded undulating ground.</i></p>		2,625	2,625	1,88,508	50.8	
<p>No. 12 Party—Assam and Burma. <i>Mostly high densely wooded hills and part of the open cultivated Manipur valley.</i> <i>Mostly densely jungle-clad plains and low and high hills.</i></p>		7,442 (f)	8,328	2,18,198	31.2	
		886				
<p>TOTALS, EASTERN CIRCLE:— 11,363 sq. m. Rs. 4,61,027 Cost-rate 46.0</p>						

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1923-24.

PARTY AND LOCALITY. Character of Country. Scale and Class of Survey..		OUT-TURNS OF PLANE-TABLING.		COSTS OF SURVEY INCLUDING MAPPING.		REMARKS.
		Areas on each Scale of each Class.	Totals of areas on all Scales.	Total Costs.	Cost-rates.	
		Sq. miles.		Rs.	Rs. per sq. mile.	
No. 10 Party—Upper Burma and Lower Burma.						BURMA CIRCLE.
Heavily wooded hills	... Half-inch Original Survey	1,764	4,389	1,99,756 (g)	45·5	(g) Includes Rs. 5,622 cost of forest surveys debitable to the Forest Department, Burma.
High wooded hills	... Half-inch Revision Survey	529				
Heavily wooded hills	... One-inch Original Survey	866				
Wooded hills, open plains, creeks, islands and mangrove swamps.	One-inch Supplementary Survey.	1,200				
Wooded hills on island	... Two-inch Original Survey	24				
Densely wooded hills	... Four-inch Original Survey	6				
No. 11 Party—Lower Burma.						
High hills with dense evergreen forest, and well wooded low ground varied with hills, rock outcrops, and scattered cultivation.	One-inch Original Survey	1,806	2,451	1,86,798 (h)	76·2	(h) Includes Rs. 18,344 debitable to the Forest Department, Burma.
Cultivated areas, well wooded hills and plains and forest swamp.	One-inch Supplementary Survey.	999				
Low undulating ground densely wooded.	Two-inch Original Survey	180				
Hills and low ground densely wooded.	Four-inch Original Survey	16				
No. 18 Party (Aero-Photo)—Lower Burma.						
Densely wooded coastal portion of the Irrawaddy Delta.	Three-inch Original Air-Photo Survey.	1,440	1,440	3,78,200 (i)	262·6	(i) Includes Rs. 3,03,000, debitable to the Forest Department, Burma.
No. 21 (Burma Forest) Party—Lower and Upper Burma.						
Densely wooded hills and plains	Four-inch Original Survey	4	776	1,79,502 (j)	231·3	(j) All debitable to the Forest Department, Burma.
	Two-inch Original Survey	772				
TOTALS, BURMA CIRCLE:—		9,056 sq. m.		Rs. 9,44,256	Cost-rate 104·3	
GRAND TOTALS:—		67,123 sq. m.		Rs. 21,96,518	Cost-rate 33·4	

WORK OF FIELD PARTIES, &c.—TOPOGRAPHICAL SURVEYS.

NORTHERN CIRCLE (*vide* Index map No. 1).

DIRECTOR { Colonel E. A. Tandy, R.E., up to 18th March 1924.
Lieut.-Colonel L. C. Thuillier, I.A., from 19th March 1924.

12. No. 1 Party.—This party surveyed an area of 4,060 square miles partly on the one-inch and partly on the half-inch scale in the Allahābād, Bāndā, Jaunpur, Mirzāpur, Partābgarh, Rāe Bareli and Sultānpur districts of the United Provinces; 31 square miles on the scale of four inches to one mile in Allahābād and its immediate vicinity; 240 square miles on the one-inch scale in Bhadohi district of Benares State in the United Provinces; and 2,131 square miles partly on the one-inch and partly on the half-inch scale in the Indian States of Rewah (2,023 square miles) and Sohāwal (22 square miles) of the Baghelkhand Agency and Pannā (86 square miles) of the Bundelkhand Agency of Central India; or a total of 6,462 square miles. In addition, an area of 33 square miles was triangulated in the Allahābād district to supply data for the detail survey during the current season.

PERSONNEL.
Class I Officers.
Mr. C. C. Byrne, in charge to 5th October 1923.
Mr. M. C. Petters, in charge from 6th October 1923.
Class II Officers.
Major C. H. Treaham.
Mr. O. D. Jackson.
" Moqimuddin.
Upper Subordinate Service.
8 Officers.
Lower Subordinate Service.
33 Surveyors, etc.

The country surveyed on the one-inch scale consists mainly of well cultivated plains dotted over with numerous lakes, marshes and groves of mango trees and intersected by several rivers, the principal of which are the Ganges, Jumna and (southern) Tons. The area surveyed on the half-inch scale comprises portion of the plateau and the northern slopes of the Kaimur Hills. The plateau is covered with tall grass, but the northern slopes are densely wooded with a thorny undergrowth.

13. No. 2 Party.—This party surveyed an area of 590 square miles in the Hamirpur and Bāndā districts of the United Provinces, 487 square miles in the Bijāwar, Charkhāri, Chhatarpur, Garrauli (Jāgīr), Lugāsi and Pannā States of the Bundelkhand Agency in Central India on the one-inch scale; and 4,057 square miles in Jaipur State, 586 square miles in Karauli State, 159 square miles in Tonk State, 429 square miles in Būndi State, and 2,089 square miles in Kotah State, all

PERSONNEL.
Class I Officer.
Bt.-Lieut.-Colonel S. W. S. Hamilton, D.S.O., R.E., in charge to 31st December 1923, and again from 25th January 1924.
Class II Officers.
Mr. P. A. T. Kenny, O.B.E., in charge from 1st to 24th January 1924.
Mr. A. J. A. Drake.
" Duni Chand Pari.
" P. K. Ghosh, B.Sc., F.R.G.S.
" M. A. Chowdhury, B.A. (on probation).
Upper Subordinate Service.
6 Officers.
Lower Subordinate Service.
32 Surveyors, etc.

in Rājputāna, and 1,248 square miles in Gwalior State on the half-inch scale. The party also carried out revision survey of an area of 23 square miles for the map of Agra and Environs on the scale of six inches to one mile.

The country surveyed on the one-inch scale consisted of jungle-clad hills and cultivated plains, while that on the half-inch scale was very similar, with a large area of undulating forest country in addition.

An area of 9,400 square miles was triangulated in advance for next season's detail survey in Kotah and Gwalior States, in portions of the Būndelkhand Agency and in the Jhānsi district of the United Provinces.

14. No. 3 Party.—This party surveyed an area of 2,419 square

PERSONNEL.

Class I Officers.

Lieut.-Colonel L. C. Thuillier, I.A., in charge to 18th March 1924.
Mr. E. C. J. Bond, V.D., in charge from 19th March to 30th June 1924.
Major J. D. Campbell, D.S.O., R.E., in charge from 1st July 1924.

Class II Officers.

Mr. J. C. C. Lears.
" J. H. Johnson.

Upper Subordinate Service.

5 Officers.

Lower Subordinate Service.

32 Surveyors, etc.

miles on the half-inch scale in the Dehra Dūn and Garhwāl districts and Tehri State of the United Provinces.

It comprised that portion of the Himālayas lying north of Mussoorie, east of Tehri and around Rudraprayāg, Karnaprayāg and Chamoti, watered by the Bhāgirathi, Alaknandā, Pindar and Mandākinī rivers. The hills

rising from 4,000 to 19,000 feet above mean sea level are precipitous and generally densely wooded with oak and pine. The lower valleys are fairly well cultivated and communications are not difficult in the lower altitudes.

15. Training.—8 pupil surveyors were entertained during the year, and are receiving instruction in No. 20 Party.

In addition, a number of pupil surveyors were entertained in No. 3 Party and were trained in drawing during recess, with the view of employment on four-inch survey in the Sutlej Valley. 60 were eventually selected and posted to No. 20 Party for this work.

9 soldier surveyors joined for training during the year, and are receiving instruction in No. 2 Party.

16. Recess Work.—The fair-mapping of sheets of the previous and current season's survey, was completed by 30th September 1924, with the exception of four sheets on the one-inch, and five on the half-inch scale.

Five sheets, which have been drawn in colours as an experiment, have been delayed owing to the necessity of thickening up the red detail to ensure good reproduction.

The remainder have been delayed owing to the full drawing strength not being available for No. 3 Party, this party having had to make preparations for the Sutlej Valley four-inch work.

17. Particulars of work done by Nos. 22 and 23 Parties and Settlement Survey Detachment will be found on pages 62 to 64.

SOUTHERN CIRCLE (*vide* Index map No. 1).

DIRECTOR { Lt.-Col. G. A. Beazeley, D.S.O., R.E., up to 10th April 1924.
Lt.-Col. C. M. Browne, C.M.G., D.S.O., R.E., from 11th April 1924.

18. No. 5 Party.—This party surveyed an area of 5,495 square miles as follows:—18 square miles in Indore State, 117 square miles in Bhopāl State, both of the Central India Agency, and 4,065 square miles in the Hoshangābād, Betūl, Chhindwāra, Seoni, Balāghāt and Bhandāra districts and Makrai State, all of the Central Provinces, on the one-inch scale; 45 square miles in Indore State and 1,250 square miles in Bhopāl State, both of the Central India Agency, on the half-inch scale.

The country surveyed consists of well cultivated plains and jungle-clad hills and plains.

19. No. 6 Party.—This party completed an area of 7,767 square miles of original half-inch survey and 1,010 square miles of original one-inch survey in the Atrāf-i-balda, Karīm-nagar, Nalgonda and Warangal districts of Hyderābād and in the Kistna district of Madras.

An area of 11,918 square miles of triangulation was completed in the Warangal and Karīm-nagar districts of Hyderābād, the Godāvāri, Guntūr and Kistna districts and Agency Tracts of the Madras Presidency and in the Bastar State. This does not include about 400 square miles which was rapidly triangulated to fix stations in connection with some special work done for Messrs. Currimbhoy Ebrahim & Sons, Ltd.

PERSONNEL.

Class I Officer.

Major F. B. Scott, I.A., in charge.

Class II Officers.

Mr. J. H. S. Wilson.

" F. C. Pilsber.

" Muhammad Najamuddin, B.A.

Upper Subordinate Service.

1 Officer.

Lower Subordinate Service.

32 Surveyors, etc.

PERSONNEL.

Class I Officer.

Major R. S. Wauchope, O.B.E., I.A., in charge.

Class II Officers.

Mr. E. A. Meyer.

" J. C. St. C. Pollett.

" A. F. Murphy.

" E. N. Nateman, B.A.

" C. P. E. Davenport
(on probation).

Upper Subordinate Service.

6 Officers.

Lower Subordinate Service.

37 Surveyors, etc.

240 linear miles of theodolite traversing were completed.

The country under survey varied from flat highly cultivated and populated areas to dense forest-clad hills.

20. No. 7 Party.—This party surveyed an area of 3,095 square

PERSONNEL.
Class I Officer.
Major H. T. Morshed, D.S.O., R.E., in charge from 15th October 1923.

Class II Officers.
Mr. S. S. McA'Fee Fielding, in charge up to 14th October 1923.
Mr. V. W. Morton.
" N. S. Harihara Iyer.

Upper Subordinate Service.
4 Officers.

Lower Subordinate Service.
26 Surveyors, etc.

Kurnool districts of Madras, and Raichūr district of Hyderābād.

The country surveyed was mostly flat or slightly undulating, with patches of cultivation and numerous low rocky outcrops, and presented no difficulties.

21. No. 8 Party.—This party surveyed an area of 8,943 square

PERSONNEL.
Class I Officer.
Captain L. H. Jackson, I.A., in charge.
Class II Officers.

Mr. M. Mahadeva Mudaliar, M.A.
" B. T. Wyatt.
" M. S. Ganessa Aiyar.
" Srinivasa Rao Kelkar, B.Sc.
(on probation).

Upper Subordinate Service.
4 Officers.

Lower Subordinate Service.
44 Surveyors, etc.

State and the wooded heights of the Western Ghāts, the country surveyed consists of undulating plains interspersed with outcrops of rocky low-lying hills.

22. Instruction in Triangulation.—A class was formed before the close of the recess season for instruction of officers and surveyors in triangulation and traversing.

1 Class II officer, 1 Upper Subordinate officer and 13 surveyors received instruction. The field work was carried out in the neighbourhood of Bangalore.

miles in the Cuddapah and Anantapur districts of Madras and 698 square miles in the Kolār and Tumkūr districts of Mysore, on the one-inch scale; and 1,149 square miles in the Anantapur district of Madras and 3 square miles in the Tumkūr district of Mysore, on the half-inch scale. The party also triangulated an area of 4,582 square miles in the Anantapur, Bellary and

miles on the one-inch scale. Of this area, 772 square miles fell in Hyderābād State, and the balance of 8,171 square miles in the districts of East Khāndesh, West Khāndesh, Nāsik, Ahmadnagar, Thāna, Poona and Kolāba of the Bombay Presidency.

With the exception of the open and cultivated plains of Hyderābād

23. *Miscellaneous.*—Nos. 5, 6, 7 and 8 Parties, Circle Office and No. 4 Drawing Office were inspected by the Surveyor General in September 1924.

Nos. 5, 6, 7 and 8 Parties were inspected once in the field and on several occasions during recess by the Director, Southern Circle.

24. *Recess Work.*—45 one-inch sheets out of 64 surveyed and mapped during the year, 31 one-inch sheets previously surveyed and mapped, 6 one-inch sheets previously surveyed but with mapping incomplete and 1 one-inch sheet previously surveyed, mapped and submitted for publication (but of which the fair sheets were recalled before publication and revised during the year under report) were submitted by parties to the circle office before the 30th September 1924. All the remaining sheets will be fair-mapped before the close of the recess season. There are 2 one-inch sheets in arrears; one, surveyed in 1921-22 but of which publication was withheld, has now been submitted to the circle office and one, surveyed during 1922-23 and fair-mapped last year, which was kept pending the settlement of a Madras-Mysore boundary question, will shortly be submitted by the party to the circle office.

3 original half-inch sheets out of 11 surveyed during the year were submitted by parties to the circle office before the 30th September 1924. The remaining 8 sheets will be fair-mapped before the close of the recess season. There are no arrears of mapping from the previous season's work.

Besides the above, 5 out of 8 two-inch special forest sheets of Hyderabad (Deccan) surveyed and mapped during the year and 1 similar sheet, the publication of which was withheld last year for completion of survey to margin, were submitted by No. 6 Party to the circle office before the 30th September 1924, and the remaining 3 sheets will be fair-mapped before the close of the recess season. 3 one-inch special forest sheets of Indore and Dhār States previously surveyed and mapped were submitted by No. 5 Party to the circle office before the 30th September 1924. There are no arrears of mapping of special forest sheets from the previous season's work with the exception of the 1 sheet of No. 6 Party mentioned above.

EASTERN CIRCLE (*vide* Index map No. 1).

DIRECTOR { Colonel W. M. Coldstream, C.I.E., R.E., up to 18th December 1923.
Lt.-Colonel A. A. McHarg, D.S.O., R.E., from 19th December 1923.

25. **No. 4 Party.**—This party was transferred from the Northern to the Eastern Circle on 1st October 1923 and surveyed an area of 410 square miles on the four-inch scale in the Rāniganj coalfield in the districts of Bānkurā, Birbhūm and Burdwān of Bengal and of Mānbhūm and Santāl Parganas of Bihār and Orissa.

PERSONNEL.

Class I Officer.

Mr. C. C. Byrne, in charge.

Class II Officers.

Major J. H. Williams.

Mr. J. H. Johnson.

Lieut. C. S. McInnes.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

28 Surveyors, etc.

The survey was mostly based on reductions of sixteen-inch cadastral survey supplemented by lines of levelling through the area, and contours at ten feet vertical intervals. (as asked for by the Geological Department) have been shown. The sheets are being fair-mapped to comprise an area of five minutes of latitude by eight minutes of longitude.

The area surveyed consisted of open undulating country with the Dāmodar, its main tributary the Barākar and the Ajay rivers flowing through the area in the south-easterly direction.

The country is extremely well served by both railways and metalled roads, most collieries having their own branch lines as well as their private roads; in the immediate vicinity of collieries, the only cultivation lies, as a rule, in the course of the smaller streams, which are completely obliterated by terraced rice fields.

Water is scarce and is conserved in tanks for both irrigation and other purposes. In addition to the numerous collieries there are important iron works in the vicinity of Asansol, Rāniganj and Kulti, silicate works near Barākar junction, and potteries, oil presses, paper mills, &c., elsewhere.

26. No. 9 Party.—This party surveyed an area of 2,625

PERSONNEL.

Class I Officers.

Bt.-Lient.-Colonel E. H. Phillimore,
D.S.O., R.E., in charge to 31st October 1923.

Captain H. R. C. Meade, I.A., in charge
from 1st November 1923.

Class II Officers.

Mr. E. J. Biggie.

” R. E. Saubolle.

” Bhupendra Nath Saha, M.Sc.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

32 Surveyors, etc.

square miles as well as the Amdā-Jāmdā branch of the Bengal-Nāgpur Railway on the one-inch scale in the district of Singhbhūm and the Feudatory States of Bāmra, Bonai, Keonjhar, Mayūrbhanj and Pāl-Laharā in the province of Bihār and Orissa.

The area under survey comprised cultivated open undulating country in the basins of the two large rivers, the Brāhmāni and Baitarani, and sāl covered wooded hills rising to close on 4,000 feet.

An area of 540 square miles was triangulated for one-inch survey and 1,620 square miles were reconnoitred for triangulation during the ensuing field season in the districts of Singhbhūm and Angul and the Feudatory States of Bihār and Orissa.

27. No. 12 Party.—This party surveyed an area of 8,328 square

PERSONNEL.

Class I Officers.

Lieut.-Colonel C. M. Browne, C.M.G.,
D.S.O., R.E., in charge to 2nd April 1924.

Bt.-Lieut.-Colonel R. H. Phillimore,
D.S.O., R.E., in charge from 3rd April to
July 1924.

Class II Officers.

Mr. B. M. Berrill, in charge from 26th
July 1924.

Mr. E. M. Kenny.

„ D. K. Rennick, M.B.E.

„ E. C. Hanson.

Captain J. O'C. Fitzpatrick.

Mr. H. H. Creed.

Upper Subordinate Service.

5 Officers.

Lower Subordinate Service.

41 Surveyors, etc.

miles on the one-inch and half-inch scales, in the Sadiyā Frontier Tract, the districts of Sibsāgar and Nāgā Hills and proposed controlled extension area adjoining the latter district in Tribal Area and the Manipur State in Assam as well as in the Upper Chindwin district of Burma.

1,000 square miles of triangulation and 427 linear miles of traversing covering an area of 1,150 square miles were carried out in the Sadiyā Frontier Tract in advance of detail survey.

The area surveyed included part of the Brahmaputra valley, part of the Manipur valley and high hills ranging from 350 to 12,600 feet, the greater portion being covered with dense forest and in the Nāgā Hills comparatively scarcely inhabited.

28. Training.—Most of the pupils attached to parties in the field for training appear to be promising and will probably become useful surveyors.

Eight more pupils were entertained in April 1924; they were attached for training in field and recess work to No. 5 Drawing Office; two have now been posted to No. 9 Party and six to No. 4 Party for further training. Two of the eight appear to be very promising.

One Upper Subordinate officer of No. 4 Party, two of No. 12 Party and three surveyors of No. 9 Party received a little training in triangulation during recess.

29. Recess Work.—23 sheets were partly and 18 wholly surveyed by the three parties, of which 4 only have been received in the circle office.

No. 4 Party, owing to its new recess head-quarters being for reasons of economy at Hazāribāgh and away from circle head-quarters, to its new style of work and chiefly to the faulty arrangements made to obtain blue prints in time which resulted in a whole month's delay was unable to complete any of its sheets; all its sheets therefore have been transferred to No. 5 Drawing Office for completion which may be expected by the end of December 1924.

No. 9 Party's remaining 8 sheets will, it is expected, be submitted in November; this party started its field season too late and thereby curtailed its recess season, hence the incomplete submission of its sheets.

No. 12 Party has suffered from unavoidable changes in executive charges (five in eight months) and owing to its work lying in parts of 8 sheets, mostly with heavy contouring, all of which required completion to edge from old surveys, in addition to 13 other sheets, the total number of sheets to be drawn was rather larger than the party's drawing capacity; 2 sheets were submitted in October 1924, 7 more, examined by section officers but not by the Officer in charge, in November and the remaining 8 will probably be completed and submitted by end of December 1924.

A great deal of party work has therefore, mostly unavoidably, been handed over to the circle drawing office for completion. With the earlier start in field work this ensuing field season, however, there should be no excuse for a repetition of this next year.

BURMA CIRCLE (*vide* Index map No. 1).

DIRECTOR { Lt.-Col. G. P. Gunter, O.B.E., R.E., to 24th March 1924.
 Lt.-Col. E. T. Rich, C.I.E., R.E., from 25th March to 4th August 1924.
 Lt.-Col. R. H. Phillimore, D.S.O., R.E., from 5th August 1924.

30. No. 10 Party.—This party surveyed an area of 4,389

PERSONNEL.
Class I Officers.
 Captain O. Slater, M.C., R.E., in charge to
 1st April 1924.
 Captain G. Lennox, I.A., in charge from 2nd
 April 1924.

Class II Officers.
 Mr. S. S. McA'F. Fielding.
 „ F. J. Grice.
 Captain F. E. R. Calvert.

Upper Subordinate Service.
 4 Officers.

Lower Subordinate Service.
 30 Surveyors, etc.

Lower Burma.

square miles on the half-inch, one-inch, two-inch and four-inch scales in the Akyab, Kyaukpyu and Sandoway districts of Lower Burma and in the Minbu and Thayetmyo districts of Upper Burma.

An area of 2,897 square miles was triangulated for topographical surveys in the same districts of

The nature of the country surveyed varies very considerably. Inland the area is hilly and well wooded and rises to 5,700 feet in the Arakan Yoma Range. The coast is highly cultivated and intersected by many tidal creeks. The hill ridges, which mainly run north and south, form in the sea area numerous wooded islands usually fringed with mangrove swamps. Nearly all communication in the coastal area is by water and in the hills by paths.

The party suffered considerably from depredations by tigers; one surveyor, one khalasi and one coolie were killed.

31. No. 11 Party.—Survey operations were continued in Lower

PERSONNEL.

Class I Officer.

Mr. J. O. Greiff, in charge.

Class II Officers.

Mr. F. Simpson.

" G. E. R. Cooper.

" A. V. Dickson.

Upper Subordinate Service.
8 Officers.

Lower Subordinate Service.

27 Surveyors, etc.

Burma, in the Amherst district. The total area surveyed on all scales was 2,451 square miles, made up of 1,306 square miles original and 999 square miles supplementary surveys, on the one-inch scale; 130 square miles on the two-inch scale, and 16 square miles on the four-inch scale, of Reserved Forests. In addition an area of 2,605 square miles of supplementary and original triangulation was done, and 97 linear miles of traversing run, to supply data for current detail survey, and for next season's programme.

The country surveyed comprised part of the Dawna mountains, parts of the Thaungyin and Haungtharaw valleys, the northern portion of the Ataran valley, and the island of Bilugyun lying off the town of Moulmein, which was included in the area surveyed. Except for the fertile plains of Bilugyun island and those lying along the banks of the Ataran river, the country surveyed is hilly, furrowed by numerous streams and watercourses, and densely wooded, the mean elevation ranging between sea level and 5,000 feet, Mulayit, the highest peak on the Dawna range, being 6,822 feet high. The higher elevations are steep and precipitous and covered with dense evergreen forest, but in the low hills and spread out undulating valleys, the character of the jungle changes to a mixed forest of evergreen and deciduous trees and bamboo, with a heavy undergrowth of tall grass and scrub, and low lying forest swamps subject to annual floods. Part of the survey followed the Siamese frontier.

32. No. 18 Party (Aero-Photo).—From the 1st October

PERSONNEL.

Class I Officers.

Major C. G. Lewis, R.E., in charge from 8th October 1923.

Mr. E. C. J. Bond, V.D., in charge to 7th October 1923.

Class II Officers.

Mr. L. Williams, M.B.E.

" N. R. Mazumdar.

Upper Subordinate Service.
2 Officers.

Lower Subordinate Service.

1 Magnetic observer.

5 Computers, etc.

1923 the magnetic work and records of this party were taken over by the Director, Geodetic Branch, and the party was reconstituted under its present designation in order to take up aerial survey of the Irrawaddy Delta forests.

Approximately 1,440 square miles were surveyed by this method on the three-inch scale in the

Myaungmya and Pyapon districts of Lower Burma. The air-photography was carried out by Mr. R. C. Kemp, in contract with the Government of Burma; the fixing of ground control points, the compilation of the mosaics and fair-mapping were carried out by this party. The survey was undertaken at the instance of the Forest Department which has borne 85 per cent. of the cost.

The type of country, consisting of densely wooded alluvial plains, intersected by tidal creeks, was particularly suited to survey from the air. (See also Section II, page 21).

33. No. 21 (Burma Forest) Party.—The work done by this

PERSONNEL.

Class I Officer.

Mr. H. W. Biggie, in charge.

Class II Officers.

Lieut. L. B. Fitz-Gibbon.

Mr. T. F. Kitchen.

„ H. M. Critchell.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

88 Surveyors, etc.

party is included in that shown under Forest Surveys, Burma Circle, pages 20 to 22.

The area over which operations extended consists of densely wooded hills and plains.

34. Recess Work.—The sheets to be drawn by the parties of the Burma Circle during the recess season numbered seventy including forty-eight special forest sheets. Besides these there were three one-inch and three special forest sheets in arrears from the previous year's drawing which have now been completed. None of the sheets surveyed during the year had been received in the circle office by the 30th September. They will probably all be sent for publication before the beginning of next recess season.

II.—FOREST SURVEYS.

35. Details of the topographical surveys of reserved forests executed by field parties of the Survey of India for the year are given below. In the majority of cases, the surveys were carried out on the one-inch scale, but in special cases the four-inch, two-inch and half-inch scales were used. An area of a little over one thousand square miles was surveyed by aerial photography and mapped on the three-inch scale. Boundary surveys were made where necessary, and plots will be prepared as required.

NORTHERN CIRCLE.

36. United Provinces. Western Forest Circle.—In the *Bāndā Forest Division*, a portion of the reserved forest areas for which four-inch sheets already exist, was revised on the half-inch scale in the course of the topographical surveys.

SOUTHERN CIRCLE.

37. Central Provinces. Southern Forest Circle.—In the *Balāghāt Forest Division*, an area of 1·14 square miles was surveyed on the one-inch scale in the newly afforested extensions to the Chawarpani, Sonāwāni and Nawegaon reserved forests.

38. Madras. II and III Forest Circles.—In the *Anantapur*, *North Cuddapah* and *West Cuddapah Forest Divisions*, areas of 135·28 square miles and 172·74 square miles of reserved forests were surveyed on the one-inch and half-inch scales respectively.

EASTERN CIRCLE.

39. Assam. Eastern Forest Circle.—In the *Sadiyā Forest Division*, an area of 132 square miles was surveyed on the one-inch scale in the Sengajan and Depi Raya reserved forests.

BURMA CIRCLE.

40. Burma. Hlaing Forest Circle.—In the *Insein Forest Division*, 50 linear miles of boundaries of the Mahuya Reserve were

surveyed on the two-inch scale for adjustment with the old two-inch surveys of 1899-1902, which will be redrawn and published on the same scale with boundaries added.

Delta Forest Circle.—In the *Henzada-Ma-ubin Forest Division*, an area of 350.1 square miles was surveyed on the two-inch scale in the Padaw, Sinthe, Shwethanin, Kyangin, Yenandaung, Kaingtha, Myinwadaung and Extensions, South Myanaung and Extension and North Myanaung Reserves. In addition, an area of 98.4 square miles of unclassified forest land and cultivation was surveyed on the same scale to show the main approaches to these reserves, and 15 small exclusions scattered over the reserves were surveyed on the eight-inch and four-inch scales.

In the *Bassein Forest Division*, an area of 194 square miles in the Myittaya, Sinma and Sin-hmon Reserves was surveyed on the two-inch scale, and an area of 50.2 square miles of unclassified forest and cultivated land lying between the Sinma and Sin-hmon Reserves and the sea coast, was surveyed on the same scale. 13 small exclusions in the Sinma and Sin-hmon Reserves were also surveyed on the sixteen-inch and twenty-inch scales.

In the *Delta Forest Division*, the undermentioned reserved forest areas were surveyed by aerial photography:—

Name of Reserve.	Area in square miles.
Lebyauk	42
Kyagan Kwinbank	112
Kakayan	118
Pyinalan	165
Labutkwe	21
Kalayaik & Extension	37
Nyinaung	27
Kadonkani	284
Meinmahla	58
Pyindaye	302
Total	1,106

As photography was found unsuitable for the complete survey of the Lebyauk Reserve, which consists of low undulating hills, a considerable amount of supplementary work will be required on the ground.

The Pyindaye Reserve, surveyed by the Land Records Department in 1919-20 on the four-inch scale, was revised by air-photography.

Rectified mosaics of all the above reserves were compiled in Maymyo, and the fair-mapping on the three-inch scale, in twenty-eight sheets, is in hand.

In the *North Arakan Forest Division*, an area of 5·63 square miles of Block No. 1 of the Bandula Reserve was surveyed on the four-inch scale, and an area of 7·29 square miles of Blocks Nos. 2, 3, 4 and 5 of the same reserve was surveyed on the one-inch scale.

In the *South Arakan Forest Division*, an area of 23·5 square miles in the Kunchaung Reserve was surveyed on the two-inch scale.

Sittang Forest Circle.—In the *South Pegu Forest Division*, an area of 4 square miles was surveyed on the four-inch scale in the Pyinbongyi Extension, now one of the component blocks of the Salu Reserve, and an area of 2 square miles of the Shanywagyi Block of the same reserve was surveyed on the two-inch scale. In addition 92·8 linear miles of the boundaries of the Aungmya, Kalein and Talaingma Reserves, and the Aseilttaung and Shanywagyi Blocks of the Salu Reserve were surveyed on the two-inch scale for adjustment with the old two-inch surveys of 1899—1902, which will be redrawn and published on the same scale with boundaries added.

Tenasserim Forest Circle.—In the *Thaungyin Forest Division*, an area of 5·70 square miles of the Mekane, Kyaukket and Mepele-Thaungyin Extensions was surveyed on the four-inch scale, and 30·5 linear miles of the boundaries of the Taok and Ta-u-ke Reserves were surveyed on the same scale. In addition 45 linear miles of new roads in the Mepele-Thaungyin, Mekane and Kyaukket Reserves were surveyed on the four-inch scale in the course of one-inch topographical operations for incorporation in the old four-inch forest sheets.

In the *Ataran Forest Division*, an area of 9·77 square miles comprising Gwingyi Extension III, and part of Megwa Extension II was surveyed on the four-inch scale, and an area of 130·15 square miles of the Dali Reserve was surveyed on the two-inch scale.

Northern Forest Circle.—In the *Kathā Forest Division*, an area of 75·5 square miles, including 2·5 square miles of unclassed forest land, was surveyed on the two-inch scale in the Mezabya Reserve.

Chindwin Forest Circle.—In the *Minbu Forest Division*, an area of 115·14 square miles comprising portion of Mon Reserve and Mon Extension I, was surveyed on the half-inch scale.

III.—CANTONMENT AND LARGE SCALE SURVEYS.

41. No. 20 Party.—During the year the party completed the survey of Chaklālā, Pāthānkot and Kohāt cantonments on the 16-inch scale, and Mona and Sargoda on the 6-inch scale. The bāzār area of Kohāt cantonment was also surveyed on the 64-inch scale.

PERSONNEL.

Class I Officer.

Mr. C. E. C. French, in charge.

Upper Subordinate Service.

1 Officer.

Lower Subordinate Service.

21 Surveyors, etc.

The survey of Montgomery was abandoned by order of the General Officer Commanding, Ferozepore, as it ceased to exist as a cantonment on the 1st October 1924.

200·58 linear miles of traversing and 60·93 linear miles of levelling were completed at a cost of Rs. 31·66 and Rs. 19·11 per linear mile respectively.

The fair-drawings of Madras Military Lands, Wellington, Ahmadābād and the bāzārs of Deolālī and Ahmadābād have been completed and submitted for publication.

The out-turn and cost-rates of the various surveys are as follows:—

Sixteen-inch original, 3,734·00 acres @ Rs. 1·32 per acre.

Sixteen-inch revision, 2,336·00 acres @ Rs. 1·82 per acre.

Sixty-four-inch revision, 6·04 acres @ Rs. 47·67 per acre.

Six-inch original 35·00 square miles @ Rs. 213·84 per square mile.

The total areas fair-mapped with cost-rates are as follows:—

11,844·00 acres on the sixteen-inch scale @ Re. 0·99 per acre.

3,635·00 acres on the twelve-inch scale @ Re. 0·51 per acre.

140·00 acres on the sixty-four-inch scale @ Rs. 18·93 per acre.

66·00 acres on the forty-eight-inch scale @ Rs. 13·95 per acre.

**Alphabetical List of Cantonments and Military Stations surveyed
and published up to the end of 1923-24.**

- | | |
|--|--------------------------------------|
| (1) Agar Cantonment. | (81) Kalka Cantonment. |
| (2) Aurangābād do. | (82) Kamptee do. |
| (8) Ahmadnagar do. | (83) Karāchi Fort Trust (Manora). |
| (4) Ahmadābād do. | (84) Landour Cantonment. |
| (5) Bakloh do. | (85) Meerut do. |
| (6) Balūn or Thath (Dalhousie)
Camp Area. | (86) Madras District Military Lands. |
| (7) Bannu Cantonment. | (87) Nasirābād Cantonment. |
| (8) Bellary do. | (88) Nimach do. |
| (9) Bangalore Civil & Military Station. | (89) Peshāwar do. |
| (10) Chaman Cantonment. | (40) Pallāvaram do. |
| (11) Chitrāl Station. | (41) Poonamallee do. |
| (12) Cannanore Cantonment. | (42) Quetta do. |
| (13) Dehra Dūn do. | (43) Quetta Fort. |
| (14) Deoli do. | (44) Quetta Civil Station. |
| (15) Drazinda Out Post. | (45) Rājkot Cantonment. |
| (16) Droah Cantonment. | (46) Rāwalpindi do. |
| (17) Delhi New do. | (47) Sahāranpur Remount Depôt. |
| (18) Deolāli & neighbourhood (6-inch). | (48) Sanāwar Cantonment. |
| (19) Erinpura Cantonment. | (49) Saugor do. |
| (20) Fort Lockhart. | (50) Siālkot do. |
| (21) Ghairat Station. | (51) Simla Indian Infantry Lines. |
| (22) Guna Cantonment. | (52) Sitābaldī Fort (Nāgpur). |
| (23) Hangu do. | (53) Saint Thomas's Mount Cantt. |
| (24) Hāpur (Bābūgarh) Remount
Depôt. | (54) Secunderābād & Bolārūm Cantt. |
| (25) Hosūr Remount Depôt. | (55) Thal Cantonment. |
| (26) Jandola Out Post. | (56) Topa do. |
| (27) Jatta do. | (57) Velichi Military Lands. |
| (28) Jhelum Cantonment. | (58) West Hill Cantonment. |
| (29) Jullundur do. | (59) Wellington do. |
| (30) Jhānsi do. | (60) Zām Out Post. |

IV.—*GEODETIC BRANCH.*

DIRECTOR { Lt.-Colonel H. McC. Cowie, R.E., up to 30th March 1924.
 Dr. J. deGraaff Hunter, M.A., Sc.D., F. Inst.P., from 31st March to
 27th April 1924.
 Lt.-Colonel R. H. Thomas, D.S.O., R.E., from 28th April 1924.

GEODETIC OPERATIONS.

42. No. 13 Party.—Astronomical Latitudes.—This party

PERSONNEL.

Class I Officer.

Major C. M. Thompson, I.A., in charge.

Lower Subordinate Service.

3 Computers, etc.

was employed on latitude operations, the old Zenith telescope No. 1 by Messrs. Troughton and Simms on its wooden stand being used throughout for the observations. Latitudes were observed at 4 stations in Bihār and Orissa and 9 in the United Provinces. The stations in Bihār and Orissa lay along the B. & N. W. Railway to the north-east and south-east of Gorakhpur. Those in the United Provinces lay along the B. & N. W. Railway and O. & R. Railway north of Gorakhpur and along the line Gorakhpur-Benares-Partābgarh-Ajodhyā (Lakarmandi Gbāt).

The results of the observations are given in the following table:—

Station.	Height Feet.	Longitude.	Geodetic Latitude.			Astronomical Latitude.			A—G
			G			A			
Shāhpur ...	178	85 47 25.37	26	24	42.37	24	42.73 ± .067	+ 0.36	
Sinaria ...	239	85 15 54.25	26	45	12.55	45	6.27 ± .082	— 6.28	
Sikta ...	267	84 40 54.56	27	1	44.04	1	31.97 ± .098	—12.07	
Rāmnagar ...	312	84 19 35.56	27	9	4.09	8	50.43 ± .102	—13.66	
Mathia ...	334	83 51 32.13	27	8	4.37	7	54.10 ± .068	—10.27	
Rajabari ...	267	83 15 35.49	26	54	3.04	54	2.12 ± .067	—0.92	
Saunbarsa ...	315	83 21 18.45	27	11	26.33	11	16.26 ± .086	— 9.97	
Baniapar ...	267	83 23 2.28	26	15	7.72	15	15.50 ± .076	+ 7.78	
Kanann ...	270	83 23 51.38	25	43	3.62	43	13.33 ± .055	+ 9.76	
Ramapura ...	356	82 5 40.58	25	44	55.09	45	3.23 ± .069	+ 8.14	
Sirwara ...	348	82 7 30.01	26	16	23.86	16	33.74 ± .055	+ 9.88	
Bisaul ...	342	82 20 54.43	26	40	37.38	40	42.76 ± .069	+ 5.38	
Kopa ...	365	82 12 48.22	27	7	3.74	7	1.24 ± .053	— 2.50	

A positive value of A—G denotes a southerly attraction of the plumb-line.

The topographical effects attributable to visible masses have been estimated from maps and the Hayford deflections deduced therefrom on the hypothesis of a uniform isostatic compensation at a depth of 113·7 kilometres. The following table shows the residuals for the above stations unexplained by the Hayford hypothesis :—

Station.	Observed Astro. Deflection.	Estimated Topo. Deflection.	Hayford Deflection.	Unexplained Residual or Observed—Hayford Deflection.
	"	"	"	"
Rāmnagar ...	—13'66	—86'36	— 7'18	— 6'48
Saunbarsa ...	— 9'97	—77'02	— 4'37	— 5'60
Sikta ...	—12'07	—85'91	— 6'59	— 5'48
Mathia ...	—10'27	—81'39	— 5'27	— 5'00
Sinaria ...	— 6'28	—83'20	— 5'57	— 0'71
Kopa ...	— 2'50	—66'29	— 2'59	+ 0'09
Rajabari ...	— 0'92	—70'19	— 3'05	+ 2'13
Shāhpur ...	+ 0'36	—77'64	— 3'94	+ 4'30
Bisaul ...	+ 5'88	—58'32	— 1'38	+ 6'76
Ramapura ...	+ 8'14	—47'18	— 0'32	+ 8'46
Baniapar ...	+ 7'78	—57'92	— 1'12	+ 8'90
Kanaun ...	+ 9'76	—51'58	— 0'17	+ 9'93
Sirwara ...	+ 9'38	—51'73	— 0'77	+10'65

It will be seen from the above table that on the Gangetic plain, on which the observations were taken this season, the Hayford residuals increase nearly steadily from north to south, *viz.*:—from —6·48 to +10·65. The Hayford theory, though reducing the large negative estimated topographical deflections to smaller negative values, does not account for the actual negative values obtained in the northern portion (about one-quarter), nor explain the positive values which appear in the southern portion (about three-quarters) of the Gangetic plain.

An examination of the change of deflections points to the fact that as we proceed from the north to the south of the Gangetic plain, the

latitude stations come more vertically above the "hidden chain" or sub-surface excess of density, referred to in Professional Paper 5, which falls in the neighbourhood of latitude 22° in this area.

The Himālayan attraction would appear to emanate from a greater depth and material of lesser density, and the attraction of the "hidden chain" would appear to emanate from a lesser depth and denser material than can be accounted for on the Hayford hypothesis.

43. No. 14 Party.—Pendulum Observations.—This party

PERSONNEL.

Class I Officers.

Major W. E. Perry, M.C., R.E., in charge
up to 14th October 1923.

Major H. J. Couchman, D.S.O., M.C.,
R.E., in charge from 15th to 22nd
October 1923.

Captain E. A. Glennie, D.S.O., R.E.,
in charge from 23rd October 1923.

Class II Officers.

Mr. Raj Bahadur Mathur, B.A.

Lower Subordinate Service.

3 Computers, &c.

made pendulum observations at 11 stations extending from Pilibhit (U. P.) to Motihāri (Bihār). The table annexed gives the results of the observations. These observations complete the examination of the Gangetic plain between the meridians of 78° and 85° and show that the two small belts of high

density predicted from 1912-13 results are non-existent. There appears to be a simple trough of low density, deepest at the foot of the Himālayas and rising gradually right across the plain to the "hidden chain" without any intervening belts of higher density.

Summary of results of Pendulum observations.

28

Station.	Latitude. N.	Longitude. E.	Height above M. S. L.	CORRECTIONS.			γ_0	γ_A (Free Air).	γ_B (Bouguer).	γ_C (Hayford).	g	$g-\gamma_A$	$g-\gamma_B$	$g-\gamma_C$
				For Height.	Bouguer.	Hayford.								
			Feet.	dynes.	dynes.	dynes.	dynes.	dynes.	dynes.	dynes.	dynes.	dynes.	dynes.	dynes.
Etawah ...	26 47 00	79 00 55	492	- 046	+ 017	- 003	979-079	979-033	979-050	979-011	978-998	- 0-035	- 0-052	- 0-013
Fatehgarh ...	27 22 06	79 38 00	493	- 046	+ 017	- 004	979-121	979-075	979-092	979-052	979-023	- 0-052	- 0-069	- 0-020
Pilibhit ...	28 39 05	79 49 31	610	- 057	+ 021	- 019	979-216	979-150	979-180	979-100	979-045	- 0-114	- 0-135	- 0-055
Shahjahanpur ...	27 54 21	79 55 52	510	- 048	+ 017	- 007	979-161	979-113	979-130	979-079	979-040	- 0-073	- 0-090	- 0-039
Sitapur ...	27 33 18	80 41 08	449	- 042	+ 015	- 008	979-135	979-093	979-108	979-057	979-003	- 0-090	- 0-105	- 0-054
Sonaripur ...	28 27 39	80 44 24	514	- 048	+ 017	- 031	979-203	979-155	979-172	979-080	979-013	- 0-142	- 0-159	- 0-067
Bahnich ...	27 34 02	81 35 41	403	- 038	+ 014	- 015	979-136	979-098	979-112	979-039	978-977	- 0-121	- 0-135	- 0-063
Gonda ...	27 08 21	81 56 25	352	- 033	+ 012	- 010	979-105	979-072	979-084	979-034	978-940	- 0-123	- 0-135	- 0-085
Gauneri ...	27 31 48	82 35 45	364	- 034	+ 012	- 028	979-133	979-099	979-111	979-034	978-943	- 0-156	- 0-168	- 0-091
Bagaha Ghāt ...	27 08 06	84 03 05	298	- 023	+ 010	- 024	979-104	979-076	979-086	979-011	978-923	- 0-153	- 0-163	- 0-088
Motihari ...	26 39 10	84 54 35	220	- 021	+ 007	- 018	979-069	979-048	979-055	978-994	978-895	- 0-153	- 0-160	- 0-099

WORK OF FIELD PARTIES, &c.—GEODETIC BRANCH.

PERSONNEL.

Class I Officers.

Major C. M. Thompson, I.A., in charge up to 7th October 1923.

Mr. Hanuman Prasad, Rai Sahib, in charge from 8th October 1923 to 16th July 1924.

Major W. E. Perry, M.C., R.E., in charge from 17th July to 14th August 1924.

Captain O. Slater, M.C., R.E., in charge from 15th August 1924.

Class II Officer.

Mr. G. J. S. Rae.

Lower Subordinate Service.

3 Computers, etc.

PERSONNEL.

Class I Officer.

Dr. J. deGraaff Hunter, M.A., Sc.D., F. Inst. P., in charge.

Class II Officer.

Mr. D. H. Luxa.

Lower Subordinate Service.

10 Computers, etc.

44. No. 15 Party.—Tri-angulation.—No field operations were carried out by this party during the year under report, the personnel being employed at the Head Quarter Offices of the Geodetic Branch, Survey of India.

45. No. 16 Party.—Tidal Operations.—Tidal registrations were carried out by means of self registering tide-gauges during the year under report at the following stations:—

Stations.	Date of commencement of observations.	Date of closing of observations.	Number of years of observations.	REMARKS.
Aden ...	1879 ...	Still working	45	{ Observations are being continued solely for the purposes of the Port Trust. † Observations were restarted on 28th November 1923. § Observations taken on a tide-pole. ‡ Registrations taken on an automatic tide recorder.
Karachi ...	{ 1869 ... 1861 ...	1880 ... Still working	*13 48 } 56	
Bombay (Apollo Bandar).	1878 ...	"	46	
Bombay (Prince's Dock).	1888 ...	"	86	
Madras ...	{ 1880 ... Restarted 1895	1890 ... Still working	10 29 } 39	
Kidderpore ...	1881 ...	"	48	
Rangoon ...	1880 ...	"	44	
Moulmein ...	{ 1880 ... Restarted 1909	1886 ... Still working	6 15 } 21	
Bassein (Burma) ...	{ 1902 ... Restarted 1923	1908 ... Still working	2 1 } 3	
Port Blair ...	1880 ...	"	44	
Basrah ...	{ 1916 ... 1922 ...	1922 ... Still working	§7 ‡2 } 9	

- In addition to the above, the readings of the actual times and heights of high and low-water at Bhaunagar, Chittagong and Akyab were continued under the orders of the Port Officers concerned, who forwarded these results monthly to this office.

Since the 2nd November 1923, the Port Director, Basrah has been forwarding the weekly charts of the tidal curves that are being registered on the automatic tide recorder at Margil, and this is still being continued.

The observations for the year commencing 1st January 1923 were reduced by the method of harmonic analysis and the constants thus deduced were used in the computation of data for the Basrah tide-tables for 1925.

The tide predictions for the 1925 tide-tables for Basrah as also for the Indian ports, were carried out with the aid of the tide-predicting machine at Dehra Dūn. The printing and publication of these tide-tables were carried out in the office of the Director of the Geodetic Branch, Survey of India, Dehra Dūn, and the despatch of the same is expected to be completed by about the end of October 1924. Advance copies, in manuscript form, of the tide-tables for 1925 of the following ports:—Suez, Aden, Būshire, Karāchi, Bombay, Madras, Chittagong, Mergui, Dublāt (Sāgar Island), Diamond Harbour, Kidderpore, Elephant Point, Bhaunagar, Colombo, Rangoon, Marmagāo and Trincomalee were prepared and despatched to the Hydrographer to the Admiralty by the end of May 1924. Similarly, for the Hooghly river, to the Deputy Conservator of the Port of Calcutta and to Messrs. Thomas Cook & Son in addition. Advance copies in manuscript form of the tidal predictions for the Hooghly river for the months of February, March and April 1926 were prepared and despatched to the Port Officer, Calcutta.

Tidal registrations at the ten observatories still working have been carried out satisfactorily, and will be continued during the coming year. During the past year the following observatories were inspected:—Port Blair, Rangoon and Kidderpore. In addition, a new tide-gauge was installed at Bassein and tidal registrations were restarted at this station after the lapse of 21 years, and will be continued till satisfactory data is obtained on which the future predictions for Bassein can be based, and which, it is hoped, will enable more accurate predictions being made.

The following table shows the annual and decadal percentages of errors in the predicted times and heights of high and low-water at the eight stations where observations have been taken on self registering tide-gauges, from which it will be seen that the predictions for 1923 were as accurate as those carried out in the past under the direction of the National Physical Laboratory, Teddington.

PERCENTAGE OF ERRORS IN PREDICTED TIMES AND HEIGHTS.

Year.	AT OPEN COAST STATIONS.					AT RIVERAIN STATIONS.								
	Number of Stations.	IN TIME.		IN HEIGHT.			Number of Stations.	IN TIME.		IN HEIGHT.				
		Within 15 minutes of actuals.	Within 8 inches of actuals.	Within 1/8 of mean range at springs.	Within 15 minutes of actuals.	Within 8 inches of actuals.		Within 1/8 of mean range at springs.						
									H.W.—L.W.	H.W.—L.W.	H.W.—L.W.	H.W.—L.W.	H.W.—L.W.	H.W.—L.W.
1914	6	77	79	96	97	98	98	3	75	67	71	55	92	84
1915	6	82	82	98	98	96	96	3	76	66	73	67	94	92
1916	6	81	82	96	97	96	99	3	81	68	78	62	93	87
1917	6	75	72	96	98	96	97	3	78	65	69	64	92	88
1918	6	83	82	97	97	97	96	3	76	63	66	65	90	89
1919	6	78	75	96	97	97	98	3	74	65	70	69	98	92
1920	6	82	81	94	97	97	98	3	76	66	64	62	89	86
1921	6	77	72	94	97	97	99	3	74	66	75	71	92	84
1922	5	81	75	97	98	96	97	3	78	66	71	73	92	95
1923	5	78	71	98	96	96	95	4	52	49	63	61	75	78
Average of ten years.	...	79	77	96	97	97	97	...	74	64	70	65	90	89

Tide-predicting machine.—The height curves and time charts for the 1925 tide-tables were completed on the machine by about the end of January 1924. The height curves and time charts for the 1926 tide-tables are in hand at present and will, it is hoped, be completed before the end of October 1924.

Electrical registration of height of water at any-time in tidal prediction.—A device was introduced by Dr. deGraaff Hunter, which was fitted to the tide-predicting machine designed by Lord Kelvin and Mr. Edward Roberts, which is now employed by the Survey of India at Dehra Dūn, to record electrically on a chronograph the times at which successive prescribed heights of water are reached. The device may be found useful on other machines where vertical motion is recorded against time or other abscissæ.

A full explanation and an illustration of this device is contained in the Journal of Scientific Instruments, Vol. I, No. 8, May 1924. Copies of the chart, recording the heights and times of high and low-water at Bombay for 1925 can be obtained from the Secretary, the Institute of Physica, 10, Essex Street, W. C. 2.

The tidal predictions for 1926 for the 40 Indian ports are being run off on the tide-predicting machine, using the above device.

46. No. 17. Party.—Levelling.—Five detachments, three single, one double, one special, and a tertiary levelling group were employed in the operations summarised below:—

(a) *In the Punjab*, from Jhang to Multān and from

PERSONNEL.

Class I Officers.

Major A. H. Gwyn, I.A., in charge.

Class II Officers.

Mr. B. N. Mazumdar.

“ O. N. Pushong.

“ Jiya Lal Sahgal.

Upper Subordinate Service.

7 Officers.

Lower Subordinate Service.

27 Computers, &c.

64 purely temporary Levellers.

Bahāwalpur to Khānpur.

(b) *In Bombay*, from Nakhtrāna Motā to Viramgām, *via* Rājkot.

(c) *In Rājputāna*, from Mārwar Pāli to Govardhanlā, *via* Barmer and Jaisalmer.

These three lines form part of the new level net of India.

(d) *In Burma*, for the Public Works Department (Irrigation).—

(1) from Kyaukse to Minzu

(2) “ Ywakaingyi to Amarapura

(3) “ Yewe to Meiktila

(4) “ Kyaukse to Mandalay

(5) “ Kyauktaga to Myitkyō

(6) “ Dalanun to Pazunmyaung

(7) “ Moulmein to Pa-an

(8) “ Moulmein to Wēkali

(9) “ Babukon to Kawmyatkyi

(10) “ Nyaungbinzeik to Natchaung.

(e) *In Bombay*, (special detachment), gravity survey near Khairpur Mirs.

(f) *In the Punjab*, for the Sutlej Valley Irrigation project, an extension of the “tertiary” levelling net work in the Multān, Montgomery and Lahore districts, and in the Bahāwalpur State.

The party completed 990 miles of primary, 659 miles of secondary and 31,865 miles of tertiary levelling; the greater part of the work being done for Local Governments (*vide* para. 71).

47. No. 19 Party.—Base Line Operations.—No comparator

PERSONNEL.

Class I Officers.

Captain H. E. Roome, M.C., R.E., in charge to 21st October 1923.

Lt.-Colonel H. McC. Cowie, R.E., in charge from 22nd October 1923 to 31st March 1924.

Dr. J. deGruuff Hunter, Sc. D., M.A., F. Inst. P., in charge from 1st to 11th April 1924.

Captain O. Slater, M.C., R.E., in charge from 12th April 1924.

Lower Subordinate Service.

1 Magnetic Observer.

1 Surveyor.

or base line work was undertaken by this party during the year under report, the personnel being employed at the Head Quarter Offices of the Geodetic Branch, Survey of India.

PART 3.—OFFICE WORK.

I.—HEAD QUARTER OFFICES.

MAP PUBLICATION OFFICE (*vide* Index maps at end).

DIRECTOR { Lt.-Col. A. A. McHarg, D.S.O., R.E., up to 18th December 1923.
Lt.-Col. M.O'C. Tandy, D.S.O., O.B.E., R.E., from 19th December 1923 to 25th February 1924.
Lt.-Col. F. F. Hunter, D.S.O., I.A., from 26th February to 30th March 1924.
Col. H. Wood, R.E., from 31st March 1924.

48. Brief reports of the work carried out during the year

PERSONNEL.

Class II Officer.

Mr. Pramādarānjan Ray, R.S.

under review in the six offices administered by the Map Publication Office are given in paras. 50 to 54, 64, 73 and 74.

49. The classes of maps for the publication of which the Head Quarter Offices are responsible are as follows:—

- (a) Topographical maps on the one-inch scale.
- (b) Topographical maps on the half-inch scale.
- (c) Topographical maps on the quarter-inch scale.
- (d) (i) Geographical maps on the 1:1,000,000 scale
(about 1 inch = 16 miles).
- (ii) La Carte Internationale du Monde on the 1:1,000,000 (about 1 inch = 16 miles).
- (e) Geographical maps on the 1:2,000,000 scale (about 1 inch = 32 miles).
- (f) General maps on the same and smaller scales.
- (g) Special maps.

The progress made in the publication of each of these classes is detailed below:—

(a) **Topographical maps on the one-inch scale.**— During the year 187 modern sheets have been published. The General Staff have now decided to treat this series as the tactical map of India, in place of the half-inch series.

Index map No. 2 at the end of this report shows the progress made in the publication of the modern one-inch public sheets, and the following table gives the output of these sheets since the modern topographical surveys were begun:—

Years of publication.	NUMBER OF ONE-INCH SHEETS PUBLISHED.					
	Northern Circle.	Southern Circle.	Eastern Circle.	Burma Circle.	Totals	
1906-15	518	314	358	Figures for 1906-23 are included in the Eastern Circle.	1,190	
1915-16	85	69	50		204	
1916-17	23	40	22		85	
1917-18	18	12	13		43	
1918-19	32	19	6		57	
1919-20	15	37	52		104	
1920-21	15	11	19		45	
1921-22	20	46	29		95	
1922-23	32	38	18		88	
1923-24	62*	71	39		15	187
Total published ...	820	657	†284		‡337	2,098
Probable number of one-inch sheets which will not be published owing to the area covered by them being included in the programme for survey and publication on the half-inch scale ...	911	564	278		195	1,948
Approximate number remaining for publication ...	421	808	420		523	2,172
Approximate number of public one-inch sheets in India ...	2,152	2,029	992	1,055	6,218	

* In addition 3 one-inch sheets have been published on the 2-inch scale.

† Excluding 322 sheets of the Burma Circle.

‡ Including 322 sheets published in 1906-23.

In addition to the above, preliminary editions (in colours) of 20 one-inch sheets, prepared from modern revenue surveys, have been published during the year pending their topographical revision. One provisional issue of a one-inch sheet has also been published during the year.

27 modern one-inch, 11 preliminary editions, 1 provisional issue of one-inch, and 60 old style one-inch sheets have been reprinted during the year.

(b) **Topographical maps on the half-inch scale.**—Index map No. 3 at the end of this report shows the progress made in the publication of the modern half-inch public sheets. This series, which was commenced in 1914, is no longer treated as the *tactical* map of India. Most of the sheets published up to date are reductions from the one-inch map, but others are from direct half-inch surveys.

The following table gives the output of these sheets:—

Years of publication.	NUMBER OF HALF-INCH SHEETS PUBLISHED.		
	Drawn from component one-inch sheets.	Surveyed on half-inch scale.	Total.
1914-15	...	1	1
1915-16	21	4	25
1916-17	50	6	56
1917-18	59	6	65
1918-19	26	4	30
1919-20	31	8	39
1920-21	59	2	61
1921-22	75	7	82
1922-23	52	4	56
1923-24	68	24	92
Totals	441	66	507
Approximate total number of half-inch sheets in India	.....	.....	1,630

12 modern public half-inch sheets have been reprinted during the year.

(c) **Topographical maps on the quarter-inch scale.**—These maps are prepared in "degree" sheets which include 1° of latitude and 1° of longitude, i.e., the area covered by 16 one-inch sheets, or 4 half-inch sheets.

Index map No. 4 at the end of this report shows the progress made in the publication of the modern quarter-inch public sheets.

The following table gives the output of these sheets:—

Years of publication.	NUMBER OF "DEGREE" SHEETS PUBLISHED.				
	Northern Circle.	Southern Circle.	Eastern Circle.	Burma Circle.	Total.
1911-15	10	8	10	Figures for 1911-23 are included in the Eastern Circle.	28
1915-16	...	1	4		5
1916-17	1	...	3		4
1917-18	...	...	4		4
1918-19	...	3	8		11
1919-20	4	...	4		8
1920-21	1	...	...		1
1921-22	1	3	5		10
1922-23	10	8	2		20
1923-24	13	6	4		23
Totals	40	31	25*	23†	119
Approximate number of "degree" sheets in India	170	140	75	65	450

* Excludes 20 sheets of the Burma Circle.

† Includes 20 sheets published in 1911-23.

8 preliminary sheets in colours from comparatively modern surveys have been published and 20 modern and 2 preliminary sheets are at press.

In addition to the above, 4 modern, 3 preliminary and 17 provisional public quarter-inch sheets have been reprinted during the year.

(d) **Geographical Maps on the 1:1,000,000 scale.**—(i) **The 'India and Adjacent Countries' Series** (*Vide* Index map No. 5).—During the year no new sheet of this series has been published, but 9 sheets have been reprinted.

(ii) **La Carte Internationale du Monde.**—(*Vide* Index map No. 6).—A full description of the genesis of this series was given in the General Report for 1913-14. During the year one new sheet has been published making a total of 13 sheets up to date, and one sheet has been reprinted.

(e) **Geographical Maps on the 1:2,000,000 scale.**—(*Vide* Index map No. 7).—2 new sheets have been published during the year and 1 map has been reprinted.

(f) **General Maps on the same and smaller scales.**—The engraved plates of all these maps have been corrected and brought up to date as far as possible and 2 maps have been reprinted during the year.

(g) **Special maps.**—The annual edition of the Railway Administration map (on the scale of 1 inch = 64 miles) has been corrected and will be published in November 1924.

One new provincial map (on the scale of 1 inch = 32 miles) has been published and two have been reprinted.

Maps of 'Calcutta and Surrounding Country' (scale one inch = one mile), 'Secunderābād and Bolārūm' (scale three inches = one mile) and 'Benares and Environs' (scale four inches = one mile) have been published and the Town Guide map of Lucknow (scale twelve inches = one mile) in 2 sheets has been reprinted.

Plan of City of Calcutta on scale three inches = one mile has also been reprinted.

Numerous special maps have also been prepared and printed for the Army, for Local Governments, Railways and other Departments. The work for the Army has been particularly heavy owing to the introduction of a new system of map references, according to which all topographical maps supplied to the military have to be surprinted with a mesh showing one-minute squares.

50. Map Record and Issue Office.—During the year sales to the public again showed a steady increase over previous years.

The Catalogue was reprinted after being brought up to date 1st July 1924.

The re-organization of the record room continued. Up to date 5,206 steel and asbestos, or entirely steel shelves have been completed. The racks are connected by expanded steel galleries. The whole installation is fire proof and lighted by electricity.

980,132 maps, plans and diagrams valued at Rs. 4,47,710 were issued during the year as compared with 359,917 valued at Rs. 2,11,014 issued in 1913-14.

The Branch Office formerly at No. 5, Esplanade East, has been removed permanently to the Government Central Book Depôt, No. 8, Hastings Street, Calcutta.

ISSUES.—FROM THE MAP RECORD AND ISSUE OFFICE.

YEAR.		ON BOOK TRANSFER (TO GOVERNMENT OFFICIALS).		ON CASH PAYMENT (TO PRIVATE INDIVIDUALS AND MAP AGENTS).		FREE ISSUES.		TOTAL.	
		Number of Printed Copies.	Value Rs.	Number of Printed Copies.	Value Rs.	Number of Printed Copies.	Value Rs.	Number of Printed Copies.	Value Rs.
1923-24	Departmental Maps.	159,179	1,74,903	64,361	97,399	52,567	89,353	276,107	3,61,655
	Extra-departmental Publications.	516,017	66,538	173,161	15,759	14,847	3,758	704,025	86,055
	Total ...	675,196	2,41,441	237,522	1,13,158	67,414	93,111	980,132	4,47,710
1922-23	Total ...	894,642	2,96,959	219,746	83,724	64,073	82,770	1,178,461	4,63,453
1921-22	Total ...	1,222,832	2,10,510	104,750	62,075	67,812	68,903	1,395,394	3,41,488

Total number of requisitions and enquiries received in the Map Record and Issue Office:—

Year 1921-22	...	...	...	...	8,868
.. 1922-23	...	...	...	...	8,860
.. 1923-24	...	...	...	...	9,303

Table III.—Publications received in Map Record & Issue Office, during the year 1923-24.

A.—From the Calcutta Printing Offices, (including the Engraving Office).

Class of Maps.	Scale.	NUMBER OF DIFFERENT MAPS OF EACH CLASS RECEIVED.		Number of sheets printed.	Value.	
		New Publications.	Reprints and New Editions.			
DEPARTMENTAL.						
					<i>Rs.</i>	
GENERAL MAPS.						
Maps of India ...	Various	...	5	16,750	3,485	
GEOGRAPHICAL MAPS.						
Map of India and Adjacent Countries.	1"=32 miles	...	...	...	...
Southern Asia Series	1:2,000,000	2	1	2,045	6,135	
India and Adjacent Countries Series.	1:1,000,000	...	9	3,550	5,200	
La Carte Internationale du Monde	1:1,000,000	1	1	350	350	
TOPOGRAPHICAL MAPS.						
Quarter-inch, (Modern)	1"=4 miles	33	26	24,260	35,827	
Do. (Prely.)	1"=4 miles	8	3	3,400	5,100	
Do. (Provl.)	1"=4 miles	...	17	3,750	5,475	
Half-inch, (Modern)	1"=2 miles	98	16	42,585	1,27,365	
Do. (Prely.)	1"=2 miles	...	...	...	...
One-inch, (Modern)	1"=1 mile	166	38	67,537	99,969	
Do. (Prely.)	1"=1 mile	20	11	8,125	12,187	
Do. (Provl.)	1"=1 mile	1	1	650	775	
Old Style sheets	Various	...	60	6,075	9,621	
SPECIAL MAPS.						
District Maps	1"=4 miles	...	...	...	...
Administration Report Maps	1"=8 miles	...	5	705	262	
Provincial Maps	Various	1	2	1,838	3,502	
Plans of Cities and Cantonments...	Various	2	2	1,310	3,145	
Index Maps	Various	2	12	6,150	1,570	
Miscellaneous Maps	Various	26	25	29,581	22,028	
Total	360	234	218,661	3,41,989
EXTRA-DEPARTMENTAL.						
Maps	Various	275	43	134,712	42,436	
Plans and Diagrams	Various	264	13	153,998	11,927	
Illustrations	.....	201	1	92,138	20,402
Miscellaneous	.....	81	41	259,170	10,841
Total	811	98	640,018	85,608
Grand Total	1,171	332	858,679	4,27,602
B.—From the Geodetic Branch, Survey of India, Dehra Dūn.						
Various ...	Various	16	13	1,910	3,670	
C.—LETTERPRESS.						
1. Survey of India General Report, 1922-23. Price Rs. 2.						
2. Hand-book of Topography, Chapter IV, 1924. Price Rs. 1.						

51: No. 1 (Head Quarters) Drawing Office.—The organiza-

PERSONNEL.

Class I Officer.

Mr. J. Prasad, R.B., in charge.

Class II Officers.

Mr. P. Williams.

" Abinash Chunder Bose.

" C. West.

" A. B. Hunter.

" Priya Nath Sur.

" Amar Krishna Mitra:

" F. B. Kitchen.

" Munshi Lal, B.A.

" H. T. Hughes.

" P. C. Mitra, B.A.

Upper Subordinate Service.

1 Officer.

No. 1 Drawing Office.

The work carried out by the various sections was as follows:—

(1) The Compilation Section.—

- (a) "La Carte Internationale du Monde au 1:1,000,000".—Eight sheets were reported in hand last year and one new sheet was taken up this year. Of the nine sheets, three have been completed and sent in for publication. Contour patterns of two sheets have been completed and sent to the Engraving Office. Of the remaining four, colour pattern of one sheet, contour patterns of two sheets and preliminary compilation of one sheet are in hand. Pattern for one sheet has been prepared and sent to the Engraving Office for correction of plates for reprint.
- (b) The Southern Asia Series, scale 1:2,000,000.—Of the five sheets reported in hand last year, layer patterns of three, outline and contour patterns of one and the outline pattern of the remaining one sheet are in hand. No new sheet was taken up this year.
- (c) India and Adjacent Countries, scale 1:4,000,000.—Preparation of various colour patterns is in hand.
- (d) Miscellaneous.—
- (i) Colour patterns of the new 50-mile Wall Map of India are under preparation.
 - (ii) Black prints of plane-table sections of 33 sheets have been pasted together for supply of blue prints to various parties.
 - (iii) Three Height Indicator Scales and five originals of line blocks for Chapter VIII of the Handbook of Topography have been prepared.
 - (iv) Indexes on different scales have been brought up to date for various reports.

tion of the office remained practically the same as last year, with the exception that the Imperial Standard Mapping Section, which was directly under the administrative control of the Director, Map Publication, was placed, with effect from the 22nd January, under the supervision and orders of the Officer in charge,

(2) *The One-Millionth Section.*—

- (a) Engraved editions.—Nine sheets were reported in hand at the close of the last year and two new sheets were taken in hand during the year. Of these eleven sheets, one has been completed and sent in for publication, contour patterns of two and outline pattern of one have been completed and sent to the Engraving Office, contour pattern of one, outline patterns of three and preliminary outline pattern of one are under preparation and compilation charts of the remaining two are under examination.

Patterns for two sheets have been prepared and sent to the Engraving Office for correction of plates for reprint.

- (b) Helió. editions.—The one sheet that was reported in hand at the close of the last year has been completed during the year and is ready for press.
- (c) Reprints.—Originals of three sheets have been brought up to date and sent to press for reprint. This includes one reported in hand at the close of the last year.

(3) *The Quarter-Inch Section.*—

- (a) Original compilation and drawing.—At the end of the last year there were three quarter-inch sheets in hand; one new sheet has been taken up during the year under report. Of these, three have been completed and sent in for publication and one is still in hand.
- (b) Stump-shaded originals of 103 sheets on various scales have been prepared during the year under report, including three quarter-inch sheets that were in hand at the close of the last year. That of the 50-mile Wall Map of India which was taken up last year is nearing completion. The originals of five sheets are in hand.
- (c) The drawing and hill-shading of the "Vivid Map of India" on the 16-mile scale were completed and the map was sent for exhibition at the British Empire Exhibition.
- (d) The reprint of the Catalogue of Maps was taken up and the various originals and colour patterns for all the indexes and the letterpress were brought up to date and sent in for publication.

- (e) Originals and colour patterns of the indexes and the letter-press for the Burma map catalogue have been prepared and sent to press.
- (4) *The Reprint Section.*—
- (a) 26 old style one-inch sheets (including 7 in hand at the close of the last year), 27 modern one-inch sheets (including 9 of last year) and 10 half-inch sheets have been brought up to date and sent to press for reprint; 4 old style and 2 modern one-inch and one quarter-inch sheets still remain in hand.
- (b) Symbols on originals of 13 modern sheets have been modernised for future editions.
- (c) 14 provisional quarter-inch sheets compiled from Indian Atlas material and 1 preliminary sheet have been brought up to date and sent to press for reprint; 1 preliminary sheet is in hand.
- (d) *Miscellaneous.*—
- (i) The 64-mile Railway Map of India has been brought up to date and sent in for reprint.
- (ii) 2 Indian Atlas sheets and 23 miscellaneous maps (including 6 in hand at the close of last year) have been prepared and brought up to date and sent to press. 5 miscellaneous maps are still in hand.
- (5) *The Mapping Section.*—
- (a) 24 modern topographical sheets (including 2 in hand of last year) have been brought up to date and sent for reprint.
- (b) Corrections have been carried out on the originals of 172 sheets on various scales before publication.
- (c) Press order proof corrections have been carried out on the originals of 220 modern topographical sheets including 2 in hand of last year.
- (d) 37 fair and print-original sheets and the colour patterns, tint originals, &c, of various special maps (including 4 in hand of last year) have been completed and sent to press. These include maps prepared for various Government and Commercial Departments. Two cases are still in hand.

OFFICE WORK.—HEAD QUARTER OFFICES.

(e) The new one-minute mesh for the General Staff has been inserted by hand on 160 printed copies of modern sheets on various scales. Mesh originals for 184 sheets on different scales, as also for 7 miscellaneous maps have been prepared.

(6) *The Office Copy Section.*—

(a) Additions and corrections received from various local authorities have been entered on the existing "office copies" of 2,148 sheets. 602 "office copies" of newly published or reprinted sheets have also been prepared during the year.

(b) The areas of 278 newly published one-inch and half-inch sheets have been checked against the Auxiliary Tables and entered in the Area Register.

(c) The miscellaneous work of this section includes—

(i) supply of authenticated copies of revenue and historical maps, revenue data from field books and other records to officials and private persons,

(ii) the preparation of complete sets of maps of the Districts and States of India and Burma in order to bring the "office copies" thereof up to date by references to the various Local Governments.

(7) *The Examining Section.*—

This section is responsible for the examination of the sheets drawn by other sections in the office. 165 cases pertaining to 274 sheets have been examined during the year, including 6 cases pertaining to 6 sheets in hand from last year; 13 cases pertaining to 13 sheets remain in hand.

In addition to the above current work this section has supplied scientific data to various officials, kept up corrections to Imperial Gazetteers, examined projections of sheets on copper plates in the Engraving Office, reported on boundary patterns prepared in other offices, plotted points on the plane-table section for the Mount Everest Expedition Survey, checked geographical names in various Survey of India publications, drafted and examined proofs of correction slips to the different chapters of the Handbook of Topography, Conventional Signs, Type Table, &c. The alphabetical index to names for the new 50-mile Wall Map of India which was in hand last year has also been completed during the year.

(8) *The Imperial Standard Mapping Section.*—

This section has been employed on the fair-mapping of the preliminary editions of one-inch sheets, compiled from modern revenue survey material and has completed them from old material where no modern work is available.

11 new one-inch sheets and 2 quarter-inch sheets of Bengal and Bihar & Orissa have been fair-mapped and submitted for publication; and 11 new sheets have been compiled during the year for one-inch supplementary survey by No. 4 Party in 1924-25. One partially completed one-inch sheet has been held over for want of material, 2 sheets fair-mapped but not completed, as the material was received too late, and 4 sheets still remain in hand pending receipt of material.

An area of 235 square miles in the Jherria coal field area has been reduced from modern revenue material, and 325 square miles in the Rāniganj coal field area compiled from four-inch thana maps for supplementary survey on the four-inch scale by No. 4 Party in 1924-25.

52. **Engraving Office.**—(1) *Engraving Section.*—During the

PERSONNEL.
Class I Officer.
Mr. J. Prasad, R.B., in charge.

year under report this section has been employed in the following:—

(a) *India & Adjacent Countries.*—Scale 1 : 1,000,000.

Out of the seven sheets in hand last year, one has been sent in for publication, another will be sent in very shortly, two are in final stages and two still in hand. One projected last year is awaiting material.

(b) *La Carte Internationale du Monde*—Scale 1 : 1,000,000.

Two sheets reported in final stages last year were held back for incorporation of additional information and are expected to be ready for publication very shortly, three sheets completed are under examination and three sheets still in hand.

(c) *Southern Asia Series*—Scale 1 : 2,000,000.

One sheet (North Tibet) reported ready for publication last year was held back for incorporation of new information and will be completed shortly. Two sheets (Bombay and Brahmaputra) completed and under examination. One (Delhi) nearing completion and three sheets (Koko Nor, Kashmir and Calcutta) are in hand.

- (d) The miscellaneous work has, as usual, been rather heavy. A "Warrant of Appointment" plate was engraved for H. E. the Viceroy. Office copy corrections have been carried out on maps of India on various scales and on the map of Calcutta on six-inch and three-inch scales. The conventional signs and guide card plates have been added to. All the one inch = 32 miles indexes have been corrected and brought up to date for the catalogue, and a large number of rack number labels have been hand-printed for the Map Record and Issue Office. Six steel "male dies" for the preparation of matrices for conventional sign stamps have been engraved. The compilation of the insets and a new revised colour scheme for the Wall Map of India continued throughout the year. Two new tint plates Nos. 41 and 41A have been engraved for the Photo.-Litho. Office.
- (2) *Copper Plate Printing Section.*—10,934 impressions were pulled during the year, against 29,191 during the preceding year. 35 per cent. of this represents extra-departmental work such as photogravures, commission forms, &c. Of the departmental work, 30 per cent. were scales and the rest art paper prints from various plates. During the year there was a great fall in the demand for photogravures, scales, commission forms and charts.

The Electro-typing Section dealt with 56 plates.

53. *Photo.-Litho. Office.*—The out-turn of the office, as can

PERSONNEL.

Class I Officers.

Major F. J. M. King, R.E., in charge to
27th May 1924.

Captain T. M. M. Penney, R.E., in charge
from 26th May 1924.

be seen from the accompanying tables, is smaller than last year, which was an exceptional one owing to the large number of maps reprinted for mobilization purposes,

but it is very much the same as the year before as regards the number of departmental sheets printed, *vide* Table A, column 4.

What does, however, show a marked decrease is the amount of extra-departmental work done. This is largely due to the general retrenchment and economy that was practised throughout every department in the course of the last year. The only branches that show an increase are the Type Section and the Process Engraving Section *vide* Table B, columns 3 and 7.

The cost of the office again shows a slight reduction.

The outstanding innovation throughout the year was the introduction of the minute mesh on maps of military areas, and the difficulties in registration encountered in surprinting the mesh on to sheets that had been for some time in stock in the Map Record and Issue Office threw an interesting light on the amount of distortion that takes place in the paper of sheets stored in this climate.

TABLE A.—WHOLE PHOTO.-LITHO. OFFICE.

1	2	3	4	5	6
Year.	*Cost of office.	Value of out-turn at office rates.	NUMBER OF MAPS PRINTED.		
			Departmental.	Other than Departmental.	Total.
	<i>Rs.</i>	<i>Rs.</i>			
1921-22	3,05,038	5,37,535	666	2,998	3,639
1922-23	2,64,415	5,71,286	956	2,760	3,716
1923-24	2,63,502	4,56,368	661	2,016	2,677

* Does not include cost of chemicals, paper, &c., obtained from England.

TABLE B.—LITHO. BRANCH.

1	2	3	4	5	6	7
Year.	Number of impressions pulled in Litho. Branch.	Number of half-tone impressions pulled.	Number of line-block impressions pulled.	TYPE SECTION OUT-TURN.		
				Pages or items published.	Copies printed.	Impressions pulled.
1921-22	3,543,470	90,633	745,670	2,854	933,391	1,766,319
1922-23	4,035,405	51,069	328,628	2,815	1,026,900	1,593,605
1923-24	2,670,351	92,257	182,540	2,599	1,098,138	1,915,327

TABLE C.—PHOTO. BRANCH.

	1921-22.	1922-23.	1923-24.
Negatives	5,894	5,604	6,316
Zinc plates	7,395	7,078	6,688
Photogravure plates	} 475	} 605	} 820
Half-tone blocks			
Line blocks			

54. Mathematical Instrument Office.—During the year

PERSONNEL.
Mr. S. Woodhouse, in charge.

from 1st April 1923 to 31st March 1924, there was a decrease in the

demands made on this office for supply of instruments, and also in the value of work done in the workshop (*vide* items 1 and 6 in the statement under para. 2 below). The store made a profit of Rs. 26,348 against Rs. 63,358 in 1922-23, and the workshop Rs. 43,313 against Rs. 39,718 in 1922-23. The establishment was retrenched as per item 10 of the statement below with a view to effect economy.

2. The following comparative statement shows the figures for the last 3 years :—

	1921-22.	1922-23.	1923-24.
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
1. Total value of stores issued to Public Offices as shown in the Profit and Loss statements.	5,32,768	6,25,953	4,46,559
2. Value of repairs to instruments received from Public Offices for repairs, and returned in serviceable condition.	1,18,445	1,70,010	1,56,682
3. Value of instruments received from Government Offices as no longer required.	58,743	83,933	54,824
4. Book value of the stock of instruments, &c., in the Serviceable Store.	6,91,499	5,75,844	5,14,985
5. Book value of the stock of instruments, &c., in the Repairable Store.	1,25,646	1,26,616	1,11,113
6. Total value of work done in the Workshop.	4,20,408	4,89,329	3,92,072
7. Value of instruments manufactured in the Workshop for Serviceable Store.	1,76,123	1,68,588	1,14,677
8. Value of instruments purchased locally	11,296	22,840	13,034
9. Value of instruments and materials obtained from England through the Director General, India Store Department.	4,53,016	2,20,650	1,47,723
10. Average No. of employees and their pay including pension contribution.	{ No. 628 Rs. 1,93,658	{ No. 554 Rs. 1,88,009	{ No. 402 Rs. 1,57,280

3. During the year the stocks of the Serviceable, Repairable and Material Stores were taken twice as usual and the discrepancies found were duly adjusted. Also a good deal of surplus and obsolescent stock articles were disposed of to the best advantage of Government.

II.—DEHRA DŪN OFFICES.

GEODETIC BRANCH OFFICE.

55. Computing Office.—Computations on a large scale were

PERSONNEL.

Class I Officer.

Dr. J. deGraaff Hunter, M.A., Sc.D.,
F. Inst. P., in charge.

Mr. Mukundananda Acharya, Head Com-
puter and 11 other senior computers and 2
junior computers.

carried out this year at the re-
quest of extra-departmental officers.
Special mention may be made, in
this connection, of a requisition for
rectangular co-ordinates of about
3,000 points from the military authorities and of two others,
requiring heavy computations, for the construction of maps on two-
centred and three-centred azimuthal projections for the Chief of the
General Staff. In addition to the above, multifarious computations,
for charts (9 in number), for deducing adjustment corrections graphi-
cally, to be applied to the pendant series of triangulation in Burma,
for aneroid heights, for grid co-ordinates, for plumb-line deflections on
Helmert spheroid, were carried out.

By request of M. Lallemand computations were made to ascertain
if the mean sea level is different at adjacent tidal stations, and a note
compiled for the discussion of this subject at the Madrid meeting (1924)
of the International Union of Geodesy and Geophysics.

The preparation of Bombay Tidal Prediction Chronograph sheet
showing both times and heights of high and low-water with values of
heights computed and noted at the proper places was carried out.

The form of geoid (sea level surface) which was deduced last year
and exhibited by means of contours, on a $\frac{1}{5M}$ map was redrawn this
year showing the elevation of geoid above Helmert-Hayford spheroid
instead of above Everest spheroid as was done last year. The prepara-
tion of traverse tables in a novel form has been completed.

The tidal and geoidal charts have been exhibited at the British
Empire Exhibition, Wembley.

The preparation of a revised and extended 5th edition of the
Auxiliary Tables of the Survey of India is still in progress. A full
edition of Part II as well as that of Part III has been printed.

Besides numerous requisitions for magnetic data, nearly 220
requisitions for various data from departmental and non-departmental
officers were complied with.

Triangulation pamphlets were compiled for 67 sheets. These
include both Mesopotamian Triangulation and Turco-Persian Boundary
Commission work. 45 degree sheets have been printed off in
pamphlet form during the year.

Magnetic Survey.—The magnetic operations, except at the Dehra Dūn observatory, were suspended in October 1923, when the Toungoo observatory was dismantled, the observatory buildings being handed over to the Director, Burma Circle.

The declination, horizontal force and vertical force magnetographs were in operation throughout the year at the Dehra Dūn observatory and daily absolute observations were taken by the observer in charge.

The results of the observations at the Dehra Dūn, Toungoo, Barrackpore, Kodaikānal and Alibāg observatories, repeat and field stations, reduced to the epochs 1909·0 and 1920·0 are now under publication.

MEAN VALUES OF MAGNETIC ELEMENTS AT THE DEHRA DŪN OBSERVATORY FOR THE YEAR 1923.

Name.	Latitude and Longitude.	Dip.	Declination.	Horizontal Force.	Vertical Force.
	° ' "	° ' "	° ' "	C. G. S.	C. G. S.
Dehra Dūn	{ 80 19 19 N 78 8 19 E }	45 12'6 N	1 38'6 E	0'82926	0'88168

Observatories.—Meteorological observations were continued as usual; the Omori Seismograph was in operation throughout the year and recorded 13 earthquakes.

Photographs of the sun were taken on 279 days. Photographs for 43 days could not be taken on account of repairing the dome; and for the remaining days of the year the sun was invisible.

Preservation of Trigonometrical Stations.—587 stations were repaired by district officers at a cost of Rs. 3,607. Out of 360 districts from which reports were due, 38 failed to make returns.

56. No. 2 (Dehra) Drawing Office.—During the year the work of this office was carried on by six sections. The Stein section having completed and sent to press the last of the special maps shown as in hand in the previous year, was abolished in the beginning of December 1923.

PERSONNEL.

Class I Officer.

Major W. E. Perry, M.C., B.E., in charge to 16th July 1924.

Class II Officers.

Mr. H. P. D. Morton, in charge from 17th July 1924.

Mr. H. B. Simons.

„ Rama Prasad Ray, B.A.

„ Dhirendra Nath Banerji, L.C.E.

Upper Subordinate Service.

2 Officers.

The Triangulation Chart and Cantonment Section.—Deals with the fair-drawing of triangulation, levelling and index charts, and the publication, reprint and correction of cantonment plans. In addition to the ordinary work of this section, of the 15 forest maps of Indian States received for publication at the end of last year, and shown as in hand, the accessory work on 10 of them was completed, and they have been published. Twenty-nine miscellaneous maps, charts and diagrams were also completed, and 389 sheets of cantonment plans, hand-coloured.

The Compilation Section.—Deals with the compilation and fair-mapping of geographical maps on different scales. The fair sheet on scale 1/M *viz.* No. 101 (Yunnanfu) shown as in hand last year is nearing completion. Another sheet of this series, *viz.* No. 91 (Batang), which was received from the Map Publication Office at Calcutta for the insertion of some new work, was completed accordingly and returned. The rough compilation of the 4 sheets on scale 1/M *viz.* Nos. 92 (Bhamo), 107 (Ningsiafu), 108 (Kungchangfu) and 109 (Chengtū) shown as in hand last year, together with that of another received during this year *viz.* No. 110 (Kweiyang) is proceeding. The rough compilation of the Yunnan outline sheet on scale 1/2M shown as in hand last year, and the Kashmir contour sheet are still in progress. The remaining sheet of Sir H. H. Hayden's Tibet map has been completed and sent to press. Materials for 5 sheets of the Tibet maps *viz.* Nos. 71 NE, SE, 77 NW, SW and NE have been collected, 3 outline sheets Nos. 71 NE, SE and 77 NW are being fair-mapped, and the rough compilation of the 2 remaining outline sheets and of all the contour sheets has been commenced. A new quarter-inch sheet *viz.* No. 85 P has been taken up during the year and is in hand. The stump-shading of two sheets was taken up during the year and completed. In addition, this section supplied some plotted sheets and maps for the use of the last Mount Everest party.

Quarter-inch and Miscellaneous Section.—As the half-inch sheets allotted to this, originally the half-inch, section were completed last year, the section dealt with quarter-inch and other miscellaneous work during the year. The fair-mapping of the remaining cantonment plans *viz.* 11 of Bangalore and one of Abbottābād, shown as in hand last year was completed and the plans sent in for publication. The stump-shading of one half-inch sheet shown as in hand last year has been completed. Seven quarter-inch sheets were taken up during the year; of these, 4 *viz.* Nos. 72 M, 77 K and O and 85 O are nearing

completion, and the remainder *viz.* Nos. 85 I and J and 86 D, taken up lately, are in hand. In addition, the section dealt with 264 miscellaneous maps, diagrams and charts and completed 261, leaving the balance in hand.

The Examining Section.—Examines the majority of the important sheets drawn in this office. 529 sheets have been examined during the year (including the 22 sheets shown as in hand last year) and 5 sheets are under examination.

The Sutlej Valley Project Section.—Deals with the fair-drawing of levelling charts (showing spot heights and contours) for the Sutlej Valley Irrigation project of the Punjab Government. 130 sheets shown as the balance in hand last year have all been completed and sent to press. Materials for 321 sheets (levelled during the season 1923-24) have been received during the year; of these, 39 sheets have been completed and sent to press, leaving a balance of 282 sheets in hand.

The Map Record Section.—Deals with the storage of originals and office copies of cantonment plans, triangulation and other charts and geographical maps; it keeps a small stock of the various maps published by the department for occasional issue to the public and for departmental use, and deals with all correspondence on this subject.

Summary of the work of the office during the year 1923-24.

Class of maps.	Balance of sheets on 1st October 1923.	Sheets received in 1923-24.	Sheets sent to press in 1923-24.	Balance of sheets in hand on 1st October 1924.	REMARKS.
Triangulation charts ...	12	15	19	8	
Levelling charts ...	2	1	2	1	
Index charts to illustrate reports.	1	8	4	...	
Cantonment plans for publication.	75	118	180	68	
Cantonment plans for correction.	20	140	160(a)	...	(a) Corrections carried out in both originals and office copies.
Cantonment plans fair-drawing.	12	...	12	...	

Summary of the work of the office during the year 1923-24.—(concl'd.)

Class of maps.	Balance of sheets on 1st October 1923.	Sheets received in 1923-24.	Sheets sent to press in 1923-24.	Balance of sheets in hand on 1st October 1924.	REMARKS.
Forest maps of Indian States for publication.	15	5	10	8(b)	(b) Two maps returned to the Director, Southern Circle.
Miscellaneous maps, charts and diagrams.	4	289	290	3	
Colour guides of cantonment and other maps.	202	225	389	38	
Quarter-inch sheets ...	...	8	...	8	
Sutlej Valley project level and contour charts, scale 4 inches = 1 mile.	180	321	169	292	
GEOGRAPHICAL MAPS.					
Fair sheets, scale 1/M ...	1	1	1	1	
Rough compilation, scale 1/M.	4	1	...	5	
Rough compilation, scale 1/2M.	1	...	...	1	
Stamp-shading, various scales.	1	2	3	...	
Sir H. H. Hayden's Tibet map.	1	...	1	...	
Maps of Tibet, scale 1 inch = 8 miles, fair sheets, outline.	...	3	...	3	
Rough compilation, outline sheets.	...	5	3(c)	2	(c) Being fair-mapped.
Rough compilation, contour sheets.	...	5	...	5	
Sir Aurel Stein's explorations in Chinese Turkistan and Kansu in 1900-01, 1906-08 and 1913-15, for publication on 2/M scale.	1	...	1(d)	...	(d) In final proof stage.

57. Forest Map Office.—As the result of the Indian Re-

PERSONNEL.

Class I Officer.

Major W. E. Perry, M.C., R.E., in charge
to 16th July 1924.

Class II Officers.

Mr. H. P. D. Morton, in charge from 17th
July 1924.

" Asmat-ullah Khan, K.B.
" A. B. Hunter.
" T. F. Kitchen.
" N. N. Chuckerbutty, L.C.E.
" Nank Chand Pari, B.A., B.S.

Upper Subordinate Service.

1 Officer.

trenchment Committee's recommendations, the Government of India decided that from the 1st of April 1924, the whole cost of this office should be debited in the Survey of India budget and, with the object of placing the office on a self-supporting basis, that its full cost (less receipts) should be distributed between Provincial

Governments employing it, and the Central Government, in proportion to the reserved forest areas under them.

The strength of the office and its organization remained practically the same as last year.

The work carried out by the various sections was as follows:—

(1) *The Drawing Section.*—The progress of this section is shown in the table below:—

Class of map.	In hand on 1st October 1923.	Received during the year.	Drawn and sent for publication during the year.	In hand on 30th September 1924.	Published during the year.	Total number of copies printed.
(a) ...	20	89	59	0	70	19,815
(b) ...	*34	25	50	†6	51	
(c) ...	*0	2	2	0	8	
(d) ...	*1	6	7	0	9	
(e) ...	2	8	5	0	6	
(f) ...	25	18	2	§86	8	
(g) ...	*0	80	†26	4	17	
Total 1923-24.	82	118	†151	46	159	
Total 1922-23.	...	160	†164	...	218	21,688

* Figures as amended.

† 11 of these are hand-corrected prints and are not for publication.

‡ Publication of 3 maps was cancelled during the year.

§ 2 of these are to be hand-corrected and are not for publication.

¶ Includes two-inch and four-inch forest maps drawn by Survey parties.

(a) Reprints of forest maps on various scales.

(b) Forest editions on the two-inch scale of modern one-inch maps.

(c) Maps of Forest Circles and Divisions.

(d) Maps to illustrate working plans, etc.

(e) Maps and diagrams to accompany Administration Reports.

(f) Forest maps from special surveys, mostly on the four-inch scale.

(g) Index and miscellaneous maps.

(2) *The Portfolio Section.*—Office copies of 496 maps and colour specimens of 30 maps were prepared; corrections to 216 sheets were completed, 83 office copies were coloured up and 959 sheets were hand-coloured for issue on indent. In addition this section corrected the forest information on 60 maps for the various Survey of India drawing offices requiring them for compiling the half-inch and degree sheets, and corrected 425 forest maps for No. 8 Party for survey in season 1924-25.

(3) *The Map Record Section.*—The number of maps, diagrams and original fair sheets received for storage was 9,901; 4,855 maps, &c., valued at Rs. 12,721 were issued gratis. Sales by book-transfer to Government departments amounted to Rs. 5,931 for 1,708 maps; these figures show an increase of 681 maps and Rs. 2,794 over those for last year. Cash sales to the public amounted to Rs. 1,443 for 653 maps, a decrease of Rs. 592 from the amount realized the previous year.

(4) *The Book-Binding Section.*—This section as a special case dealt with 9 volumes for the Forest Research Institute, the value realized by cash being Rs. 26; 2,151 maps of various sizes were mounted on cloth for issue.

Miscellaneous.—At the special request of the Conservator of Forests, Northern Circle, Central Provinces, and of the Divisional Forest Officers of the South Raipur and Hoshangābād Forest Divisions, the area statements of the reserved forest areas in 94 four-inch sheets were revised.

The list of forest triangulation and traverse data was completed and sent to press. The revised catalogue of maps published by the Forest Map Office is still in press, and copies are expected to be ready shortly for issue.

58. *Photo.-Zinco. Office.*—During the year 1923-24 the work undertaken comprised:—

Cantonment plans.

Index and Triangulation charts.

Forest maps.

Miscellaneous maps.

Extra-departmental maps.

It deals also with the despatch of sheets printed in the section and with all the correspondence on the subject. The Sutlej Valley charts reproduced by the vandyke process kept the section fully occupied.

Years.	No. of Subjects.	No. of Negatives.	No. of Pulls.	No. of Chocolate and Bromide prints.
1921-22	1,480	2,028	805,415	Nil.
1922-28	1,719	1,580	818,229	1,198
1923-24	1,270	1,680	374,954	55

59. Type Printing Section.—The following were printed during the year:—

1. Records of the Survey of India, Volume XVIII, 1921-22.
2. Tide-tables for Indian Ports, 1925.
3. 45 Triangulation pamphlets.
4. Levelling pamphlet 79 and new data for pamphlets 43, 53, 54, 55 and 73.
5. Hand-book of Topography, Chapters II and III (both revised).
6. Auxiliary Tables, Parts II and III (both revised and extended).
7. Type Book of the Geodetic Branch, Survey of India.

The following are in hand:—

- (1) Records of the Survey of India dealing with the Magnetic Survey of India.
- (2) Tidal Chapter of the Trigonometrical Hand-book.
- (3) Levelling pamphlet 44 (revised and extended).
- (4) Narrative Report of the Bhutan and South Tibet Survey Detachment by Captain H. R. C. Meade, I.A.
- (5) Forest Map Office Record Book.

III.—CIRCLE AND LOCAL DRAWING OFFICES.

60. No. 3 Drawing Office (Northern Circle).—During the

PERSONNEL.

Class I Officer.

Mr. J. A. Freeman, in charge to 1st January 1924, and again from 2nd September 1924.

Class II Officers.

Mr. P. A. T. Kenny, O.B.E., in charge from 2nd May to 1st September 1924.

Mr. E. B. West, in charge from 2nd January to 1st May 1924.

Mr. A. A. Graham.

Upper Subordinate Service.

1 Officer.

Lower Subordinate Service.

54 Draftsmen, etc.

year 2 two-inch sheets, 56 one-inch sheets out of 60 and 15 half-inch sheets out of 20 previously surveyed, were fair-mapped by parties and have been submitted for publication.

Half-inch sheets compiled from one-inch sheets.—11 half-inch sheets were fair-drawn in the Circle Drawing Office, and have been submitted for publication during the year.

Modern material available.—The fair-mapping of 16 half-inch sheets, of which the component two-inch and one-inch sheets have been published or sent for publication, is in hand. In addition to the above there are 16 half-inch sheet areas, of which the component two-inch or one-inch sheets though surveyed, have not been published. The material for these areas will shortly be available for fair-mapping.

Quarter-inch sheets compiled from modern one-inch and half-inch sheets.—During the year 7 quarter-inch sheets were fair-mapped and submitted for publication.

Modern material available.—The fair-mapping of 4 quarter-inch sheets, of which the component one-inch or half-inch sheets have been published, is in hand. There are, besides the above, 11 quarter-inch sheet areas, of which the component one-inch and half-inch sheets, though surveyed, have not been published.

Special maps.—During the year, the Lucknow and Environs map in four sheets, the Mussoorie-Simla road map on four-inch and six-inch scales respectively, and the Bhatta village (Mussoorie) project survey, scale one hundred feet to the inch, were fair-drawn and submitted for publication.

The colour patterns of the Lucknow and Environs map and of the Mussoorie-Simla road map were prepared and sent for publication.

Hill-shaded sheets.—29 one-inch, half-inch and quarter-inch sheets were stump-shaded and submitted for publication.

Layer guides.—Nil.

Colour patterns and press order proofs.—During the year 107 colour patterns of two-inch, one-inch, half-inch and quarter-inch sheets were prepared and submitted for publication.

Miscellaneous.—The traverse plots of "mauzas" in 4 sheets of Basti and Gondā districts, on the sixteen-inch scale, were supplied and the cost of preparation recovered from the Deputy Commissioners of the respective districts.

For the purpose of reprint the office copies of 62 sheets were corrected and submitted for publication.

During the year 78 published sheets on various scales were sold to the public at a cost of Rs. 128.

Record Section.—During the year the compilation of topographical triangulation data falling in 11 degree sheets was completed, that of 5 other sheets is in hand.

Topographical triangulation and traverse data were extracted and supplied to various other departments.

61. No. 4 Drawing Office (Southern Circle).—During the

PERSONNEL.
Class I Officer.
 Mr. J. O'B. Donaghey, in charge.
Class II Officer.
 Mr. E. Claudius.
Upper Subordinate Service.
 3 Officers.
Lower Subordinate Service.
 44 Draftsmen, etc.

year 37 one-inch and 9 half-inch sheets previously surveyed and mapped and 9 one-inch sheets and one half-inch sheet surveyed and mapped during the year under report which were received from parties before the 30th September 1924 were finally examined

and submitted for publication; out of these 6 one-inch sheets, which were received in an incomplete state from the party concerned, were completed before being submitted for publication. There are no arrears.

Half-inch sheets compiled from modern one-inch sheets.—13 sheets were mapped and submitted for publication. Including 4 being mapped by parties there are 13 sheets in hand of which one will shortly be submitted for publication.

Modern material available.—The material for 2 half-inch sheets has been received but the mapping has not yet been commenced. The material for one half-inch sheet of which the component one-inch sheets have been published has been called for. In addition there are 7 half-inch sheet areas of which the component one-inch sheets have been submitted for publication but are not yet published, and 16 half-inch sheet areas completely surveyed on the one-inch scale but of which all the component one-inch sheets have not yet been submitted for publication.

Quarter-inch sheets compiled from modern one-inch and half-inch and old style sheets.—8 sheets were mapped and submitted for publication. There are 3 sheets in hand.

Modern material available.—There are 6 quarter-inch sheet areas of which the component half-inch sheets have been submitted for publication, 3 quarter-inch sheet areas of which the component half-inch sheets have been mapped or are in hand but have not all been submitted for publication and 10 quarter-inch sheet areas completely surveyed but of which the mapping of all the component half-inch sheets has not yet been commenced.

Reprint sheets.—There are no reprint sheets in hand. Office copy corrections were entered on No. 1 Drawing Office's office copies of 4 sheets which are being reprinted.

Colour patterns.—These were prepared for 96 sheets and submitted for publication. There are no arrears, the colour patterns of one sheet of which proofs were lately received are in hand.

Hill-shaded sheets.—These were prepared for 81 sheets and submitted for publication. Prints for 8 sheets are in office, 4 of these are in arrears and 4 sheets are in hand.

Layer guides.—Nil.

Photo.-Zinco. work.—

Number of reproductions	...	...	...	285
" " enlargements	...	...	...	195
" " reductions	...	...	...	446
" " vandyked plates prepared	...	...	...	224
" " prints pulled	...	...	...	7,864

Work for private individuals on cash payment was done to the value of Rs. 170.

Special maps.—6 two-inch sheets of the special forest survey of Hyderābād (Deccan) surveyed and mapped by No. 6 Party were received before the 30th September 1924 for final examination, these will be finally examined and submitted for publication on receipt of plane-table sections which are at present in use in the party for half-inch mapping. 8 two-inch sheets of the special forest survey of Hyderābād, which were finally examined and submitted for publication last year were received back from the Publication Office together with proofs, the press order proofs of 6 of these sheets have been examined and submitted for publication together with the fair sheets

on which necessary corrections were carried out, the proofs and fair sheets of the remaining 2 sheets have been examined and corrected and will shortly be submitted for publication. 3 one-inch special forest sheets of Indore and Dhār States previously surveyed and mapped were received from No. 5 Party, these three sheets were finally examined and submitted for publication.

Proofs together with the fair sheets of 11 one-inch special forest sheets were received from the Publication Office, all these proofs were examined and submitted for publication after the necessary corrections had been carried out on the fair sheets. The publication of 3 one-inch special forest sheets is being undertaken by this office, the printing of these is now in hand. The colour patterns of 14 one-inch and 8 two-inch special forest sheets have been prepared, the coloured copies of these and of all future similar sheets will be prepared by hand in this office on receipt of uncoloured published prints from the Publication Office.

The three-inch road map of Bangalore mentioned as being in hand in last year's report has been cancelled in favour of a three-inch town map; the preparation of the necessary reductions, the inking up of blue prints of existing large scale surveys and other miscellaneous work for this map have been carried out by this office. The field work in connection with it will be undertaken shortly by No. 7 Party.

Triangulation charts and computations.—Six triangulation pamphlets with charts and topographical data complete were prepared in draft form and are ready for fair copying and despatch to the Director, Geodetic Branch, when called for by him. The preparation of two triangulation pamphlets in draft form is in hand. Material was extracted and supplied to (a) the parties of the Southern Circle (b) the Director, Northern Circle (c) the Director, Madras Survey (d) the Bhopāl Government (e) the military authorities for various Artillery Practice Camps (f) the General Staff, Poona (g) the Senior Officers' School at Belgaum. The revision of the register of triangulation and traverse records is still in hand.

Miscellaneous.—The sorting and arranging of records and copies of published sheets has been completed.

Published copies of sheets were sold to the public to the value of Rs. 865.

62. No. 5 Drawing Office (Eastern Circle).—The following sheets were received from field parties during the year:—

PERSONNEL.			
<i>Class I Officer.</i>			
Mr. W. M. Gorman, in charge.		Four-inch sheets	... 1
<i>Class II Officer.</i>		One-inch "	... 22
Mr. B. M. Berrill.		Half-inch "	... 6
<i>Upper Subordinate Service.</i>		Quarter-inch "	... 4
3 Officers.			
<i>Lower Subordinate Service.</i>			
27 Draftsmen, etc.		Total	... <u>33</u>

All the above sheets were submitted for publication except one one-inch and one four-inch sheet.

The 4 quarter-inch sheets were drawn and completed to edge from old surveys.

Half-inch sheets compiled from modern one-inch and old style sheets.—During the year, 18 sheets were in hand, including 10 from last year; of these 11 were submitted for publication, leaving 7 in hand.

Modern material available for half-inch mapping.—All sheets of which the component 1-inch sheets are either published or under publication have been put in hand.

Quarter-inch sheets compiled from modern one-inch, half-inch and old style sheets.—Five sheets were in hand, including one from last year, of which 2 were submitted for publication leaving 3 in hand, 2 of which are held up pending new survey to be undertaken in 1924-25.

Modern material available for quarter-inch mapping.—All material, of which the half-inch component sheets are published or under publication, has been put in hand.

Layer guides.—One was received and submitted.

Colour patterns and press order proofs.—Those of 51 sheets including 5 recalled from last year were received and 46 dealt with, leaving 5 in hand unavoidably delayed due to changes by local officials in boundaries and names.

Triangulation charts and traverse data.—The circle office triangulation records were registered and indexed on the card system and traverse record volumes for sheets 78 P, 83 B, C, D, F and J were prepared. The tabulating in synoptical form of all modern minor triangulation and the preparation of pamphlets for the area in the vicinity of the frontier as also of the traverse record volumes of Aijal, Dum-Dum, Barrackpore and Ichāpur (Ishapore) and the registering and indexing of other traverse volumes still remain to be done.

63. No. 7 Drawing Office (Burma Circle).—This office was**PERSONNEL.***Class II Officer.*

Mr. W. G. Jarbo, in charge.

Upper Subordinate Service.

1 Officer.

Lower Subordinate Service.

18 Draftsmen, etc.

formed on the 2nd October 1923 from the existing Maymyo Drawing Office. During the year 8 two-inch, 12 one-inch and 2 half-inch sheets, surveyed in 1922-23 were received

from field parties, and were finally examined. With the exception of 3 one-inch sheets, all were submitted for publication during the year. Of sheets surveyed in 1922-23, there still remain 3 two-inch forest sheets, retained with the party for entry of new boundaries. None of the sheets surveyed in 1923-24 were submitted by the 30th September 1924.

Half-inch sheets compiled from modern one-inch sheets.—8 half-inch sheets were drawn and completed in No. 7 Drawing Office during the year. 3 others are in hand.

Modern material available for half-inch mapping.—There are 2 modern half-inch sheets, of which the component one-inch sheets have been published and 2 others of which the one-inch sheets have been submitted for publication, the drawing of which has not yet been put in hand.

Quarter-inch sheets compiled from modern half-inch sheets.—One of these sheets is in hand.

Modern material available for quarter-inch mapping.—There are 8 quarter-inch sheets of which the component half-inch sheets have been published or sent for publication.

Colour patterns and press order proofs.—These have been received for 9 one-inch and 7 half-inch sheets, and were all completed and submitted. In addition to these the colour patterns of 17 special 2-inch forest sheets were prepared and submitted.

Preparation of Forest Index showing Gazetted Reserves.—This index, on the one-millionth scale, which was begun last year, was completed during the year.

64. No. 6 Drawing Office (Simla).—The *Survey Section* has**PERSONNEL.***Class I Officer.*

Major L. G. Crosthwait, I.A., in charge.

Class II Officers.

Mr. F. H. Grant.

,, H. H. P. Butterfield.

Army Section.

4 European Draftsmen.

3 Printers.

Survey Section.

2 Clerks.

18 Draftsmen.

been employed on the compilation and fair-drawing of trans-frontier maps on the one-millionth, half-inch and quarter-inch scales, and incorporating additional survey and information on sheets previously published.

During the year 5 1/M sheets, 24 quarter-inch and 3 half-inch sheets were compiled, fair-drawn and submitted for publication; 5 quarter-inch and 4 half-inch sheets were sent for publication of new editions after new material and information had been added.

Press order proofs of 38 sheets were examined and colour patterns prepared.

The *Army Section* is employed on the preparation and printing of maps and plans for the Army and other Government Departments.

During the year 353 maps and plans were dealt with and 61,696 copies printed on the litho-printing presses.

PART 4.—WORK FOR LOCAL GOVERNMENTS AND OTHER GOVERNMENT DEPARTMENTS.

65. Northern Circle. No. 22 (Riverain) Party.—The party

PERSONNEL.

Class I Officers.

Mr. Dhani Ram Verma, B.S., in charge.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

36 Traversers, etc., (excluding 25 purely temporary men).

continued the work of traversing and laying down base lines. 269 linear and 641 square miles of main-circuits along the Indus river in Miānwāli and Dera Ismail Khān districts and 2,727 linear miles and 569 square miles of minor traverse

in the Chenāb riverain tract in Jhang district were executed, 412 theodolite stations of the former and 13,243 of the latter in 190 villages were fixed. 468 corners of 156 squares in 502 square miles were demarcated with permanent mark-stones on both banks of the Chenāb river in Jhang district, to serve as bases for future survey and demarcation of boundaries and fields in the bed of the river. 1,815 plotted and 369 boundary *masāvis* (settlement mapping sheets) on the scale of 1/2,640 and 29 four-inch sheets were traced and supplied to the Settlement Officer, Jhang. Besides these 311 boundary *masāvis* were partly compiled on the scale of one inch = 220 feet for the next field season's work, and 165 miscellaneous traces were prepared. All the traverse stations marked during the field season were plotted on 29 four-inch sheets.

66. No. 23 (Punjab Rectangulation) Party.—During the

PERSONNEL.

Class I Officers.

Major E. Foster, I.A., in charge to 5th May 1924.

Major J. D. Campbell, D.S.O., R.E., in charge from 6th May to 30th June 1924.

Mr. E. C. J. Bond, V.D., in charge from 1st July 1924.

Class II Officers.

Mr. Maya Das Puri, B.S.

„ A. M. Talati, L.C.E.

„ F. W. Smith,

„ C. O. Picard.

„ Abdul Karim, B.A.

„ G. A. Norman.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

21 Traversers, etc., (excluding 138 purely temporary traversers).

year the party was employed on rectangulation in connection with the Punjab Government's Suttlej Valley project in the Multān, Montgomery, Lahore and Ferozepore districts and in Bahāwalpur State.

A total area of 5,540 square miles was rectangulated and 35,000 corner stones of 100-acre rectangles were embedded. In an area of 3,585 square miles 3,233 linear miles were traversed in advance for the purpose of laying

down the corners of 2,400-acre rectangles.

The country under rectangulation comprises three separate areas:—

(1) The area included in the Lahore, Montgomery and Ferozepore districts, bounded on the north by the old bed of the Beās river from the north of Pākattan to Kasūr; on the east from Kasūr to Ferozepore; on the south from Ferozepore to the junction of the Ferozepore-Bahāwalpur and Bikaner boundaries and thence along the Bahāwalpur State boundary to the south of Pākattan. In this area the country is well cultivated, is irrigated by canals and interspersed with patches of thick forest.

(2) The area in the Bahāwalpur State included between the Indus and Panjnad rivers and the railway line from its junction with the Sukkur district boundary to Chaudri railway station; and the area in the Cholistān between the railway line and the old bed of the Hakra river from a point 25 miles east of Khānpur to a point on the Bahāwalpur State boundary south-east of Takht Mahal railway station. The country included in this area is mostly a sandy desert in which water is scarce.

(3) A narrow strip of land in the Multān district north and south of Jalālpur Pirwāla and between the Sutlej river and the old bed of the Beās river. This strip of land is well cultivated and interspersed with patches of jungle.

In recess the party was employed on the compilation of "*masāvis*" of the area rectangulated, traverse computations and the preparation of material for the ensuing field season.

67. The Settlement Survey Detachment.—With a view to

PERSONNEL.
Class II Officers.
 Mr. Maya Das Puri, R.S., in charge.
 „ Abdal Karim, B.A.
 „ Narendra Nath Chuckerbutty, L.C.E.

Upper Subordinate Service.
 2 Officers.

Lower Subordinate Service.
 19 Surveyors, Traversers, etc.
 (excluding 45 purely temporary men).

assisting the Settlement Officers, Peshāwar and Attock, the Settlement Survey Detachment was formed experimentally on the 1st February 1924, as a part of No. 3 Party (N. C.); and was made an independent unit with effect from the 1st June 1924.

The old settlement maps were examined and their defects pointed out to both the Settlement Officers. The whole of the Mardān and Chārsadda *tahsils* in the Peshāwar district and some hilly portions of the Attock *tahsil* were taken up in the middle of the field season under difficult circumstances, due to the inexperience of the traversers and the difficulty of preventing camps being robbed.

At the special request of the Settlement Officer, Peshāwar, field operations were continued during the hot weather so that all the plots of both the *tahsils* could be supplied by early next winter to enable him to finish the detail survey during the season 1924-25 for assessment purposes.

The maps of 454 villages were reduced by pentagraph to the one-inch scale and compiled on 23 one-inch topographical sheets.

In all 4,197 linear miles of main and minor traverses in 854 square miles (356 in Chārsadda and 498 in Mardān) of 270 villages of the Peshāwar district; and 398 linear miles in 74 square miles of 13 villages of the Attock *tahsil* were traversed; and 17,256 stations in the former and 1,837 stations in the latter were laid out on the ground. Only 467 square miles of the Peshāwar district were computed and plotted; and 1,350 plotted *masāvis* (settlement mapping sheets) on the scale 24 inches to a mile and 128 four-inch village indexes were supplied to the Settlement Officer, Peshāwar. In the Attock *tahsil* the whole area, *viz.*, 74 square miles, was completed; and 320 plotted *masāvis* of 13 villages on the scale 32 inches to one mile, and 13 four-inch indexes were supplied to the Settlement Officer, Attock. Besides these 650 miscellaneous traces were prepared and all the work done during the year was plotted on 42 four-inch sheets.

The ground in the Peshāwar district was flat, highly fertile, and well irrigated; while in Attock the area was scattered, broken, and poorly cultivated.

68. Southern Circle. No. 5 Party.—At the request of the Commandant, Royal Artillery, Southern Command, a surveyor fixed additional points in the Sailānā Artillery Practice Camp for artillery ranging purposes.

69. Eastern Circle.—In addition to his duties in the Imperial Department, the Director, as Director of Surveys, Assam, held administrative charge of the Assam Survey Department, including the Assam Traverse Party, the Drawing and Reproducing Offices at Shillong and the Assam Survey School at Jhālukbari; also in his capacity as technical adviser on survey matters to the Government of Bengal he visited the Bengal Traverse Party in the field.

70. No. 12 Party.—During the year, at the request of the Assam Government, surveyor Singhbir Thāpa accompanied

Mr. J. H. Hutton, C.I.E., I.C.S., Deputy Commissioner of the Nāga Hills district, in a tour in the unadministered Nāga tribal area almost as far as the main range forming the Assam-Burma boundary and carried out a reconnaissance survey on the half-inch scale of an area of 1,351 square miles, which has been included in the party's mapping programme for the year.

71. Geodetic Branch.—At the request of the Chief Engineer, P. W. D. (Irrigation), Burma, 593 miles of levelling of precision were executed.

For the Punjab Government, 659 miles of secondary and 31,865 miles of tertiary levelling in connection with the Sutlej Valley Irrigation project covering about 4,800 square miles were completed. The preparation and printing of contoured charts for the same project is in progress.

At the request of the Burma Oil Company, Messrs. K. K. Das, B.A., and Jugal Behari Lal were deputed for a period of 4½ months to assist Dr. Pekar, Geophysicist of Budapest, in a gravity survey with the Eötvös torsion balance in Khairpur State and Sukkur District (Sind).

In recent years the data obtained by this instrument have been found useful in the elucidation of geological structures concealed beneath alluvium.

72. Head Quarter Offices.—The total out-turn of all extra-departmental publications during the year for the Army, for Local Governments and for other government offices is given in Table A of the Photo.-Litho. Office report on page 45, in the "Issues" table and in Table III of the Map Record and Issue Office report on pages 37 and 38.

In addition to the special maps for other departments which are mentioned in para. 49(g) on page 36, these extra-departmental publications include maps to illustrate the various reports of government officials, maps for railway guides, and for posting in railway carriages, &c. The usual large numbers of weather charts for the Meteorological Department and of the photogravure and half-tone illustrations for the Archæological and other departments were also printed.

The work entailed by the preparation of originals for some of these special maps, in addition to their publication, is mentioned in the reports of No. 1 Drawing Office and of the Engraving Office on pages 39 to 44.

73. Mathematical Instrument Office.—Repairs to range-finders, binoculars, telescopes, sight dials, &c., manufactures of articles and calibration of gun-clinometers were carried out for the Army; also a large number of microscopes were repaired for the Medical department in addition to the general repair and manufacture work for other civil departments.

74. No. 6 Drawing Office (Simla).—In addition to its normal work for the Army, this office has prepared maps and plans for the Foreign and Political, Home, Legislative and Meteorological Departments, Census Commissioner of India, Government Press, Public Health Commissioner and Punjab Hydro-Electric Survey.

APPENDIX.

COLONEL C. H. D. RYDER, C.B. C.I.E., D.S.O., R.E.

The Department has lost one of its most distinguished officers by the retirement, on the 28th of September, of the late Surveyor General, Colonel C. H. D. Ryder, C.B., C.I.E., D.S.O. R.E.

He joined the Department as a Lieutenant on November the 20th, 1891, with nearly 5½ years' service, of which over 3 years had been spent in India. During his career in the Survey of India, he did topographical work in various parts of India and Burma, and the following summary will show his exceptional record as an explorer in nearly all the countries of Southern Asia:—

1894-95. One of the Survey officers attached to the Mekong Boundary Commission.

1898—1900. Explorations in Yunnan—Twice across China from Burma, the first time ending up *via* Tonking, and the second year working down the Yangtze river during the Boxer rebellion, and finally joining up with the China Field Force, where he was present at the actions of Pei-tsang and Yangtsun and at the relief of the Peking Legations. For his reconnaissance work he received the thanks of H. E. the Commander-in-Chief, and for war service the medal with clasp and a mention in despatches.

1903—05. Accompanied the Tibet Expedition to Lhāsa—Medal with clasp, D.S.O., and mentioned in despatches—From Lhāsa worked along the Brahmaputra and Sotlej valleys, behind the Himalayas, to Simla—Awarded gold medals by the Royal Geographical Society and the Geographical Society of France, and a silver medal by the Scottish Geographical Society.

1913-14. Senior Survey Officer with the Turko-Persian Boundary Commission, and later Deputy Commissioner as well, being in charge of the operations on the outbreak of the War, when the Commission was broken up and he proceeded to England *via* Russia—Awarded the C.I.E.

Apart from this remarkable record, Col. Ryder will be held in lasting memory by the Department on account of his valuable services as an administrator. In 1906 he was selected to hold the newly formed post of Superintendent, Frontier Surveys, which was, next to that of Surveyor

General, the most important post in the Department. His tact and ability in administering the six Frontier Parties, and afterwards the Northern Circle, were an important factor in building up the improved traditions of work which the Department has been able to evolve since it was granted the improved organisation of 1906. Later on, 1915 to 1918, he held the post of Superintendent, Map Publication, in Calcutta during the most difficult period of the War. The success with which the Calcutta Offices responded to the heavy strain which was put upon them owing to War demands by the Army and many other Departments, was largely due to his excellent administration for which his services were brought to the notice of the Government of India. He was then posted as Director of Survey Operations in Iraq, where he effected notable improvements in organisation and procedure (1918-19), and was mentioned in despatches.

Col. Ryder finally succeeded to the post of Surveyor General on the 16th of March 1919, where his patience, ability, and solid good judgment were invaluable in facing post-war problems and in getting the Department properly re-established on a peace footing. This difficult work was embarrassed, firstly by the necessity of re-adjusting the pay, etc., of all services owing to the rise in prices, and latterly by problems of retrenchment and finance; but in spite of all difficulties, the re-establishment of the Department has been carried through with admirable success, and it has been handed over in a condition which should provide an excellent foundation for all future developments.

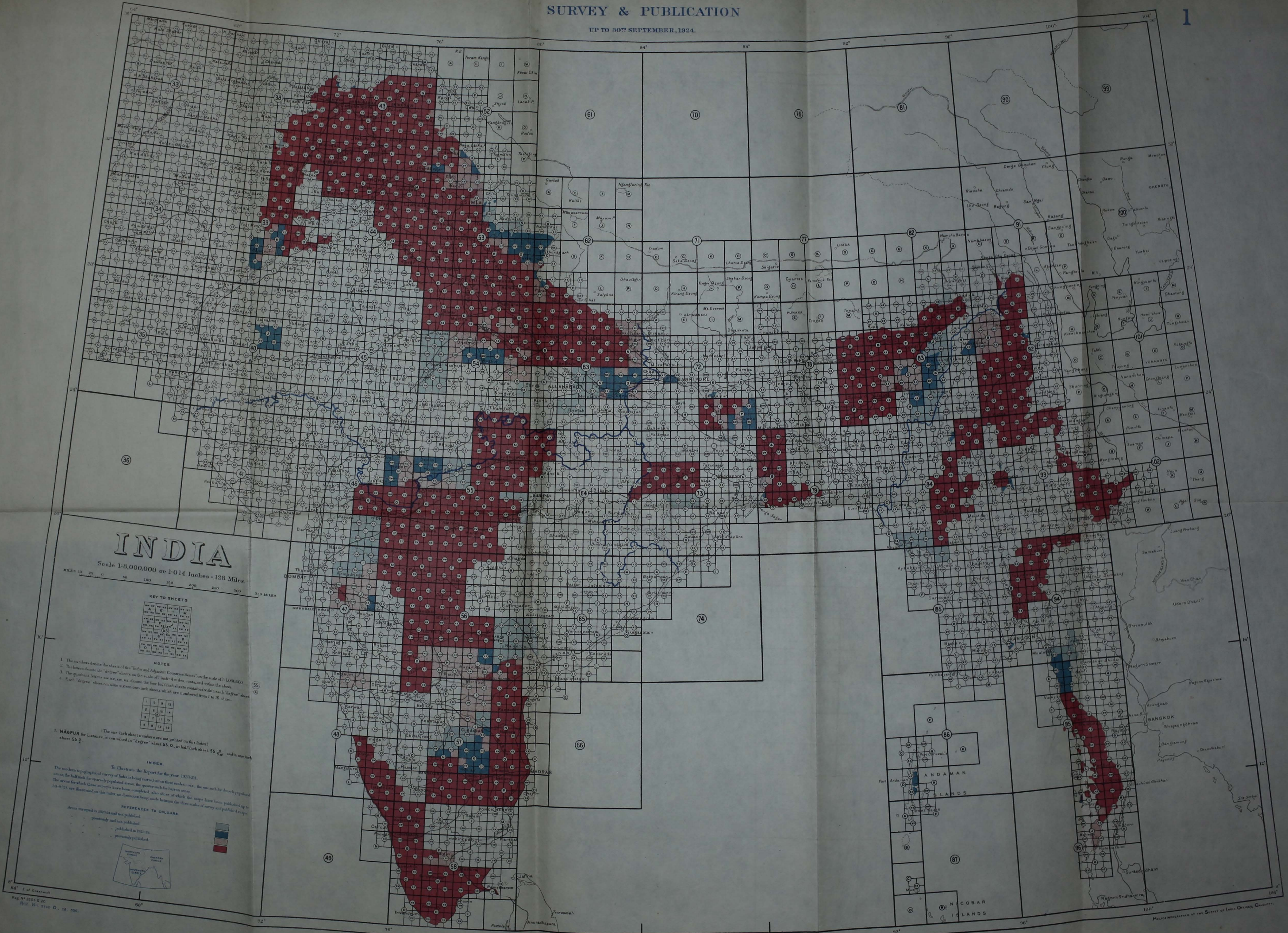
In addition to this patient work of re-construction, which was combined with the perfecting of a great variety of details of procedure and technique, a very notable improvement has been effected in departmental organization by the detachment of Burma from the Eastern Circle to form a separate Survey Circle, in April 1923. This new Burma Circle has already justified its existence in many ways, and should lead to valuable developments which would have been otherwise quite impossible.

On the human side of administration, Col. Ryder set a most valuable example in dealing with difficult personal problems, and always commanded the complete confidence of those who had the pleasure of working with him. He was awarded the C. B. (Military) in 1922, and his services as Surveyor General were extended for a period of 9 months after attaining the age of 55.

SURVEY & PUBLICATION

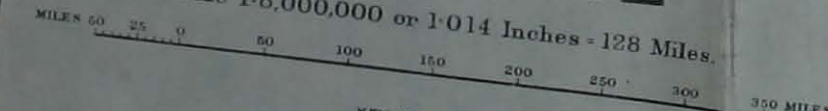
UP TO 30th SEPTEMBER, 1924.

1



INDIA

Scale 1:8,000,000 or 1:014 Inches = 128 Miles.



KEY TO SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112

NOTES

- The numbers denote the sheets of the "India and Adjacent Countries Series" on the scale of 1:1,000,000.
- The letters denote the "degree" sheets on the scale of 1 inch = 4 miles, contained within the above.
- The quadrant letters N, S, E, W, denote the four half-inch sheets contained within each "degree" sheet.
- Each "degree" sheet contains sixteen one-inch sheets which are numbered from 1 to 16.

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

- NAGPUR for instance, is contained in "degree" sheet 55, 0, in half-inch sheet 55, 0, and in one-inch sheet 55, 2.

INDEX

To illustrate the Report for the year 1923-24. The modern topographical survey of India is being carried out on three scales, viz. one inch for details, one inch for general purposes, and one inch for large areas. The areas for which these surveys have been completed, also those of which the maps have been published up to 30-9-24, are illustrated on this index, no distinction being made between the three scales of survey and published maps.

REFERENCES TO COLOURS



64° E. Greenwich
 Map No. 2054 Q 20
 Rev. N. 3140 D. 19. 850.

PUBLICATION OF THE ONE-INCH SERIES


UP TO 30th SEPTEMBER, 1924.

INDIA

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MILES 0 50 100 150 200 250 300 350

KEY TO SHEETS

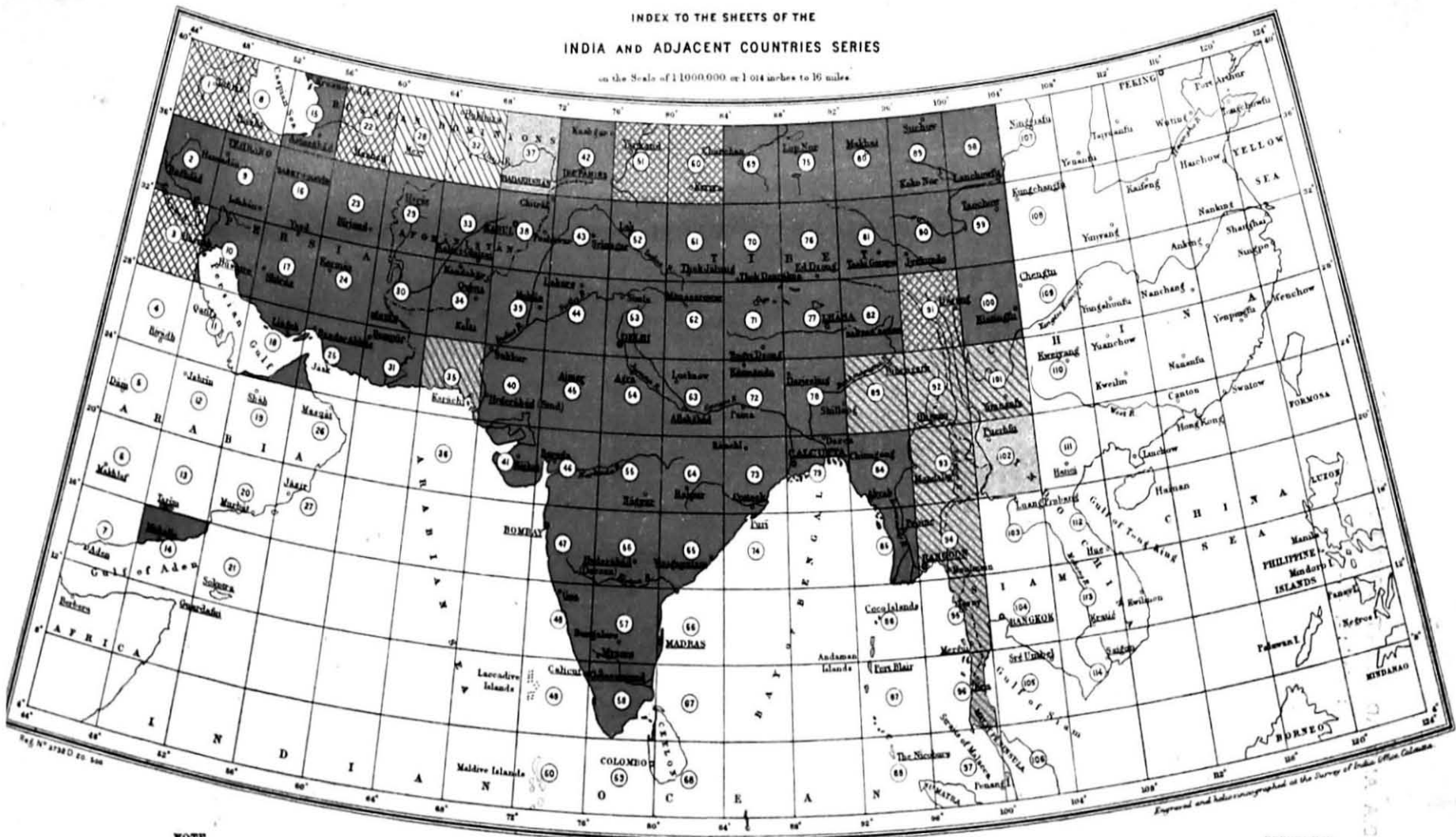
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ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ

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- INDEX
- To illustrate the Report for the year 1923-24
- All modern one-inch maps (including preliminary editions) that have been prepared from modern reconnaissance parties (these upon special orders) which have been published up to 30-9-24 are illustrated on this index.
- REFERENCES TO COLOURS
- Areas published on the 1" scale in 1923-24 (Preliminary Editions)
- previously 1" scale
 - in 1923-24 from modern surveys
 - previously
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84° E. of Greenwich
No. 2224 D 90
Rev. No. 2141 D, 1A, 200.

INDEX TO THE SHEETS OF THE
INDIA AND ADJACENT COUNTRIES SERIES

on the Scale of 1 1000 000 or 1 014 inches to 16 miles.



NOTE.

The names underlined on this Index are the title names of the sheets, and their numbers are shown in circles. Sheets 55 and 56, 57 and 60, are published respectively as combined sheets.

Scale 1:1000000

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REFERENCE

To illustrate the Report for the year 1923-24.

Sheets published without contours & layers

with contours & layers

under publication

to hand

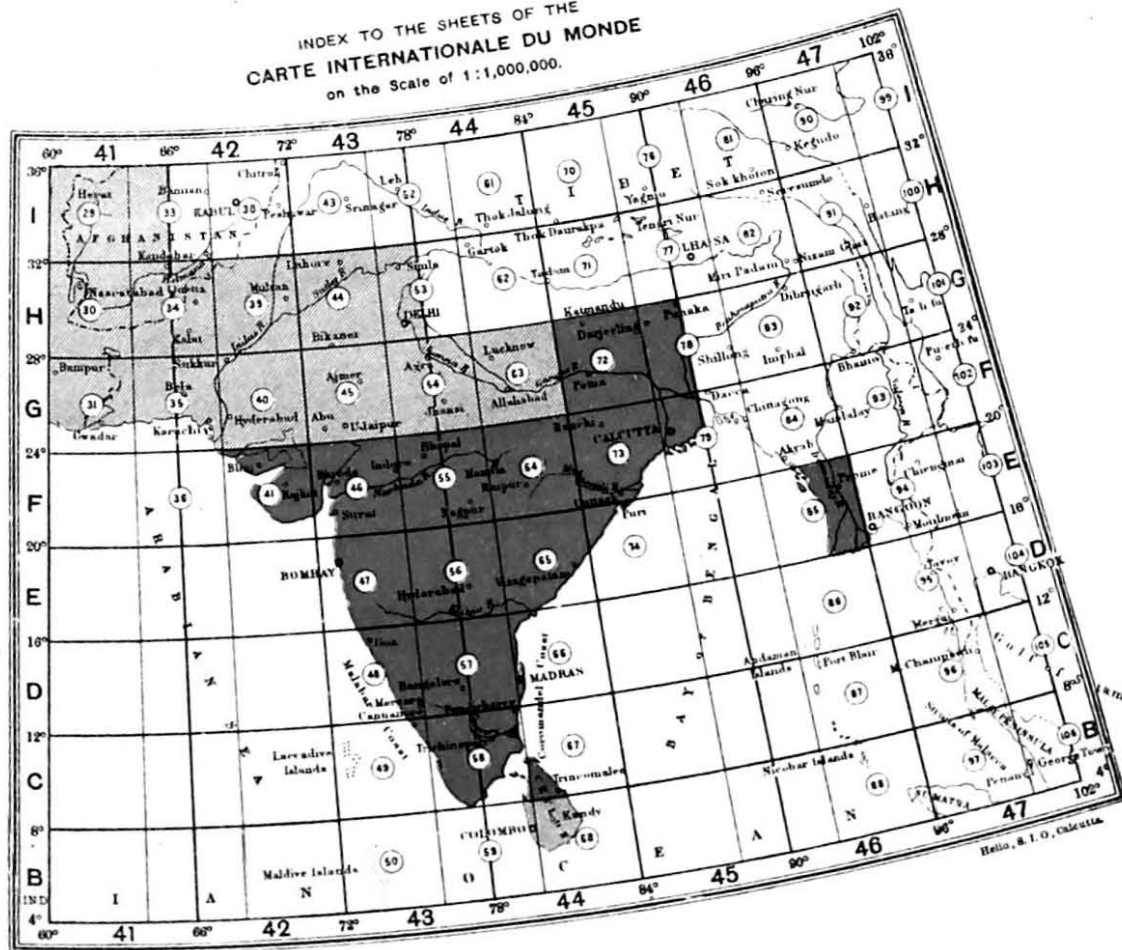


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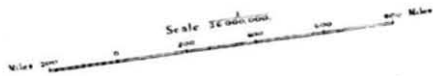
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Sheets published
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 " in hand
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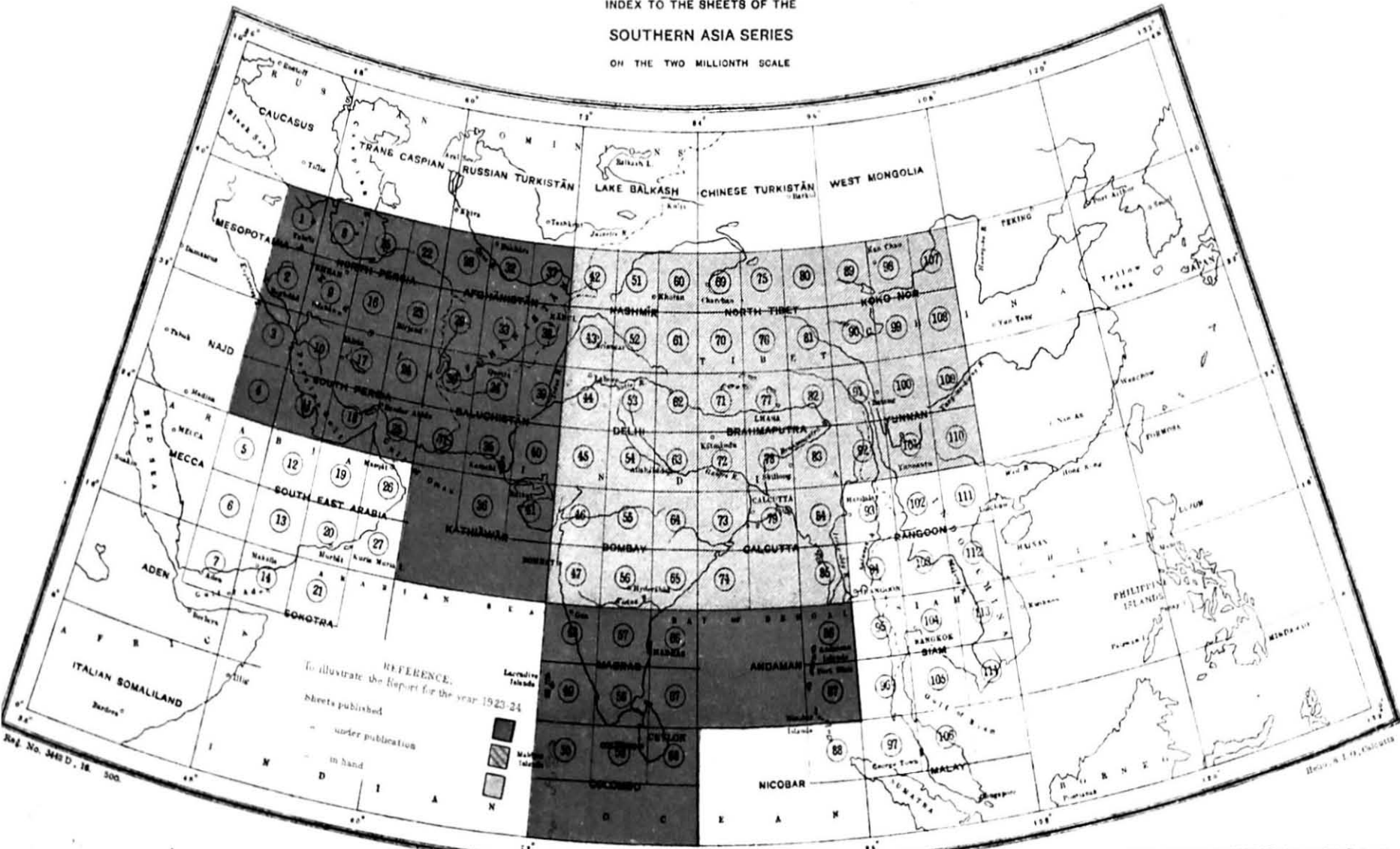


6

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7

SOUTHERN ASIA SERIES

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Survey of India.

GENERAL REPORT

FOR 1924.

From 1st October 1923
To 30th September 1924.



PREPARED UNDER THE DIRECTION OF

Colonel E. A. TANDY, R.E.,

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