

Survey of India.

GENERAL REPORT

FOR 1922-23.

From 1st October 1922

To 30th September 1923.



PREPARED UNDER THE DIRECTION OF

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

SURVEYOR GENERAL OF INDIA.

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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	13
Eastern Circle	16
Burma Circle	18
II.—FOREST SURVEYS.—	20
Northern Circle	20
Southern Circle	21
Eastern Circle	21
Burma Circle	21
III.—CANTONMENT AND LARGE SCALE SURVEYS.—No. 20 Party	24
Cantonments	25
IV.—THE TRIGONOMETRICAL SURVEY.—	26
Astronomical Latitudes	26
Pendulum Observations	26
Triangulation	26
Tidal Operations	26
Levelling	28
Base Lines	26
Magnetic Survey	30
PART 3.—OFFICE WORK—	
I.—HEAD QUARTER OFFICES.—	31
Map Publication Office	31
Map Record and Issue Office	31
TABLE III.—Publications during the year	36
No. 1 Drawing Office	37
Engraving Office	41
Photo.-Litho. Office	42
Mathematical Instrument Office	44
II.—DEHRA DUN OFFICES.—	45
Computing Office	45
No. 2 Drawing Office	46
Forest Map Office	50
III.—CIRCLE AND LOCAL DRAWING OFFICES.—	52
PART 4.—	
WORK FOR OTHER GOVERNMENT DEPARTMENTS—	58

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,

1922—23.

From 1st October 1922

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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 61,648 square miles; and that this brings the total progress since 1905 to 688,217 square miles, leaving 1,133,383 square miles still to be done.

3. The first Index map, at the end of this 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 36 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) A record out-turn of 61,648 square miles of topographical survey was completed. There has been a steady increase since the year 1918-19 (*vide* Table I) and the previous

GENERAL.—INTRODUCTION.

record of 55,786 square miles surveyed in 1913-14 has now been surpassed, although the number of topographical parties employed has remained the same, *viz.*, 12.

- (b) The work of the Trigonometrical Survey has again been considerably curtailed owing to financial stringency, and no field work of the astronomical, pendulum and base lines parties was carried out.
- (c) The issues of maps to the public and Government officials continued to increase.
- (d) The increased usefulness of the department, apart from its normal topographical work, may be gauged by the increase in receipts from outside sources for work done. These receipts in the financial year 1913-14 amounted approximately to Rs. 9,36,000 and in 1922-23 to Rs. 24,67,000.
- (e) A new Survey Circle for Burma with a Superintendent in charge and with headquarters at Maymyo was formed on 11th April 1923. The formation of this circle has been sanctioned for a period of three years only in the first instance.
- (f) A Survey party has been formed to carry out traverse work in Bhopāl State and has been placed on "foreign service" under that State. As a consequence the Bhopāl Traverse Detachment was disbanded on 1st March 1923.
- (g) Two Survey detachments known as the Razmak and Waziristan Detachments were formed during the year for field service on the North-West Frontier. Of these the latter is still at work.
- (h) A detachment was sent to carry out surveys for the Anglo-Persian Oil Company, Muhammareh, in October 1922 and after returning to India in July has been augmented and resumed its work in September 1923.
- (i) The administrative control of the Imperial Standard Mapping Section was transferred from the Government of Bengal to the Survey of India from 1st August 1923.
- (j) The centenary of the death on 20th January 1823 of Colonel W. Lambton, F.R.S., the founder of the Great Trigonometrical Survey, was celebrated in a befitting manner in the head-quarter offices at Calcutta and Dehra Dūn.

- (k) Dr. J. deGraaff Hunter, M.A., Sc.D., F. Inst. P., attended the meeting of the International Association of Geodesy and Geophysics in Rome in May 1922 as a British Empire delegate. He was appointed to serve on two committees dealing with telegraphic longitude and with the force and deflection of gravity.
- (l) Much valuable geographical information was supplied to the department by the late Brigadier General G. Pereira, C.B., obtained during his journey from Peking through Tangar, Jyekundo and Lhāsa.
- (m) The pay of Class II officers including those promoted to Class I was again revised.
- (n) A competitive examination for the filling of 4 posts in the Class II Service was held during the year. 33 candidates were nominated by Selection Boards, held at the various Survey headquarters, to sit for the examination.

II.—ADMINISTRATION AND PERSONNEL.

6. The actual cost of the department for the financial year ending 31st March 1923 and of the two previous years is shown below:—

	1920-21.	1921-22.	1922-23.	REMARKS.
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	
Gross actual cost ...	48,70,580	62,01,542*	53,89,494†	* Includes an unusual charge of over Rs. 9,00,000 debited to the department on account of Europe stores.
Deduct receipts and credits	15,52,147	19,38,588	24,67,092†	† These figures are not final.
Net actual charges ...	33,18,388	42,62,954	29,22,402†	

7. Colonel C. H. D. Ryder, C.B., C.I.E., D.S.O., R.E., the extension of whose services had been sanctioned by His Majesty's Secretary of State for India, administered the department throughout the year.

8. Of Class I officers:—Colonel H. L. Crosthwait, C.I.E., R.E., and Messrs. J. H. Nichol and O. C. Ollenbach retired, Captains J. K. Douglas, R.E., R. S. P. MacIvor, I.A., T. W. R. Haycraft, R.E., and G. W. Gemmell, I.A., reverted to military duty.

Lieutenant H. A. Bazley, R.E., has been deputed temporarily to military duty to attend the Supplementary Course for R. E. Officers at Chatham and Cambridge.

Messrs. C. E. C. French and C. C. Byrne were promoted temporarily from the Class II Service.

Mr. A. Lacamp was appointed as Assistant Manager, Mathematical Instrument Office.

Of Class II officers:—Mr. H. G. Shaw ceased to be re-employed, Khan Bahadur Haji Abdul Rahim retired, Mr. O. J. H. Hart was drowned at Amherst, Captain W. J. B. Miller who was on military duty retired from 22nd September 1921, having been invalided by the Medical Board, India Office, Mr. T. O. Threlfall, probationer, resigned.

Mr. C. H. G. Johnson was transferred permanently under the Government of the Central Provinces.

Mr. N. N. Chuckerbutty, L.C.E., was transferred for employment in the Thomason College, Roorkee.

Messrs. J. McCracken, M.B.E., and A. F. Murphy were placed on foreign service with the Anglo-Persian Oil Company.

Messrs. B. M. Berrill and P. Simpson reverted from deputation under the Governments of Bombay and Bihār and Orissa respectively.

In the Upper Subordinate Service, Mr. Damodar Khadilkar retired, and 3 probationers resigned, Messrs. Sher Jang, K.B., and Sijawal Khan were placed on foreign service with the Anglo-Persian Oil Company and Messrs. Chuni Lal Kapur and Vidya Dhar Chopra with the Bhopāl State. 3 officers were promoted from the Lower Subordinate Service.

The total strength of the department at the close of the Survey year was 55 Class I, 91 Class II and 81 Upper Subordinate officers besides specialists, clerks, lower subordinates and menials

9. With a view to economy, No. 16 (Tidal) Party and the Computing Office, Dehra Dūn, have been temporarily amalgamated with effect from the 1st April 1923, the combined party being designated "Computing and 16 (Tidal) Party".

The Training Section of the Southern Circle was disbanded on the 16th October 1922.

No. 20 (Cantonment) Party has been placed under the administrative control of the Superintendent of the Trigonometrical Survey from the 1st April 1923.

Nos. 10, 11 and 21 Parties were transferred to the administrative control of the Superintendent, Burma Circle, on the 11th April 1923.

10. The following honour was conferred during the year:—

Back Memorial of the Royal Geographical Society.	Mr. Sher Jang, Khan Bahadur, Sub-Assistant Superintendent.
---	---

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 533,200 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>
1905-12	Mostly 2-inch and 1-inch.	122,164	66,961†	20,147†	52,610†	261,882†
1912-13	Mostly 1-inch and ½-inch.	28,192	18,849	7,404	4,482	58,877
1913-14	ditto.	25,052	15,844	7,291	7,599	55,786
1914-15	ditto.	12,834	19,286	2,448	2,808	36,676
1915-16	ditto.	8,168	17,248	2,279	4,652	32,342
1916-17	ditto.	11,689	11,838	3,560	6,168	32,750
1917-18	ditto.	4,202	12,181	3,596	4,800	24,779
1918-19	ditto.	509	7,268	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	5,768	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	5,482*	61,648
Total areas completed to date.		273,593	232,050	73,680	108,894	688,217
Approximate areas for the whole topographical programme.		750,000	542,800	262,925	265,875	1,821,600
Approximate areas remaining for survey.		476,407	310,750	189,245	156,981	1,133,383

* Excludes 3 square miles surveyed on two-inch and larger scales, and 6 square miles previously reported in 1905-06.

† Areas reported in General Report for 1921-22 have been corrected in some cases.

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1922-23.

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. 1 Party—Baluchistan, Punjab and Punjab States.						
<i>Hills, bare, precipitous and waterless</i>	Half-inch Original Survey ...	1,458	4,938	1,04,860 ^(a)	21.1	NORTHERN CIRCLE. (a) Includes cost of training pupils and probationers.
<i>Ditto</i>	One-inch Original Survey ...	164				
<i>Riverain plains, wooded and cultivated.</i>	One-inch Original Survey ...	485				
<i>Ditto</i>	One-inch Revision Survey ...	852				
<i>Plains, open sandy waste partly cultivated and intermixed with dense scrub.</i>	One-inch Revision Survey ...	2,529				
No. 2 Party—Central India, Gwalior, Rajputana and United Provinces.						
<i>Jungle-clad hills and cultivated plains.</i>	Half-inch Original Survey ...	6,868	9,612	1,86,618 ^(b)	14.2	(b) Excludes Rs. 12,555 cost of training soldier surveyors and pupils; Rs. 230 debitable to Mussoorie Municipality area and Rs. 14 to Western Jumna Canal.
<i>Cultivated plains</i>	... One-inch Resurvey ...	564				
<i>Ditto</i>	... One-inch Revision Survey ...	2,880				
No. 3 Party—United Provinces and Rajputana.						
<i>Open and thinly wooded hills</i>	... Two-inch Original Survey ...	261	5,200	88,278 ^(c)	17.0	(c) Excludes cost of arrears fair-mapping and mapping of the work of the Razmak Detachment and ¼-inch survey of season 1923-24 commenced in September 1923.
<i>Ditto</i>	... Two-inch Supplementary Survey ...	48				
<i>Cultivated plains, moderately open</i>	One-inch Resurvey ...	1,584				
<i>Open and thinly wooded hills</i>	... Half-inch Original Survey ...	417				
<i>Sparsely populated sand dunes</i>	... Quarter-inch Original Survey ...	2,890				
No. 4 Party—United Provinces and Bihar & Orissa.						
<i>Cultivated plains, congested with villages and low hills densely wooded.</i>	One-inch Revision Survey ...	6,449	6,449	1,08,812 ^(d)	16.9	(d) Excludes Rs. 349 cost of demarcating the Para-Basantpur village boundary in the United Provinces and Rs. 11,740 for the training of probationers and pupils.
TOTALS, NORTHERN CIRCLE:—			26,199 sq. m.	Rs. 4,38,058	Cost-rate 16.7	

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1922-23.

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. 5 Party—Central India and Gwalior.						SOUTHERN CIRCLE. (e) Includes 372 square miles of Indore State forests and 115,358 square miles of Dhar State forest. (f) Includes cost of fair-mapping and fixing scattered auxiliary heights.
<i>Open plains and densely wooded plateau and hills.</i>	Half-inch Original Survey ...	8,285	4,406	1,85,287	30·7	
	One-inch Original Survey ...	(e)1,171				
No. 6 Party—Hyderābād.						
<i>Undulating and cultivated country: wooded hills.</i>	Half-inch Original Survey ...	2,474	3,292	1,28,889	39·0	
	Two-inch Original Forest Survey	818				
No. 7 Party—Madras and Mysore.						
<i>Undulating, rather intricate, undulating with isolated hills, low hills, jungle-clad.</i>	One-inch Original Survey ...	4,256	6,330	1,85,485	21·4	
	One-inch Resurvey ...	1,894				
	One-inch Revision Survey ...	680				
No. 8 Party—Bombay Presidency, Hyderābād State and Portuguese India.						
<i>Low lying wooded areas in Goa and Sāvāntvādi State, portions of the Western Ghāts, and open and cultivated plains of the Bombay Deccan and Hyderābād State.</i>	One-inch Revision Survey ...	6,489	6,795	1,44,194	21·2	
	One-inch Revision Survey ...	188				
	One-inch Resurvey ...	178				
TOTALS, SOUTHERN CIRCLE:—		20,823	sq. m.	Rs. 5,43,335	Cost-rate 26·1	

WORK OF FIELD PARTIES, Etc.—TOPOGRAPHICAL SURVEYS.

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1922-23.

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.	
EASTERN CIRCLE.						
No. 9 Party—Bengal and Bihār & Orissa.						
<i>Cultivated plains, well populated, some flat some undulating, varied with rocky scrub covered hills.</i>	... One-inch Original Survey	898	3,684	1,74,289	47·3	
	... One-inch Supplementary Survey	2,791				
No. 12 Party—Assam.						
<i>Low hills jungle-clad</i>	... One-inch Original Survey	499	5,460	1,86,188	34·1	
	<i>Mainly hills, partly open, partly jungle-clad and plains cultivated and open.</i>	... Half-inch Original Survey					4,961
TOTALS, EASTERN CIRCLE:— 9,144 sq. m. Rs. 3,60,472 Cost-rate 39·4						

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1922-23.

PARTY AND LOCALITY Character of Country. Scale and Class of Survey.		OUT-TURNS OF PLANE-TABLING.		COSTS OF SURVEY INCLUDING MAPPING.		REMARK.
		Area 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.						BURMA CIRCLE.
Densely wooded hills	... Half-inch Original Survey ...	1,957	2,225	1,48,919 (g)	66·9	(g) Excludes Rs. 13,920 being cost of Maymyo Drawing Office employed on half-inch compilation and mapping.
Ditto	... One-inch Original Survey ...	268				
No. 11 Party—Lower Burma.						
High hills and low ground densely wooded.	One-inch Original Survey ...	1,598	2,679	1,98,812 (h)	72·3	(h) Includes Rs. 7,649 cost of forest surveys debitable to Forest Department, Burma, excludes Rs. 693 part cost of survey of Maymyo Residential Area debitable to Public Works Department, and Rs. 2,703 cost of Maymyo Drawing Office.
High densely wooded hills, and cultivated undulating plains mixed with forest growth.	One-inch Supplementary Survey	1,021				
Hills densely wooded	... Two-inch Original Survey ...	55				
Flat undulating ground densely wooded.	Four-inch Original Survey ...	10				
No. 21 (Burma Forest) Party—Lower Burma.						
Densely wooded hills and plains	Two-inch Original Survey ...	584	587	1,72,800	294·4	(i) Also surveyed on the 2-inch scale.
	Mostly Four-inch and larger scales Original Survey of exclusions.	3				
TOTALS, BURMA CIRCLE:—		5,491 sq. m.		Rs. 5,15,531	Cost-rate 93·9	
GRAND TOTALS:—		61,657 sq. m.		Rs. 18,57,396	Cost-rate 30·1	

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

SUPERINTENDENT { Lieut.-Colonel H. Wood, R.E., up to 21st Aug. 1923.
 { Lieut.-Colonel E.A. Tandy, R.E., from 22nd Aug. 1923.

12. No. 1 Party.—The programme comprised the survey on the

<p style="text-align: center;">PERSONNEL.</p> <p style="text-align: center;"><i>Class I Officer.</i></p> <p>Mr. C. C. Byrne, in charge.</p> <p style="text-align: center;"><i>Class II Officers.</i></p> <p>Major C. H. Tresham.</p> <p>Mr. O. D. Jackson.</p> <p style="text-align: center;"><i>Upper Subordinate Service.</i></p> <p>9 Officers.</p> <p style="text-align: center;"><i>Lower Subordinate Service.</i></p> <p>22 Surveyors, etc.</p>	<p>half-inch scale of the south-eastern portion of the Sulaimān range, which here divides Baluchistān from the Punjab, and, on the one-inch scale, the country extending eastwards from the hills to the Indus river. In addition to the above an overlap of 211 square miles was surveyed, to secure proper junction between the one-inch and half-inch mapping in the west for current work and in the east, along the Indus river, for future publication.</p>
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The area covered by the half-inch survey lies partly in Baluchistān and partly in the Punjab; it consists of 1,458 square miles of bare, precipitous hills rising from about 300 to about 4,500 feet above mean sea level. The country is uninhabitable, water is scarce and everywhere brackish—in most places it is undrinkable—and, owing to the very broken nature of the ground, communications are few and difficult. This area is nominally occupied by the Marri-Bugti tribes of Baluchistān in the west and in the east by the Mazāri, Drishak, Gurchāni, Laghāri, and Tibbi Lund, sections of the Rind-Baluch tribes in the Dera Ghāzi Khān district of the Punjab.

The area surveyed on the one-inch scale comprises the southern half of the Dera Ghāzi Khān district and small portions of the Muzaffargarh district and of Bahāwalpur State. The country may conveniently be described as :—

- (1) The Sind, or riverain, lands along the Indus (Sind) river which are irrigated both by wells and canals, closely cultivated and densely populated; being washed annually during the monsoon by the overflow of the Indus, many portions are covered with dense scrub, reeds and tall grass; the cultivated portions are well covered with trees, particularly along the canal banks, so that distant views are not obtainable.

(2) The Pachād or arid zone, lying between the hills and the Indus, is formed from loam brought down by the hill torrents during the rains. The soil of this region is very rich and is cultivated wherever water is obtainable, but such spots are comparatively few; the ground is mostly covered with dense 'jal' jungle which provides excellent fodder for camels, and large herds of these are annually brought in from the adjoining districts to graze. The wells in this area generally contain brackish water.

13. No. 2 Party.—This party surveyed an area of 2,558 square miles in the Āgra, Jālaun, Jhānsi, Hamirpur and Bāndā districts of the United Provinces; 56 square miles in Bharatpur State and 274 square miles in Dholpur State in Rājputāna, 28 square miles in Gwalior State, and 328 square miles in Bānkā-Pahāri, Baonī, Beri, Charkhāri, Datīā, Dhurwai, Jignī, Orchhā, Samthar, Sarila, and Tori-Fatehpur States of the Bundelkhand Agency in Central

India on the one-inch scale; and 17 square miles in Jālaun district of the United Provinces, 377 square miles in Bharatpur State, 211 square miles in Jaipur State, 641 square miles in Karauli State, and 762 square miles in Dholpur State all in Rājputāna, and 4,155 square miles in Gwalior State, 18 square miles in Indore State, and 187 square miles in Datīā State both the latter in the Bundelkhand Agency on the half-inch scale. The area surveyed on the one-inch scale included 15 square miles of Reserved Forest (*vide* page 20).

The country surveyed on the one-inch scale consisted of cultivated plains, open and easy. Half the area on the half-inch scale was similarly open and the remainder consisted of ranges of hills mostly covered with long grass and dense thorn jungle. There was a great deal of broken ground deeply cleft along the banks of the Chambal river and also along the Betwā and Dhasān rivers though less rugged.

Triangulation and traversing was carried out in Jaipur, Karauli, Tonk, Būndi, Kotah and Gwalior States and in the Bundelkhand Agency and areas of 7,600 and 3,650 square miles respectively completed in advance for detail survey on the half-inch scale.

PERSONNEL.

Class I Officers.

Bt.-Lieut.-Colonel S. W. S. Hamilton,
D.S.O., R.E., in charge from 1st November
1922.

Captain L. H. Jackson, I.A., in charge to
31st October 1922.

Class II Officers.

Mr. P. A. T. Kenny, O.B.E.
" Duni Chand Puri
" Prafulla Kumar Ghosh, B.Sc.,
F.R.G.S.

Upper Subordinate Service.

4 Officers.

Lower Subordinate Service.

57 Surveyors, etc.

14. No. 3 Party.—This party surveyed an area of 309 square

PERSONNEL.
Class I Officers.
 Major C. G. Lewis, R.E., in charge.
 Captain T. W. R. Haycraft, R.E.
 „ W. J. Norman, M.C., R.E.

Class II Officers.
 Mr. J. C. C. Lears.
 „ L. Williams, M.B.E.
 „ J. H. Johnson.
 „ A. J. A. Drake, D.C.M.

Upper Subordinate Service.
 2 Officers.

Lower Subordinate Service.
 26 Surveyors, etc.

miles on the two-inch scale in the Dehra Dūn and Garhwāl districts, 1,584 square miles on the one-inch scale in the Nainī Tāl, Pilibhit, Kheri and Shāhjahānpur districts and 417 square miles on the half-inch scale in Tehri State in the United Provinces. Also an area of 2,890 square miles on the quarter-inch scale in the unsurveyed portions of Mār-

wār and Jaisalmer States in Rājputāna.

The two-inch survey in Kumaun and Garhwāl has been executed chiefly in the interests of the Forest Department and the survey of nine-tenths of the reserved forests of the Kumaun Forest Circle has been carried out during the past eight years.

The triangulation necessary for the survey in Rājputāna was carried out *pari passu* with the quarter-inch detail survey.

15. No. 4 Party.—Survey operations were continued in the

PERSONNEL.
Class I Officers.
 Mr. M. C. Petters, in charge to 4th November 1922 and from 5th March 1923.
 Captain L. H. Jackson, I.A., in charge from 5th November 1922 to 4th March 1923.

Class II Officers.
 Major J. H. Williams.
 Mr. L. Williams, M.B.E.
 „ G. A. Norman, M.B.E.
 Lieut. C. S. McInnes.
 Mr. Abdul Karim, B.A.
 „ Moqimuddin, B.A.
 „ Muhammad Aslam Chowdhury, B.A.
 (on probation).

Upper Subordinate Service.
 4 Officers.

Lower Subordinate Service.
 44 Surveyors, etc.

United Provinces and Bihār & Orissa on the one-inch scale, an area of 1,050 square miles being surveyed in Shāhābād district of Bihār & Orissa and 5,083 square miles in Azamgarh, Balliā, Benares, Ghāzipur, Jaunpur, Mirzāpur and Sultānpur districts and 316 square miles in Benares State, of the United Provinces, or a total of 6,449 square miles. In addition, an area of 470 square miles was triangulated in the Mirzāpur and Shāhābād districts and Benares State to supply

data for the detail survey during the current season.

The country surveyed 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, Gumtī and Karamnāsā. In the Chakiā district of Benares State and in Mirzāpur, the country begins to undulate and the alluvial plain gives place to a hilly region densely wooded which forms the northern slopes of the Kaimur range.

A report on the deputation of an officer in connection with the disputed boundary between Pāra and Basantpur villages lying in Bāra Banki and Gondā districts, respectively, will be found on page 58.

16. Training.—No pupil surveyors were entertained during the year. Of those entertained in 1920 and 1921, 10 were promoted unclassified surveyors, and 4 were discharged.

No soldier surveyors joined for training during the year. Of the number reported as undergoing training last year, 2 have been reverted to their regiments, and, of the remainder, 3 are undergoing their 2nd period of training, 3 having been permanently transferred to the Survey of India.

17. Recess Work.—The fair-mapping of sheets of the previous and current seasons' survey, was completed by 30th September 1923, with the exception of the following:—

Sheets on the one-inch scale	...	...	9
Sheets on the half-inch scale	...	...	3
Sheets on the quarter-inch scale	...	...	1
Environs map of Lucknow	...	...	1

Of these, 2 of the half-inch sheets and the Environs map were delayed owing to some of the boundaries on them being under reference. All these sheets will be submitted for publication before the commencement of the next recess season.

18. Record Section.—This section which was formed during the year 1919-20 has now been amalgamated with No. 3 Drawing Office, and the work done by it will be found on page 53.

19. Particulars of work done by Nos. 22 and 23 Parties will be found on pages 58 and 59.

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

SUPERINTENDENT { Lt.-Col. C. P. Gunter, O.B.E., R.E., up to 2nd January 1923.
Lt.-Col. G. A. Beazeley, D.S.O., R.E., from 3rd January 1923.

20. No. 5 Party.—This party surveyed an area of 4,406 square

PERSONNEL.
Class I Officers.
Major F. B. Scott, I.A., in charge.
Captain G. Lennox, I.A.

Class II Officers.
Mr. J. H. S. Wilson.
" F. C. Pilcher.
" Muhammad Najamuddin, B.A.
Upper Subordinate Service.
4 Officers.
Lower Subordinate Service.
33 Surveyors, etc.

miles as follows:—343 square miles in Indore State, 1,069 square miles in Dhār State, 2 square miles in Jhābua State, 78 square miles in Nimkhera State, 95 square miles in Barwāni State, 238 square miles in Dewās State, 3 square miles in Jāmnia State, 289 square miles in Bhopāl State,

and 19 square miles of "disputed" territory, all of the Central India

Agency, 1,099 square miles in the Amjhera and Ujjain districts of Gwalior on the half-inch scale; 858 square miles in Indore State, 152 square miles in Dhār State, and 104 square miles in Bhopāl State, all of the Central India Agency, 57 square miles in the Amjhera and Ujjain districts of Gwalior, on the one-inch scale.

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

It also triangulated an area of 1,810 square miles in the Central Provinces.

21. No. 6 Party.—This party completed an area of 2,474 square miles of half-inch original survey and 818 square miles of two-inch original survey in the Raichūr, Mahbūbnagar and Nalgonda districts of Hyderabad.

An area of 200 square miles of supplementary triangulation was completed in the Nalgonda district and of 1,120 square miles of triangulation for half-inch surveys in the Warangal district of Hyderabad.

22 linear miles of theodolite traversing through forest areas were completed.

The country surveyed is undulating and generally cultivated except in the wooded hills of the forest areas.

22. No. 7 Party.—This party surveyed an area of 4,936 square

miles on the one-inch scale in the Cuddapah, Anantapur and Chittoor districts of Madras and 1,394 square miles on one-inch scale in the Kolār district of Mysore. It triangulated an area of 5,502 square miles in the Anantapur and Bellary districts of Madras and the Kolār and Tumkūr districts of Mysore.

The country surveyed was, in parts, hilly and intricate, and in others undulating, rather densely

populated and generally presented no real difficulties.

PERSONNEL.

Class I Officers.

Major R. S. Wauchope, O.B.E., I.A., in charge from 26th April 1923.

Captain J. K. Douglas, R.E., in charge to 26th April 1923.

Class II Officers.

Mr. E. A. Meyer.

„ J. C. St. O. Pollett.

„ E. N. Natesan, B.A.

Upper Subordinate Service.

4 Officers.

Lower Subordinate Service.

25 Surveyors, etc.

PERSONNEL.

Class I Officers.

Major J. D. Campbell, D.S.O., R.E., in charge to 8th May 1923.

Captain G. W. Gemmell, I.A.

Class II Officers.

Mr. S. S. McA'Fee Fielding, in charge from 9th May 1923.

Mr. V. W. Morton.

„ A. F. Murphy.

„ N. S. Harihara Iyer.

„ C. P. E. Davenport.

Upper Subordinate Service.

5 Officers.

Lower Subordinate Service.

38 Surveyors, etc.

23. No. 8 Party.—This party surveyed 6,795 square miles on the

PERSONNEL.

Class I Officer.

Lieut.-Colonel M. O'C. Tandy, D.S.O.,
O.B.E., R.E., in charge.

Class II Officers.

Mr. M. Mahadeva Mudaliar, M.A.

„ B. T. Wyatt.

„ M. S. Ganesa Aiyar.

„ Srinivasa Rao Kelkar, B.Sc.

Upper Subordinate Service.

4 Officers.

Lower Subordinate Service.

44 Surveyors, etc.

one-inch scale. Of this area 173 square miles fell in the Portuguese territory of Goa, 133 square miles in Hyderābād State, 181 square miles in Sāvantvādi State, 7 square miles in Kolhāpur State, 229 square miles in the Southern Marāthā Jāgirs and the balance of 6,072 square miles in the Ahmadnagar, Poona, Sholāpur, Bel-

gaum, Dhārwar and North Kanara districts of the Bombay Presidency.

Except for the low lying and wooded areas of Goa and Sāvantvādi State and the portions of the Western Ghāts between these areas and Belgaum district, the country surveyed consisted of the open and cultivated plains of the Bombay Deccan. The towns and cantonments of Ahmadnagar and Belgaum were included in the area surveyed.

The survey of the country near Belgaum was undertaken at the special request of the military authorities and was mapped on the half-inch scale in advance of the one-inch sheets.

24. Instruction in Triangulation.—A class was formed before the close of the recess season for the instruction of officers and surveyors in the handling of theodolites and in triangulation and its computations.

2 Class II officers, 3 Upper Subordinate officers and 8 surveyors received instruction. The field work was carried out in the neighbourhood of Bangalore.

Of these 1 Class II officer, 2 Upper Subordinate officers and 1 surveyor will carry out triangulation in the field under the superintendence of the Officer in charge No. 6 Party during the coming field season.

25. Miscellaneous.—Nos. 5, 6, 7 and 8 Parties, Circle Office and No. 4 Drawing Office were inspected by the Surveyor General in August and September 1923.

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

26. Recess Work.—9 one-inch sheets out of 46 surveyed during the year and 1 one-inch sheet previously surveyed and partly resurveyed during the year were submitted to the circle office before the 30th September 1923. All the remaining sheets will be fair-mapped before the close of the recess season. The publication of 1 one-inch

sheet, previously surveyed and which was submitted for publication during the year has been held up as the sheet requires a small amount of revision in the field; with this exception there are no arrears of mapping from the previous season's work.

2 original half-inch sheets out of 7 surveyed during the year were submitted to the circle office before the 30th September 1923. The remaining 5 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, 13 out of 19 special forest maps being fair-mapped by Nos. 5 and 6 Parties were submitted to the circle office before the 30th September 1923. Of the remaining 6 sheets, 4 will be fair-mapped before the close of the recess season, 1 sheet requires a small amount of revision in the field and the publication of another sheet is being withheld till it can be completed up to margin from two-inch surveys to be carried out during next field season. There are no arrears of mapping from the previous season's work.

27. Record Section.—This section which was formed on the 1st May 1921 was amalgamated with No. 4 Drawing Office from the 15th June 1923 and has been reported on under *Triangulation charts and computations* on page 54 of this report.

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

SUPERINTENDENT—Colonel W. M. Coldstream, R.E.

28. No. 9 Party.—This party surveyed an area of 3,684 square miles on the one-inch scale in the provinces of Bengal and Bihār and Orissa.

PERSONNEL.

Class I Officers.

Bt.-Lieut.-Colonel R. H. Phillimore,
D.S.O., R.E., in charge.

Captain R. S. P. MacIvor, I.A.

Lieut. H. A. Bazley, R.E.

Class II Officers.

Mr. E. J. Biggie.

„ Amar Krishna Mitra.

Lieut. C. S. McInnes.

Captain J. O'C. Fitzpatrick.

Mr. Bhupendra Nath Saha, M.Sc.

Upper Subordinate Service.

4 Officers.

Lower Subordinate Service.

37 Surveyors, etc.

The work fell in the districts of 24 Parganas, Birbhūm, Murshidābād, and Mālda in Bengal and in the districts of Santāl Parganas, Shāhābād, Sāran, Muzaffarpur and Patna in Bihār and Orissa.

The area surveyed in Bengal covered Sāgar Island at the mouth of the Hooghly river, and also an area lying between the loop line of the East Indian Railway and the Bhāgirathi river; both areas were flat and thickly populated.

The area surveyed in Bihār was flat and thickly populated in the neighbourhood of Patna, where it included the towns of Patna, Bankipore, Dinapore and Sonpur. The portion that lay in the Santāl Parganas was partly open and undulating and partly steep rocky hills covered with scrub jungle.

An area of 2,970 square miles was triangulated for one-inch survey in the Orissa Tributary States.

An area of 820 square miles was triangulated and traversed for four-inch survey covering the Rāniganj Coalfield in the districts of Burdwān, Bānkurā, Birbhūm and Santāl Parganas.

29. No. 12 Party.—This party surveyed an area of 5,460 square miles on the one-inch and half-inch scales in Assam, in the districts of Cāchār, Nowgong, Sibsāgar, Nāgā Hills and in Manipur State.

PERSONNEL.

Class I Officers.

Lieut.-Colonel C. M. Browne, C.M.G.,
D.S.O., R.E., in charge.

Captain E. R. C. Meade, I.A.

Class II Officers.

Mr. E. M. Kenny.

„ D. K. Rennick, M.B.E.

„ R. O. Hanson.

Upper Subordinate Service.

4 Officers.

Lower Subordinate Service.

40 Surveyors, etc.

310 linear miles of traversing, covering an area of 1,066 square miles, were carried out in Sadiyā Frontier Tract in advance of the detail survey.

The area surveyed was mostly hilly, ranging from 400 to about 9,000 feet; a large portion of it was covered with dense forest.

30. Training.—Six pupil surveyors were engaged in November 1922 and were under instruction in the field; they completed an average of 30 square miles each during the season, and are all likely to become useful surveyors.

Three more pupils were entertained in June 1923 and sent to No. 21 Party in Burma after 3 months' instruction in the neighbourhood of Shillong.

31. Recess Work.—Since the formation of a separate administrative circle for Burma in April, the Burma parties no longer submit their sheets to the Superintendent, Eastern Circle. Twenty-three sheets were surveyed by the other parties, of which 12 have been received in the circle office. The 11 remaining sheets are expected in November.

In the circle office, all professional records have been re-arranged and their storage and registration systematised. The transfer of records appertaining to Burma has involved a good deal of work which is now completed.

The Burma half-inch and quarter-inch mapping in hand in No. 5 Drawing Office when the new circle was formed has been finished and, except under special arrangements, no more will be undertaken.

Captain Meade and two draftsmen were engaged for 3 months of the recess season in compiling and adjusting the photo-survey carried out by the former in Bhutan and S. Tibet in 1922, and completing the four quarter-inch field sheets for fair-mapping.

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

SUPERINTENDENT—Lt.-Col. C. P. Gunter, O.B.E., R.E., from 11th April 1923.

32. No. 10 Party.—This party surveyed an area of 2,052

PERSONNEL.

Class I Officers.

Lieut.-Colonel E. T. Rich, C.I.E., R.E., in charge to 18th March 1923.
 Captain O. Slater, M.C., R.E., in charge from 19th March 1923.

Class II Officers.

Mr. W. G. Jarbo.
 S. F. Norman.
 Lieut. L. B. Fitz-Gibbon.
 Mr. F. J. Grice.
 " H. H. Creed.

Upper Subordinate Service.
 4 Officers.

Lower Subordinate Service.
 19 Surveyors, etc.

with dense jungle and consists of steep and intricate hills rising to 8,000 feet.

An area of 3,500 square miles in the Akyab, Minbu and Kyaukpyu districts of Burma was also triangulated in advance for topographical surveys. Except for a deltaic area which is highly cultivated and has numerous tidal creeks, the whole area is hilly and rises to 5,600 feet on the Arakan Yoma range. The western spurs of this range are covered with a single-stemmed bamboo but the higher ridges have a mixed forest growth. The ridges, which mainly run north and south, form in the sea area numerous wooded islands usually fringed with mangrove swamps.

33. No. 11 Party.—This party continued survey operations in

PERSONNEL.

Class I Officers.

Mr. J. O. Greiff, in charge.
 Captain T. M. M. Penney, R.E.

Class II Officers.

Mr. O. J. H. Hart.
 " G. E. R. Cooper.
 " A. V. Dickson.

Upper Subordinate Service.
 2 Officers.

Lower Subordinate Service.
 80 Surveyors, etc.

square miles on the half-inch and one-inch scales in the Myitkyina and Upper Chindwin districts of Burma and the adjoining tribal territory and 173 square miles on the half-inch scale in the tribal territory between the Mali Hka and Nmai Hka branches of the Irrawaddy, locally known as "The Triangle".

The whole area surveyed is covered

the Amberst district of Lower Burma. The total area surveyed on all scales was 2,679 square miles made up of 1,593 square miles original and 1,021 square miles supplementary surveys, on the one-inch scale; 55 square miles of Reserved Forests on the two-inch

scale; and 10 square miles on the four-inch scale. For the next season's programme an area of 2,180 square miles was triangulated.

The country surveyed extended from the southern confines of the district to north of the old town of Amherst on the sea coast. It is intersected by the low Taungnyo chain of hills which take off from the Sadaik peak, 3,080 feet high, in the south-east, on the main range separating Burma from Siam, and extend in a north-westerly direction to Moulmein, and form the western watershed of the Ataran river. Except for a narrow coastal strip, and the alluvial plains along the lower course of the Ataran, the whole of this tract is cut up by numerous streams and is densely wooded. It contains the Ataran group of Reserved Forests.

34. 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.

Captain V. P. Wainright.

„ C. B. Sexton.

Mr. H. M. Critchell.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

35 Surveyors, etc.

party is included in that shown under Forest Surveys, Burma Circle, pages 21 to 23.

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

35. Recess Work.—The sheets which had to be fair-mapped by the parties of the Burma Circle during the recess season numbered 32 including 17 special forest sheets. There was 1 two-inch sheet in arrears from the previous year's mapping which has now been completed. By the 30th September 7 of these sheets had been received in the circle office; all the remaining sheets will be received and sent for publication before the beginning of next recess season with the exception of 1 one-inch sheet which is not being drawn this recess as it requires to be examined in the field.

Two half-inch sheets already published had new survey carried out this year added to them. A new edition of these sheets will, however, not be published until the unsurveyed area is completed.

II.—FOREST SURVEYS.

36. Details of the topographical surveys of reserved forests executed by field parties of the Survey of India for the year under report, 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. Boundary surveys were made where required, and plots prepared on the four-inch scale.

NORTHERN CIRCLE.

37. United Provinces. Western Forest Circle.—In order to complete sheet No. 53 J/8S., the greater part of which falls in the Kumaun Circle, the revision of parts of the old four-inch scale maps was carried out on the two-inch scale in the following Forest divisions:—

Dehra Dūn	9 square miles.
Lansdowne	28 "

Kumaun Forest Circle.—In the *South Garhwal Forest Division*, an area of 25·5 square miles of reserved forests was surveyed on the two-inch scale, thus completing the forest surveys of this division. In order to avoid a change of scale, the intermediate non-forest areas up to the boundary of Tehri State were also surveyed on the two-inch scale.

Eastern Forest Circle.—In the *Jhānsi and Banda Forest Divisions*, reserved forest areas were surveyed on the one-inch scale as follows:—

	Area in square miles.
Jhānsi Division, Mau-Garanthā Range,	
Basneh block, No. 108	2'0
Bānda Division, Maudahā Range,	
Bandhur and Chilahta block	2'9
Kunahta block	4'5
Total	<u>9'4</u>

Working Plan Circle.—In the *Afforestation Division*, the undermentioned reserved forest areas were surveyed on the one-inch scale:—

	Area in square miles.
Blocks Nos. 100 (Tharro), 101 and 102	1'8
Blocks Nos. 104, 105 (Moti Katra)	4'4

SOUTHERN CIRCLE.

38. Madras. II and III Forest Circles.—In the *Anantapur*, *West Cuddapah* and *Chittoor Forest Divisions*, an area of 328 square miles of reserved forests was surveyed on the one-inch scale.

EASTERN CIRCLE.

39. Assam. Western Forest Circle.—In the *Cachar Forest Division* the survey of the remaining area of 99·84 square miles of the Langting Mupā reserved forest was completed on the one-inch scale.

Eastern Forest Circle.—In the *Nowgong Forest Division* the survey of the remaining areas of 93·27 (approx.) and 58·67 square miles of the reserved forests of Lunding and Kaki respectively was completed on the one-inch scale. The survey of the remaining area of 17·05 square miles of Intangki reserved forest of which an area of 72·61 square miles, surveyed on the half-inch scale last season, was not reported, was completed on the same scale.

In addition, Daldali and Dhansiri Extensions were surveyed before they were declared reserved forests, but as their boundaries are not settled, their areas are not reported.

BURMA CIRCLE.

40. Burma. Hlaing Forest Circle.—In the *Insein Forest Division* 63·1 linear miles of forest boundaries were traversed, and will be added to the Mahuya Reserve Blocks I and II for which old two-inch surveys will be drawn and published on the same scale.

Delta Forest Circle.—In the *Henzada Ma-ubin Forest Division* 294 linear miles of the boundaries of the undermentioned reserves were traversed :—

Padaw

Sinthe

Shwethanin

Kyangin

Yenandaung

Kaingtha

Myinwadaung and Extensions

North Myanaung

South Myanaung and Extensions.

In the *Bassein Forest Division* 47 linear miles of the boundaries of the reserved forests of Myittaya, Sinhmon were traversed, and an area of 401·6 square miles of the undermentioned reserves surveyed on the two-inch scale:—

Changtha	Myittaya
Kungyaung	Sinma
Kyetpanng	Sinhmon
Mezali	Unclassed forest.
Thitpok	

In the *North Arakan Forest Division* an area of 20 square miles comprising Kunchaung Reserve was triangulated in advance for the purposes of two-inch survey.

Sittang Forest Circle.—In the *South Pegu Forest Division* 111 linear miles of forest boundaries were traversed and will be added to Aungmya, Kalein, Aseiktaung, Shanywagyi and Talaingma Reserves for which old two-inch surveys will be drawn and published on the same scale.

The Pyinbóngyi Extension Reserve was also traversed for future survey on the four-inch scale.

Tenasserim Forest Circle.—In the *Thaton Forest Division* an area of 130·6 square miles in the Wetwundaung, Bilin, Kyousein, Pabein, Danu, Kalamataung and Martaban Reserves was surveyed on the two-inch scale. In addition an area of 50·7 square miles of unclassified forest and cultivated land lying between the Kalamataung Reserve and the railway line to the west, was also surveyed on the same scale to show the main approaches to the reserve.

In the *South Tenasserim Forest Division* the survey of the remaining area of 51·7 square miles of the Heinze and Kaleinaung Reserve was completed on the two-inch scale.

In the *Ataran Forest Division* Ma-u No. 5 and Gwingyi No. II Extension Reserves comprising areas of 7·3 and 2·7 square miles respectively were surveyed on the four-inch scale. In addition to the above, areas previously surveyed on this scale as unclassified forest, and now included in the Dawebank, Ma-u No. VI Extension or Ye-le, Megwa No. III Extension, Natchaung No. I and II Extensions, Ma-u N. W., East and South Extensions and Inchaung and Kyatchaung Extensions were revised and brought up to date. The survey of part of the new addition to the Dawebank Reserve comprising an area of

4.3 square miles was commenced on the same scale, and subsequently altered to the one-inch, in accordance with instructions received from the Forest Department.

100 linear miles of traversing by chain and theodolite, comprising parts of the boundaries of different extensions, were completed.

Tinyu Reserve comprising an area of 2.8 square miles was surveyed on the two-inch scale.

The survey of 232 square miles on the one-inch scale of the proposed reserves of Anankwin and Sekangyi was completed. The areas covered by the proposed reserves of Lamaing and Alantaya were also surveyed on the one-inch scale, but not the boundaries, as these had not been demarcated. Such boundaries of the proposed reserves as have been surveyed can only be regarded as approximate, as they had not been completely demarcated on the ground at the time of survey.

III.—CANTONMENT AND LARGE SCALE SURVEYS.

41. No. 20 Party.—During the year the party completed the

<p>PERSONNEL. <i>Class I Officer.</i> Mr. C. E. C. French, in charge. <i>Upper Subordinate Service.</i> 1 Officer. <i>Lower Subordinate Service.</i> 26 Surveyors, etc.</p>	<p>survey of Bareilly cantonment on the twelve-inch scale, and of the cantonments of Agra, Muttra, Sitāpur, Gorakhpur and Naini Tāl (Minor Cantonment) on the sixteen-inch scale. The bāzār areas in Bareilly and those of Agra, Muttra and Sitāpur were also surveyed on the forty-eight-inch and sixty-four-inch scales respectively.</p>
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107·78 linear miles of traversing and 73·94 linear miles of levelling were also completed at a cost of Rs. 25·95 and Rs. 20·09 per linear mile respectively.

The fair-drawn originals of Secunderābād cantonment, the bāzār areas of Bangalore and a six-inch map of Deolāli and surrounding country have been submitted for publication.

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

- Sixteen-inch original, 4,891·0 acres @ Rs. 1·63 per acre.
- Sixteen-inch revision, 10,390·0 acres @ Rs. 1·07 per acre.
- Twelve-inch revision, 4,835·0 acres @ Re. 0·76 per acre.
- Forty-eight-inch revision, 66·0 acres @ Rs. 8·28 per acre.
- Sixty-four-inch revision, 265·9 acres @ Rs. 28·61 per acre.

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

- 7,630·00 acres on the sixteen-inch scale @ Re. 0·74 per acre.
- 85·00 acres on the sixty-four-inch scale @ Rs. 13·59 per acre.
- 20·11 square miles on the six-inch scale @ Rs. 106·41 per square mile.
- 379·00 acres on the one inch to fifty feet scale @ Rs. 11·82 per acre.

Alphabetical List of Cantonments and Military Stations surveyed
and published up to the end of 1922-23.

* (1) Agar Cantonment.	(27) Kalka Cantonment.
(2) Aurangābād do.	(28) Kamptee do.
(3) Ahmadnagar do.	(29) Karachi Port Trust (Manora).
(4) Bakloh do.	(30) Landour Cantonment.
(5) Balūn or Thath (Dalhousie) Camp area.	(31) Meerut do.
(6) Bannu Cantonment.	(32) Nasirābād do.
(7) Bellary do.	(33) Nimach do.
(8) Chaman do.	(34) Peshāwar do.
(9) Chitral Station.	(35) Pallāvaram do.
(10) Dehra Dūn Cantonment.	(36) Poonamallee do.
(11) Deoli do.	(37) Quetta do.
(12) Drazinda Out Post.	(38) Quetta Fort.
(13) Drosh Cantonment.	(39) Quetta Civil Station.
(14) Delhi New do.	(40) Rājkot Cantonment.
(15) Erinpura do.	(41) Rāwalpindi do.
(16) Fort Lockhart.	(42) Sahāranpur Remount Depôt.
(17) Ghairat Station.	(43) Sanāwar Cantonment.
(18) Guna Cantonment.	(44) Saugor do.
(19) Hangu do.	(45) Siālkot do.
(20) Hāpur (Bābūgarh) Remount Depôt.	(46) Simla Indian Infantry Lines.
(21) Hosūr Remount Depôt.	(47) Sitābaldī Fort (Nāgpur).
(22) Jandola Out Post.	(48) Saint Thomas's Mount Cantt.
(23) Jatta do.	(49) Thal Cantonment.
(24) Jhelum Cantonment.	(50) Topa do.
(25) Jullundūr do.	(51) West Hill do.
(26) Jhānsi do.	(52) Zām Out Post.

* Erroneously shown as "Agra Cantonment" on page 21 of the General Report for 1921-22.

IV.—THE TRIGONOMETRICAL SURVEY.

SUPERINTENDENT—Lt.-Colonel H. McC. Cowie, R.E.

GEODETTIC OPERATIONS.

42. No. 13 Party.—Astronomical, No. 14 Party.—Pendulum, No. 15 Party.—Triangulation, and No. 19 Party.—Base Line Operations.—No field operations were carried out by these four parties, the personnel being employed at the Headquarters offices of the Trigonometrical Survey.

PERSONNEL.

Class I Officers.

Dr. J. deGraaff Hunter, Sc.D., M.A.,
F. Inst. P., in charge from 19th February 1923.

Major C. M. Thompson, I.A., in charge to
18th February 1923.

Class II Officer.

Mr. D. H. Luxa.

Lower Subordinate Service.

16 Computers, etc.

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

Stations.	Date of commencement of observations.	Date of closing of observations.	Number of years of observations.	REMARKS.
1. Aden ...	1879 ...	Still working	44	*With a small tide-gauge.
2. Karachi ...	{ 1868 ...	1880	*18	
3. Bombay (Apollo Bandar). ...	{ 1881 ...	Still working	42	
4. Bombay (Prince's Dock). ...	1878 ...	"	45	
5. Madras ...	1888 ...	"	85	
6. Kidderpore ...	{ 1880 ...	1890	10	} 88
7. Rangoon ...	{ Restarted 1895 ...	Still working	28	
8. Moulmein ...	1881 ...	"	42	
9. Port Blair ...	1880 ...	"	48	
				{ 20
			6	
		Still working	14	
		"	48	

In addition, the actual times and heights of high and low-water at Bhaunagar, Chittagong and Akyab were observed by watch and tide-pole, under the orders of the Port Officers concerned, and forwarded monthly to this office.

Hourly readings of the height of the water, on a tide-pole, were taken at Basrah throughout the day and night, and supplied weekly by the Director, Inland Water Transport, Mesopotamia. This arrangement was continued up to the 31st March 1922. Thereafter, the

diagrams taken by an automatic tide recorder, erected at Margil, were submitted by the Port Director, Basrah, up to the 30th April 1922, after which date, owing to very heavy silting during the floods, the tide recorder failed to function and was put out of action temporarily.

No further readings were received till the 2nd November 1922, since which date, the readings have been received regularly every week.

The observations for the year commencing 1st January 1922, 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 1924.

Data for the prediction of tides for 1924 by the tide-predicting machine were computed for 40 ports. In addition the detail compilation of the tide-tables for the 9 riverain ports of India for 1924 was accomplished.

The tide predictions for the 1924 tide-tables for the Indian ports and Basrah, were effected by means of the tide-predicting machine at Dehra Dūn. The printing and publication of these tide-tables were carried out in the office of the Superintendent of the Trigonometrical Survey. Their issue to officers and the public is expected to be completed by about the end of October 1923. Advance copies, in manuscript form, of tables for the 1924 tides at the ports of Suez, Aden, Būshire, Bombay, Dublāt (Sāgar Island), Rangoon and Mergui, were prepared and despatched to the Hydrographer to the Admiralty in April 1923, and for the Hooghly river, to the Deputy Conservator of the Port of Calcutta and to Messrs. Thomas Cook and Son.

Tidal registrations at the nine working observatories have been carried out satisfactorily, and will be continued during the coming year. In addition, a new tide-gauge is to be installed at Bassein and, it is hoped, be in thorough working order before the end of 1923.

The tidal observatory at Prince's Dock (Bombay) is still being worked by the Port Authorities for their own purposes.

During the past year all these observatories, except Aden and Port Blair, were inspected.

44. The following table shows the annual and decadal percentages of errors in the predicted times and heights of high and low-water at the nine stations where observations have been taken by self-registering tide-gauges, from which it will be seen that the predictions for 1922 were as accurate as they have been in the past.

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.	H.W.—L.W.	Within 8 inches of actuals.	H.W.—L.W.	Within 1½ of mean range at springs.	H.W.—L.W.		Within 15 minutes of actuals.	H.W.—L.W.	Within 8 inches of actuals.	H.W.—L.W.	Within 1½ of mean range at springs.	H.W.—L.W.
1913	6	88	82	97	97	98	99	4	68	55	70	58	94	88
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	73	62	98	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	94
1922	5	81	75	97	98	96	97	3	73	66	71	78	92	95
Average of ten years.	...	80	78	96	97	97	98	...	75	65	70	65	92	90

45. *Tide-predicting machine.*—The height curves and time charts for the 1924 tide-tables were completed on the machine by about the end of April 1923. The height curves for the 1925 tide-tables have already been run off on the machine, and it is hoped to complete the time charts for 1925 by about the end of October 1923.

46. *No. 17 Party.—Levelling.*—Five double detachments (one of which started as a single detachment) and one special levelling detachment were employed during the past season on the levelling operations summarised below:—

(a) *In the Punjab, for the Sutlej Valley Irrigation project.*—

PERSONNEL.

Class I Officers.

Major A. H. Gwyn, I.A., in charge from 19th March 1923.

Bt.-Major K. Mason, M.C., R.E., in charge to 18th March 1923.

Captain E. A. Glennie, D.S.O., R.E.

Class II Officers.

Mr. G. J. S. Rao

" O. N. Pushong

" Raj Bahadur Mathur, B.A.

" K. S. Gopalachari, B.A.

Upper Subordinate Service.

5 Officers.

Lower Subordinate Service.

25 Computers, &c.

41 purely temporary Levellers.

(i) From Kasūr to Ratta Tibba and Lodhrān,

From Ratta Tibba to Islām and Kaim Rais-ki-got,

From Kutabpur to Adamwāhan,

From Lodhrān to Bahāwalpur,

From Bahāwalpur to Fāzilka,

From Kandhyawāla to Hāsīlpur.

(ii) From Khudīān to Lodhrān.

From Dingarh to Khānpur

From Mithra to Khānpur

From Chachran to Khān Belā

From Fāzilka to Ferozepore.

- (iii) In the Multān and Montgomery districts, a close network of "tertiary" levelling, controlled by (i) and (ii).
- (b) *In Bombay* for the Ghatprabha Irrigation project.—
 - (i) From Gotar to Kalādgi
 - (ii) From Mudhol to Jodhatti
 - (iii) From Hukeri Road railway station to Mudhol.
- (c) *In Bombay*
 - (i) From Ahmadnagar to Dhond.

In Madras

 - (ii) From Gooty to Ongole.

These two lines were run in order to give heights to Survey of India bench-marks.

- (d) *In Burma*, for the Public Works Department (Irrigation).—
 - (i) From Nyaungzaye to Yandoon and Maletto.
 - (ii) From Yandoon to Kandin.
 - (iii) From Ma-ubin to Bassein.
 - (iv) From Sagamya to Pantanaw.
- (e) *In Bombay and the Punjab*, from Jacobābād to Khānpur and from Khānpur 15 miles southwards.

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

- (f) *In Bombay*, for the Sukkur Barrage project.—
 - (i) From Shāhpur to Mirpur Purāna.
 - (ii) From Landhi canal bungalow (39th mile Jāmrao) to Khipro via Jhol and Lun Khān.
 - (iii) From Khipro to Ghulām Bhurgari.
 - (iv) From Mirpur Khās to Tando Ghulām Ali via Umarmot, Nabisar, Wango, Dadah and Mātli.
 - (v) From Mirpur Khās to Tando Ghulām Ali via Mir Wāh Gorchūni, Digri and Dumbalo.
 - (vi) From Digri to Dadah.

The party completed 205 miles of primary, 2,793 miles of secondary and 13,889 miles of tertiary levelling; of which 2,479 miles of secondary and all the tertiary levelling were done for Local Governments.

MAGNETIC SURVEY.

47. No. 18 Party.—Magnetic.—The declination, horizontal

- PERSONNEL.**
Class I Officer.
 Mr. E. C. J. Bond, V.D., in charge.
Class II Officers.
 Mr. Nikunjo Ronjon Mazumdar.
 „ Jiya Lal Sahgal.
Upper Subordinate Service.
 2 Officers.
Lower Subordinate Service.
 1 Magnetic Observer.
 9 Computers, etc.

force and vertical force magnetographs were in operation throughout the year at the Dehra Dūn and Toungoo observatories and daily absolute magnetic observations were taken regularly by the observers in charge. The observatories were visited during the field season and declination, dip, and horizontal force

observations were taken for the comparison of instruments.

The Kodaikānal and Alibāg observatories, under the control of the Meteorological Department, were also visited for the same purpose.

Observations at Repeat Stations.—Magnetic observations were taken this field season at the six repeat stations, Quetta, Karāchi, Bina, Dibrugarh, Barrackpore and Waltair; these observations are intended to supplement the 5-yearly observations at all repeat stations so that the annual changes in the magnetic elements may be accurately determined.

Publication of the results of the magnetic survey.—The results of the observations at the observatories, repeat and field stations, reduced to the epochs 1909·0 and 1920·0 are now under publication.

The magnetic elements at the observatories.—The computation and tabulation of the values of declination, dip, horizontal force and vertical force for the three observatories—Dehra Dūn, Toungoo and Kodaikānal—for the year 1922 have been completed; the mean values of these elements derived from all days, excluding those of great disturbance are given in the table below:—

MEAN VALUES OF THE MAGNETIC ELEMENTS AT OBSERVATORIES IN 1922.

Observatory.	Latitude & Longitude.	Dip.	Declination.	Horizontal Force.	Vertical Force.
				C. G. S.	C. G. S.
Dehra Dūn ...	(30 19 19 N) (78 3 19 E)	N 45 8·6	E 1 43·2	·32927	·33091
Toungoo ...	(18 55 45 N) (96 27 3 E)	N 23 7·2	W 0 29·7	·30156	·16717
Kodaikānal ...	(10 13 50 N) (77 27 46 E)	N 4 40·1	W 1 58·7	·37878	·03093

PART 3.—OFFICE WORK.

I.—HEAD QUARTER OFFICES.

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

SUPERINTENDENT { Lt.-Col. E. T. Rich, C.I.E., R.E., up to 31st Oct. 1922.
 Lt.-Col. E. A. Tandy, R.E., from 22nd Oct. 1922 to 7th. June 1923.
 Lt.-Col. A. A. McHarg, D.S.O., R.E., from 8th June 1923.

48. Brief reports of the work carried out during the year under review in the six offices administered by the Map Publication Office are given in paras. 50 to 54, 62, 63, 74 and 75.

PERSONNEL.

Class II Officer.

Mr. Pramsadaranjan Ray, B.S.

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 88 modern sheets have been published.

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.*	Total.
1906-14	421	266	349	1,036
1914-15	97	48	9	154
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	13	83
Total published ...	758	586	567	1,911
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	561	473	1,945
Approximate number remaining for publication ...	483	879	997	2,359
Approximate number of public one-inch sheets in India	2,152	2,029	2,037	6,218

* Includes Burma Circle.

In addition to the above, preliminary editions (in colours) of 15 one-inch sheets, prepared from modern revenue surveys, have been published during the year pending their topographical revision.

173 modern one-inch, 13 preliminary editions, 2 provisional issues of one-inch, and 122 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 now forms the *tactical* map of India, having taken the place of the quarter-inch maps in this respect. It was commenced in 1914; 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
Totals	373	42	415
Approximate total number of half-inch sheets in India	.....	.....	1,630

26 modern and 1 preliminary 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.*	Total.
1911-14	9	5	7	21
1914-15	1	3	3	7
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	6	10
1922-23	10	8	2	20
Totals	27	23	41	91
Approximate number of "degree" sheets in India	170	140	140	450

* Includes Burma Circle.

7 preliminary sheets in colours from comparatively modern surveys have been published and 17 modern and 8 preliminary sheets are at press.

In addition to the above, 46 modern and 9 preliminary public quarter-inch sheets have been reprinted during the year.

24 quarter-inch sheets have been prepared in No. 1 Drawing Office from the old engraved quarter-inch Atlas sheets brought up to date and published (in black only) as provisional issues; and 27 of such sheets, which were published previously have been reprinted during the year. These "provisional" quarter-inch sheets, including those in hand, now cover the greater part of the area of India for which modern "degree" sheets are not likely to be available for some time.

(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 1 new sheet of this series has been published, 6 sheets have been engraved and 20 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. 12 sheets have been published up to date.

(e) Geographical Maps on the 1:2,000,000 scale.—(*Vide* Index map No. 7).—1 map of this series was reprinted during the year.

(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 8 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 reprinted with corrections during the year; 5 provincial maps and the map of India showing railways, canals and roads without corrections (on the scale of 1 inch = 32 miles) have been reprinted.

Numerous special maps have also been prepared and printed for the Army, for Local Governments, Railways and for other Departments.

Two new sheets Nos. 18 & 19 of the Calcutta and Howrah Town Guide Map, scale 12 inches = 1 mile, have been published during the year and one sheet (No. 12) has been reprinted.

Plan of City of Calcutta on scale 3 inches = 1 mile has also been reprinted during the year.

50. Map Record and Issue Office.—During the year the

PERSONNEL.	issues of maps to Government
<i>Class I Officer.</i>	officials and sales to the public con-
Major F. F. Hunter, D.S.O., I.A., in	tinued to increase.
charge.	

A diagram showing the values of maps issued during the past 10 years will be found on the opposite page.

1,178,461 maps, plans, diagrams, etc., valued at Rs. 4,63,453, were issued during the year, which may be compared with 359,917, valued at Rs. 2,11,014, issued in 1913-14.

A satisfactory feature is the increased demand for maps from the general public to whom the numbers issued by this office in 1922-23 were 219,746 valued at Rs. 83,724 as compared with 104,750, valued at Rs. 62,075 issued last year.

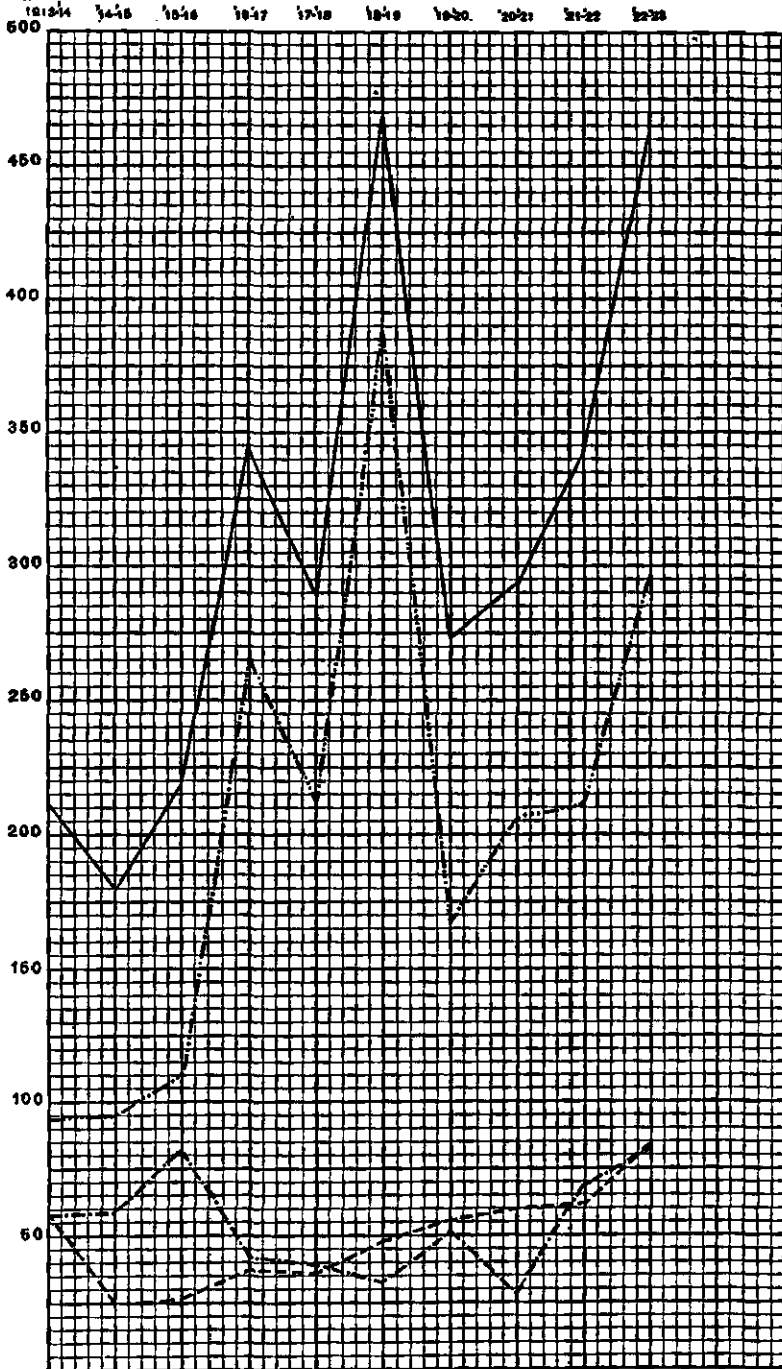
This increase is due to modest advertisements in the press as far as was possible within a limited budget provision.

A new and simplified Catalogue was published; this included extract specimens of most classes of maps published by the department.

The reorganization of the map record room continued; and arrangements have been completed for storing every modern sheet in some kind of enclosed rack. 67 steel racks, fireproof and enclosed, containing 808 shelves have been erected to date.

Rupees
in thousands

DIAGRAM SHOWING ISSUES AND SALES OF MAPS IN RUPEES



Res. No. 3324. D 23

REFERENCE.

- Cash sales
- Free issues to Govt. Officials
- Book-debit sales to Govt. Officials
- Grand total

Many maps previously mislaid in the past, on account of unsatisfactory storage, have been recovered and properly listed.

The branch office at 5, Esplanade East, Calcutta, continues a success.

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.
1922-23	Departmental Maps.	224,895	2,04,398	51,991	59,765	46,547	79,128	323,433	3,43,291
	Extra-departmental Publications.	669,747	92,581	167,755	23,959	17,526	3,842	855,028	1,20,162
	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
1920-21	Total ...	1,593,868	2,06,402	136,728	59,568	56,824	28,175	1,787,420	2,94,145

Total number of requisitions and enquiries for maps received in the Map Record and Issue Office.

Year 1920-21	...	...	...	...	7,974
" 1921-22	...	...	...	...	8,868
" 1922-23	...	...	..	...	8,860

Table III.—Publications received in Map Record & Issue Office, during the year 1922-23.

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	...	9	7,254	8,080
GEOGRAPHICAL MAPS.					
Southern Asia Series ...	1:2,000,000	...	1	225	307
India and Adjacent Countries Series.	1:1,000,000	1	20	10,880	16,320
TOPOGRAPHICAL MAPS.					
Quarter-inch, (Modern) ...	1"=4 miles	32	46	30,729	45,316
Do. (Preyl.) ...	1"=4 miles	7	9	4,150	6,225
Do. (Provl.) ...	1"=4 miles	24	27	11,200	13,375
Half-inch, (Modern) ...	1"=2 miles	74	26	38,908	1,15,974
Do. (Preyl.) ...	1"=2 miles	...	1	867	2,601
One-inch, (Modern) ...	1"=1 mile	81	173	176,816	2,61,156
Do. (Preyl.) ...	1"=1 mile	15	13	7,992	11,975
Do. (Provl.) ...	1"=1 mile	1	2	2,433	3,550
Old Style sheets ...	Various	...	122	16,720	27,159
SPECIAL MAPS.					
District Maps ...	1"=4 miles	...	1	100	150
Administration Report Maps ...	1"=8 miles	...	10	1,060	390
Provincial Maps ...	Various	...	5	2,125	4,947
Plans of Cities and Cantonments...	Various	2	2	1,700	743
Index Maps ...	Various	...	119	190,734	17,152
Miscellaneous Maps ...	Various	18	9	18,700	9,551
Total ...	.....	255	595	522,583	5,44,971
EXTRA-DEPARTMENTAL.					
Maps ...	Various	95	81	144,864	42,739
Plans and Diagrams ...	Various	689	19	173,364	23,676
Illustrations ...	.....	220	3	81,067	16,644
Miscellaneous ...	.....	230	78	369,706	18,812
Total ...	.....	1,234	181	769,001	1,01,871
Grand Total ...	.....	1,489	776	1,291,584	6,46,842
B.—From the Trigonometrical Survey Office, Dehra Dūn.					
Various ...	Various	6	13	4,221	5,852

C.—LETTERPRESS.

1. Survey of India General Report, 1921-22. Price Rs. 2 or 4s.
2. Catalogue of Maps published by the Survey of India, 1923. Price Rs. 1 or 2s.
3. Routes in the Western Himalaya, &c.. Volume I, Pūnch, Kashmir and Ladakh, &c., by Major K. Mason, M.C., R.E. 1922. Price Rs. 6 or 12s.

PERSONNEL.

Class I Officers.

Lieut.-Colonel A. A. McHarg, D.S.O.,
R.E., in charge from 1st May to 7th June
1923.

Mr. J. Prasad, R.B., in charge to 30th April
1923 and from 8th June 1923.

Class II Officers.

Mr. P. Williams.
„ Abinash Chunder Bose.
„ C. West.
„ A. B. Hunter.
„ Priya Nath Sur.
„ F. B. Kitchen.
„ Munshi Lal, B.A.
„ H. T. Hughes.
„ P. C. Mitra, B.A.

51. No. 1 (Head Quarters)
Drawing Office.—The organiza-
tion of the office remained sub-
stantially the same as last year.

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

(1) *The Compilation Section.*—(a) “La Carte Internationale
du Monde au 1,000,000”.—

Nine sheets were reported in hand last year; no new sheet was taken up this year. Of the nine sheets, one sheet has been completed and sent in for publication. Three have been completed and are about to be sent to press, contour pattern of one sheet and outline patterns of two sheets have been completed and sent to the Engraving Office. Contour patterns of the remaining two are in hand.

- (b) The Southern Asia Series, scale 1:2,000,000.—Of the seven sheets reported in hand last year, two have been completed and sent in for publication, complete outline and contour patterns of three have been sent to the Engraving Office. Of the remaining sheets, outline pattern of one is under examination and a part of outline pattern of the other is in hand. No new sheets were taken in hand during the year under report.

The original of the helio. edition of one sheet has been brought up to date and sent to press for reprint.

- (c) India and Adjacent Countries, scale 1:4,000,000.—Final proofs have been passed and sent to the Engraving Office.

(d) *Miscellaneous.*—

- (i) Preparation of the new 50-mile Wall Map of India was taken in hand during the year under report.
- (ii) Minor corrections to 2,021 stock copies of modern maps were carried out for the Map Record and Issue Office.

OFFICE WORK.—HEAD QUARTER OFFICES.

- (iii) Various indexes for the Catalogue have been brought up-to-date.
- (iv) Indexes for the General Report have been completed.

(2) *The "One-Millionth" Section.*—

- (a) Engraved editions.—Eight sheets were reported in hand at the close of last year and three new sheets were taken up during the year. Of these eleven, two were completed and sent in for publication, one is ready for press, outline patterns of three have been completed and sent to the Engraving Office, and outline patterns of the remaining five are in hand.

Patterns for three sheets were prepared and sent to the Engraving Office for correction of plates for reprint.

- (b) Helio. editions.—Outline original of one sheet in hand has been completed and contour original is in hand.
- (c) Reprints.—Originals of six sheets have been brought up to date and sent to press for reprint. One is in hand.
- (d) Miscellaneous.—The border specimen for 1/M sheets (helio. edition) has been revised and published, patterns of twenty-six standard indexes have been prepared and sent to the Engraving Office for correction of plates and traces of nine and originals of three other miscellaneous maps have been prepared.

(3) *The Quarter-Inch Section.*—

- (a) Original compilation and drawing.—At the end of the last year there were eleven $\frac{1}{4}$ -inch sheets in hand; no new sheet was taken up during the year under report. Of these eleven, seven have been completed and sent in for publication, three sheets are in hand; work on one was stopped under the orders of the Surveyor General.

(b) *Miscellaneous.*—

- (i) Stump-shaded originals of ninety-one sheets were prepared and sent in for publication. Those of three quarter-inch sheets and of the 50-mile Wall Map of India are in hand.

- (ii) Press order proof corrections have been inserted on the original fair sheets of seventeen modern topographical maps.
- (iii) Various corrections have been carried out on the originals of thirty-seven sheets.
- (iv) The drawing of the "Vivid Map of India" for the British Empire Exhibition on the sixteen-mile scale is in hand.

(4) *The Reprint Section.*—

- (a) Seventy-eight old style one-inch sheets (including seventeen sheets in hand at the close of last year) were brought up-to-date and sent to press for reprint, seven sheets remain in hand.
- (b) Ten one-inch sheets were corrected to modern graticules, brought up-to-date and sent to press for reprint; modernisation of nine sheets is still in hand.
- (c) Forty-four one-inch and half-inch sheets were corrected to modern graticules and sent to press for supply of blue prints to parties for revision survey.
- (d) Eighteen provisional quarter-inch sheets (including eleven in hand at the close of last year) were compiled from Indian Atlas sheets and sent to press for publication. This completes the programme of compilation of quarter-inch sheets from Atlas material.
- (e) Thirty provisional quarter-inch sheets compiled from Indian Atlas material (including eleven in hand at the close of last year) were brought up-to-date from office copies and sent to press for reprint.
- (f) One Indian Atlas sheet and twenty-three miscellaneous maps have been brought up-to-date from office copies and sent to press. Six sheets are still in hand.

(5) *The Mapping Section.*—

- (a) One hundred and fifteen modern topographical sheets (including seven in hand at the close of last year) were corrected and brought up-to-date from office copies and sent for reprint. Two sheets remain in hand.

OFFICE WORK.—HEAD QUARTER OFFICES.

- (b) Press order proof corrections have been carried out on the original fair sheets of one hundred and thirty-seven modern topographical sheets (including ten in hand at the close of last year); two sheets remain in hand.
- (c) The original of the 64-mile Railway Map of India was brought up-to-date and sent for reprint.
- (d) Black prints of plane-table sections of twenty-six sheets were pasted together for supply of blue prints to various parties.
- (e) Forty-seven fair, and print original, sheets and colour patterns of various special maps (including seven in hand at the close of last year) have been completed and sent to press. These include maps prepared for census, railway, commercial, military and other departments. Four miscellaneous cases are still in hand.

(6) *The Office Copy Section.*—

- (a) Additions and corrections received from various local authorities, have been entered on the existing "office copies" of 2,214 sheets. 718 "office copies" of newly published or reprinted sheets have also been prepared during the year.
- (b) The areas of 196 newly published one-inch and half-inch sheets were 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 with a view to bring their "office copies" 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.

210 cases pertaining to 309 sheets have been examined during the year; six cases pertaining to six sheets remain in hand.

In addition to the above current work this section supplied scientific data to various officials, kept up corrections to Imperial Gazetteers,

examined projections of sheets on copper plates in the Engraving Office, checked geographical names in various Survey of India publications, drafted correction slips to the topographical hand-book and tables, conventional signs, &c. The alphabetical index to names for the new 50-mile Wall Map of India is in hand.

PERSONNEL.

Class I Officers.

• Lieut.-Colonel A. A. McHarg, D.S.O.,
R.E., in charge from 1st May to 7th
June 1923.

Mr. J. Prasad, R.B., in charge to 30th
April 1923 and from 8th June 1923.

52. Engraving Office.—

(1) *Engraving Section.*—This section has been employed on the following during the year—

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

Out of the five sheets in hand last year, two are in their final stage and will very shortly be sent in for publication, two are nearing completion, and one is well advanced. One new sheet was projected and has progressed as far as completion of outline, and another new sheet was projected and is awaiting material.

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

Out of the seven sheets in hand, two are in their final stage, and will be sent in for publication very shortly; two are very nearly completed; and two are well advanced; the remaining one is in a preliminary stage. No new plates were projected.

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

Out of six sheets in hand last year, one (North Tibet) will very shortly be ready for publication. The work on one (Koko Nor) was stopped awaiting fresh material from No. 2 Drawing Office. One (Brahmaputra) was nearing completion, but portions have to be re-engraved to incorporate new work received from No. 2 Drawing Office. One (Calcutta) has been partly completed and awaiting material; two (Bombay and Delhi) are well advanced. One new sheet (Kashmir) was projected and outline completed.

(d) The miscellaneous work has been very heavy. Corrections and additions to 1/4M India have been completed, and final proofs are in hand. Office copy corrections are being carried out on all the maps of India on different

scales, as also on the complete set of the 32-mile Indices. Two Commission forms for officers in the Indian Hospital Corps in English and Urdu and in English and Hindi have been engraved and an inset of the British Isles for the 32-mile map of India was drawn for reproduction. Six titles on photogravure plates for the Geological Survey of India were engraved as well as a new title plate for 1/M sheets. Two new pages have been added to the Copy Book of Lettering. Ten district maps and the table of Conventional Signs have been corrected and brought up-to-date. Compilation of various insets and colour scheme for the 50-mile Wall Map of India is progressing.

- (2) *Copper Plate Printing Section.*—29,191 impressions were pulled during the year, against 29,876 during the preceding year. 44 % of this work was extra-departmental, consisting of photogravures, charts, commission forms and certificates. Of the departmental work about 33 % consists of scales, and the rest transfers, art paper prints and prints from various plates, such as Atlas sheets, district maps, etc.

In the Electro-typing section 96 plates were dealt with.

53. Photo.-Litho. Office.—The main feature of the year

under report is the increased out-turn of the office—the figure which best represents the out-turn being the number of impressions pulled in the Litho. Branch. This figure this year reaches 4,035,405 (*vide* column 2 of Table B). This figure has only been surpassed on two occasions, *viz.*, in 1917-18 (4,796,813) and in 1918-19 (4,248,913). The increased out-turn this year is due to the fact that a large number of maps were reprinted for mobilisation purposes for the Chief of the General Staff.

As a result of economies during the past year the cost of the office (column 2 of Table A) has been reduced by over Rs. 40,000 as compared with 1921-22, while the “profits,” arrived at by deducting the total cost of the office, including European stores, from the value of the out-turn, amount to Rs. 1,59,640 against Rs. 90,596 in 1921-22.

PERSONNEL.

Class I Officer.

Major F. J. M. King, B.E., in charge.

During the year the *Type Section* has cleared off practically all its arrears and this has been accomplished partly by the curtailing of a number of forms formerly printed in the section and partly by the installation of a ruling machine which has been running during most of the year.

The following tables briefly summarise the work of the office during the last 3 years:—

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>			
1920-21	2,70,193	4,77,839	625	2,546	3,171
1921-22	3,05,038	5,37,535	666	2,993	3,659
1922-23	2,64,415	5,71,286	956	2,760	3,716

* 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.
1920-21	3,736,999	237,976	501,265	3,429	2,034,962	3,609,532
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

TABLE C.—PHOTO. BRANCH.

	1920-21.	1921-22.	1922-23.
Negatives	5,786	5,894	5,604
Zinc plates	7,591,	7,395	7,078
Photogravure plates	} 490	} 475	} 605
Half-tone blocks			
Line blocks			

54. Mathematical Instrument Office.—During the year

PERSONNEL.

Mr. T. A. Ferrior, C.B.E., in charge to 14th February 1923.

Mr. S. Woodhouse, in charge from 15th February 1923.

from 1st April 1922 to 31st March 1923, there was an increase in the demands made on this office for instruments, &c., (*vide* item 1 in

para. 2 below) and the Store Section of the Office made a profit of Rs. 63,358 against a profit of Rs. 47,044 in 1921-22. There was also an increase in the value of work done (*vide* item 6 in para. 2 below) and the Workshop Section of the Office made a profit of Rs. 39,718 against a loss of Rs. 38,910 in 1921-22.

2. The following table shows the usual comparative figures for the last three years:—

	1920-21.	1921-22.	1922-23.
	Rs.	Rs.	Rs.
1. Total issues of stores to Public Offices as shown in the Profit and Loss statements.	4,74,911	5,32,768	6,25,953
2. Value of repairs to instruments received for repairs and returned in serviceable condition.	96,089	1,18,445	1,70,010
3. Value of instruments received from Government Officers when no longer required.	70,484	58,743	83,933
4. Book value of the stock of instruments, &c., in Serviceable Stores.	5,06,988	6,91,499	5,75,844
5. Book value of the stock of instruments, &c., in Repairable Stores.	1,07,873	1,25,646	1,26,616
6. Total value of work done in the Workshop.	4,81,809	4,20,408	4,89,329
7. Value of instruments manufactured in the Workshop for Serviceable Stores.	1,82,644	1,76,123	1,68,588
8. Value of instruments purchased locally	41,063	11,296	22,840
9. Value of instruments and materials obtained from England through the Director General of Stores.	2,98,795	4,58,016	2,20,650
10. Average No. of employees and their pay	No. 618 Rs. 1,77,655	No. 628 Rs. 1,93,658	No. 554 Rs. 1,88,009

3. During the year the stock of all the three stores (the Serviceable, the Repairable and the Material Stores), was twice taken as usual and the discrepancies found were duly adjusted.

II.—DEHRA DUN OFFICES.

TRIGONOMETRICAL SURVEY OFFICE.

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

PERSONNEL.

Class I Officers.

Dr. J. deGraaff Hunter, Sc.D., M.A.,
F. Inst. P., in charge from 27th November
1922.

Major C. M. Thompson, I.A., in charge to
26th November 1922.

Class II Officer.

Mr. Hanuman Prasad, B.S.
Upper Subordinate Service.

1 Officer.

to be carried out this year in compliance with extra-departmental requests. Special mention may be made of a requisition for the rectangular co-ordinates of over 5,000 points, and of another from the Director of Wireless Telegraphy requiring the preparation of data for the construction of a map of the world for the use of the Air Service. Hayford corrections were computed for a number of pendulum stations. The Talcott observations for latitude made last year by Bt.-Major K. Mason, M.C., R.E., at Gogipatri, Poshkar, Zebanwan and Reban in Kashmir, were completely reduced.

The form of the geoid (sea level surface) in India has been deduced from all the deflection results obtained by the Survey of India, and exhibited by means of contours on a $\frac{1}{5M}$ map. This shows the elevation of the geoid from the spheroid of reference. The desirability of such representations of the geoid for all geodetically surveyed portions of the globe has been pointed out by the International Geodetic Association.

The preparation of a revised and extended 5th edition of the Auxiliary Tables of the Survey of India is in progress. Part III, of which a small edition was printed last year, has been further supplemented by 13 new tables, and a full edition of this part is in course of printing. The professional forms of the department are being revised. 24 forms have been remodelled up to date.

The list of the protected stations of the Trigonometrical Survey numbering 4,000, was scrutinized and amended with a view to effecting economy in the maintenance of these stations.

250 requisitions for data from departmental and non-departmental officials were complied with.

Triangulation pamphlets were compiled for 61 degree sheets. These include 48 of Mesopotamian triangulation.

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

1. Records of the Survey of India, Volume XVI, 1920-21.

2. Records of the Survey of India, Volume XVII—Memoir on the Maps of Chinese Turkistān and Kansu, (Sir A. Stein, K.C.I.E.).
3. Tide-tables for Indian Ports, 1924.
4. 28 Triangulation pamphlets.
5. Levelling pamphlets 63 and 78.
6. Auto-stereo plotter, a translation from the French of Paul Corbin (Lt.-Col. H. McC. Cowie, R.E.).
7. Levelling of Precision in Mesopotamia.
8. Catalogue of books in the Library of the Trigonometrical Survey Office.

The following are in hand :—

- (i) Records of the Survey of India, Volume XVIII, 1921-22.
- (ii) Records of the Survey of India dealing with the Magnetic Survey of the country.
- (iii) Levelling pamphlet 79.
- (iv) Hand-book of Topography, Chapters II and III (both revised).
- (v) Type book of the Trigonometrical Survey Office.

Observatories.—Meteorological observations were continued as usual, and the Omori Seismograph was in operation throughout the year. The time at which meteorological observations are taken has been changed from 14 hours to 10 hours.

Photographs of the sun were taken on 306 days, the sun being obscured during the remaining days of the year.

Preservation of Trigonometrical Stations.—658 stations were repaired by district officers at a cost of Rs. 3,558. Out of 361 districts from which reports were due, 23 failed to make returns.

56. No. 2 (Dehra) Drawing Office.—During the year the

PERSONNEL.

Class I Officer.

Lieut.-Colonel L. C. Thuillier, I.A., in charge.

Class II Officers.

Mr. H. B. Simons.

" Rama Prasad Ray, B.A.

" J. McCracken, M.B.E.

Upper Subordinate Service.

3 Officers.

work of the office was carried on by six sections. Owing to retrenchment at the beginning of the year, the Cantonment mapping section was abolished and the work handed over to the half-inch section. Towards the end of the year, a new section was formed to draw the levelling charts of the Sutlej Valley Irrigation project of the Punjab Government. This work is being done on payment.

(1) *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 the section, 48 miscellaneous maps, charts and diagrams were dealt with and 351 sheets of cantonment plans hand-coloured.

(2) *The Compilation Section.*—Deals with the compilation and fair-mapping of geographical maps on different scales. Two fair sheets on the 1/M scale shown as in hand last year, were completed and sent to press. Four sheets of rough compilation on the 1/M scale were in hand at the end of last year, and one more sheet was taken up during the year; of these, one has been completed and is being fair-mapped and four are in hand. Of the rough compilation of sheets on the 1/2M scale 2 were in hand at the end of last year and one was taken up during the year; of these, two have been completed and sent to Calcutta, to be engraved and one remains in hand. The stump-shading of two sheets was in hand at the end of last year, and three more were taken up during the year; all these have been completed during the year. Three half-inch sheets shown as in hand in this section last year, have been completed and sent to press during the year. Two sheets of Sir H. H. Hayden's Tibet map and one sheet of Mount Everest map were taken in hand during the year; of these, two sheets have been fair-mapped and one of the former is still in hand. Materials for the rough compilation of five sheets of the map of Tibet on the scale of 1 inch = 8 miles are being collected.

(3) *The Stein's Section.*—Deals with the fair-mapping of Sir Aurel Stein's explorations in Chinese Turkistān and Kansu in 1900-01, 1906-08 and 1913-15. The remaining two sheets out of the 48 sheets of this series, have been published during the year. The fair-mapping of one special map sheet shown as in hand last year is still in progress, nearing completion. Eleven special triangulation charts and one levelling chart of this area shown as in hand last year, have all been fair-drawn and published during the year.

(4) *The Half-inch Section.*—Deals with the fair-mapping of half-inch sheets. All the thirteen sheets shown as in hand last year have been completed and sent to press during the year. This section has also completed the fair-mapping of five cantonment plans, and eleven further plans are in hand. Two of the plans have been combined into one and this makes up the total of 17 shown as in hand last year. This section

also took up the stump-shading of 4 sheets, of which 3 have been completed and one is in hand.

(5) *The Examining Section.*—Examines the majority of the important sheets drawn in this office. 129 sheets have been examined during the year (including the 34 sheets shown as in hand last year) and 22 sheets are in hand.

(6) *The Sutlej Valley Project Section.*—Was formed towards the end of the year under report to deal with the fair-drawing of the levelling charts (showing spot heights and contours) for the Sutlej Valley Irrigation project of the Punjab Government. Materials for 136 sheets have been received; and of these, 6 sheets have been fair-drawn and sent to press leaving a balance of 130 sheets in hand.

(7) *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.

The following is the summary of the work of the office during the year 1922-23.

Class of maps.	Balance of sheets on 1st October 1922.	Sheets received in 1922-23.	Sheets sent to press in 1922-23.	Balance of sheets in hand on 1st October 1923.	REMARKS.
Triangulation charts ...	17	23	26	12(a)	(a) Drawing of two charts stopped.
Levelling charts, scale 1/M	1	3	2	2	
Index charts to illustrate reports.	1	7	6	1(b)	(b) Publication of one index stopped.
Cantonment plans for publication.	34	67	26	75	
Cantonment plans for correction.	11	222	213(c)	20	(c) Corrections carried out in both originals and office copies.
Cantonment plans fair-drawing.	17	1	5	12(d)	(d) Two plans have been combined into one.
Forest maps of Indian States for publication.	...	15	...	15	
Miscellaneous maps, charts and diagrams.	21	40	57	4	
Colour guides of cantonment and other maps.	155	398	351	202	
Half-inch sheets ...	16	...	16	...	

Summary of the work of the office-during the year 1922-23. (concl'd.).

Class of maps.	Balance of sheets on 1st October 1922.	Sheets received in 1922-23.	Sheets sent to press in 1922-23.	Balance of sheets in hand on 1st October 1923.	REMARKS.
GEOGRAPHICAL MAPS.					
Fair sheets, scale 1/M ...	2	1	2	1	
Rough compilation, scale 1/M.	4	1	1(e)	4	(e) Being fair-mapped.
Rough compilation, scale 1/2M.	2	1	2(f)	1	(f) Sent to Calcutta for engraved edition.
Stamp-shading, various scales.	2	7	8	1	
Sir H. H. Hayden Tibet maps.	...	2	1	1	
Mount Everest map ...	...	1	1	...	
Sutlej Valley project level and contour charts, scale 1 inch = 4 miles.	...	186	6	180	
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	

Photo.-Zinco. Section.—During the year 1922-23 the work undertaken comprised:—

Cantonment plans.

Indexes and Triangulation charts.

Forest maps.

Maps illustrative of Sir Aurel Stein's explorations.

Map illustrative of Sir H. H. Hayden's explorations.

Miscellaneous maps.

Extra-departmental maps.

The following table shows the work done in the last three years:—

Years.	No. of Subjects.	No. of Negatives.	No. of Pulls.	No. of Chocolate and Bromide prints.
1920-21 ...	1,480	1,911	486,996	447
1921-22 ...	1,480	2,028	305,415	...
1922-23 ...	1,719	1,580	318,229	1,198.

57. Forest Map Office.—The strength of the office was

PERSONNEL.

Class I Officer.

Lieut.-Colonel L. C. Thuillier, I.A., in charge.

Class II Officers.

Mr. H. P. D. Morton.

„ Asmat-ullah Khan, K.B.

„ T. F. Kitchen.

„ Nanak Chand Puri, B.A., R.S.

Upper Subordinate Service.

2 Officers.

reduced during the year by half, but its organization remained substantially 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 1922.	Received during the year.	Drawn and sent for publication during the year.	In hand on 30th September 1923.	Published during the year.	Total number of copies printed.
(a) ...	2	51	38	20	67	} 21,686
(b) ...	54	45	58	41	80	
(c) ...	11	4	18	2	17	
(d) ...	...	41	38	3	38
(e) ...	...	4	2	2	1
(f) ...	82	7	14	25	17	
(g) ...	...	8	6	2	3
Total 1922-23.	99	160	*164	95	218	
Total 1921-22.	...	176	*214	...	199	28,551

* 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 455 maps and colour specimens of 62 maps were prepared; corrections to 204 sheets were completed, 69 office copies were coloured up and 1,704 sheets were hand coloured for issue on indent. In addition this section corrected the forest information on 328 maps for the various Survey of India drawing offices requiring them for compiling the half-inch and degree sheets.

(3) *The Map Record Section.*—The number of maps, diagrams and original fair sheets received for storage was 12,881; 3,675 maps, etc., valued at Rs. 9,347 were issued gratis. Sales by book-transfer to Government departments amounted to Rs. 3,137 for 1,027 maps; these figures show a decrease of 1,787 maps and Rs. 2,568 from those for last year. Cash sales to the public amounted to Rs. 2,035 for 902 maps, a decrease of Rs. 304 from the amount realized the previous year.

(4) *Book-Binding Section.*—This section dealt with 267 volumes for the Forest Research Institute, the value realized by book-transfer and cash being Rs. 681.

As the working arrangements of this section were not proving entirely satisfactory, and in anticipation of having to retrench its personnel, it was closed down in the month of January so far as the binding of books for the Forest Research Institute was concerned, and its activities were confined to departmental work. 2,616 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 Officer of the South Raipur Forest Division, the area statements of the reserved forest areas in 109 four-inch sheets were revised.

The re-indexing and the preparation of the list of all the forest triangulation and traverse data referred to in last year's report, could not be completed during the year, owing to a large number of loose computation records being found, entailing a great deal of labour in arranging, binding and labelling.

The Catalogue of maps published in 1916 by the Forest Map Office has been revised and sent to press.

III.—CIRCLE AND LOCAL DRAWING OFFICES.

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

PERSONNEL
Class I Officer.
 Mr. J. A. Freeman, in charge.
Class II Officers.
 Mr. E. B. West.
 „ A. A. Graham.
Upper Subordinate Service.
 1 Officer,
Lower Subordinate Service.
 • 49 Surveyors, etc.

year 24 two-inch sheets out of 26, 54 one-inch sheets out of 93 and 3 half-inch sheets out of 10 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 drawn in the Circle Drawing Office, and have been submitted for publication during the year.

Modern material available.—The fair-mapping of 15 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 19 half-inch sheet areas, of which some of the component two-inch or one-inch sheets though surveyed have not been published. The material for these areas will soon be available for half-inch mapping. —

Quarter-inch sheets compiled from modern one-inch and half-inch sheets.—During the year 9 quarter-inch sheets were fair-mapped and submitted for publication.

Modern material available.—There are 8 quarter-inch sheets of which the component one-inch or half-inch sheets have been published, and the fair-mapping of all of these is in hand. There are, besides the above, 8 quarter-inch sheet areas of which the component two-inch, one-inch and half-inch sheets though surveyed have not been published.

Special maps.—During the year the Town-Guide map of Lucknow in 4 sheets, the Khaur Oil Fields map in three sheets on the sixteen and eight-inch scales respectively were prepared and submitted for publication.

The colour patterns of 5 Town-Guide, Environs, and Western Jumna Head Works maps, on the twelve-inch, four-inch and eight-inch scales respectively, were prepared and submitted for publication.

Hill-shaded sheets.—40 one-inch, half-inch and quarter-inch sheets were stump-shaded and submitted for publication.

Layer guides.—Nil.

Colour patterns and press order proofs.—Press order proofs and colour patterns of 98 sheets were submitted for publication.

Miscellaneous.—The traverse plots of “mauzas” in 4 sheets of Gondā district, on the sixteen and thirty-two-inch scales, and enlargements of Mawai and Bāpōni villages of Jhānsi district, on the sixteen-inch scale, were supplied, and the cost of preparation recovered from the Deputy Commissioners of Gondā and Jhānsi.

For the purpose of reprint the office copies of 4 sheets were corrected and submitted for publication.

Record Section.—Triangulation data for 12 degree sheets were completed but their final disposal has been delayed pending the issue of revised instructions for the preparation of triangulation pamphlets.

The staff of computers was considerably reduced during the year.

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

PERSONNEL.
Class I Officer.
 Mr. J. O'B. Donaghey, in charge.
Class II Officers.
 Mr. E. Claudina.
 „ Haji Abdul Rahim, K.B.
Upper Subordinate Service.
 4 Officers.
Lower Subordinate Service.
 46 Draftsmen, etc.

year 44 one-inch and 8 half-inch sheets previously surveyed and mapped, 1 one-inch sheet previously surveyed and partly resurveyed during the year and 9 one-inch sheets surveyed during the year were received from parties before the 30th September

1923 and were finally examined and submitted for publication. There are no arrears.

Half-inch sheets compiled from modern one-inch sheets.—7 sheets were mapped and submitted for publication. There are 11 sheets in hand of which 1 will shortly be submitted for publication.

Modern material available.—The material for 3 half-inch sheets has been received but the mapping has not yet been commenced. In addition there are 11 half-inch sheet areas of which the component one-inch sheets have been submitted for publication but not yet published, and 11 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 7 sheets in hand of which 1 is ready for despatch.

Modern material available.—There are 4 quarter-inch sheet areas of which the component half-inch sheets have been submitted for publication, 6 quarter-inch sheet areas of which the component half-inch sheets

have not all been submitted for publication and 5 quarter-inch sheet areas completely surveyed but of which the mapping of the component half-inch sheets has not yet been commenced.

Reprint sheets.—The correction of 1 quarter-inch sheet was completed and the sheet was submitted for publication. There are no reprint sheets in hand.

Colour patterns.—Were prepared for 56 sheets and submitted for publication.

Hill-shaded sheets.—Were prepared for 44 sheets and submitted for publication.

Layer guides.—Nil.

Photo.-Zinco. work.—

Number of reproductions	...	...	...	318
" " enlargements	...	...	...	135
" " reductions	...	...	...	429
" " vandyke plates prepared	...	...	...	268
" " prints pulled	...	...	...	10,797

Work for private individuals on cash payment was done to the value of Rs. 135.

Special maps.—A four-inch military map of Būshire (Persia) was finally examined and submitted for publication. 8 two-inch sheets of the special forest survey of Hyderābād (Deccan) surveyed and mapped during the year have been finally examined and submitted for publication. 4 one-inch special forest sheets of the Indore State previously surveyed and mapped and 5 similar sheets surveyed and mapped during the year by No. 5 Party have been finally examined and submitted for publication.

The preparation of a road map of Bangalore on the three-inch scale is in hand.

Triangulation charts and computations.—Seven triangulation pamphlets and charts were prepared during the year and are ready for despatch to the Superintendent of the Trigonometrical Survey when called for by him. Material was extracted and supplied to (a) the parties of this circle, (b) the Northern Circle and (c) the Land Records of the Bombay Government. Material was also extracted and supplied to a private individual on cash payment to the value of Rs. 47. The work of revising the register of all triangulation and traverse records in this office is in hand.

Miscellaneous.—Preparation of Index maps, etc. The work of sorting and arranging all records and copies of published sheets in the office was taken in hand.

Published copies of sheets were sold to the public to the value of Rs. 273.

60. 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.	Scale 4 inches to 1 mile	...	1
<i>Class II Officer.</i>			
Mr. P. Simpson.	" 2 " " "	...	4
	" 1 inch " "	...	37
<i>Upper Subordinate Service.</i>			
3 Officers.	" $\frac{1}{2}$ " " "	...	9
<i>Lower Subordinate Service.</i>			
31 Surveyors, etc.		Total ...	51

Of the above, 1 two-inch sheet was returned to the Superintendent, Burma Circle for entry of boundaries and 50 sheets were submitted for publication.

8 of the half-inch sheets required completion to edge from old surveys in the Drawing Office.

Half-inch sheets compiled from modern one-inch and old style sheets.—During the year, 21 sheets were in hand, including 5 from last year; of these 11 were submitted for publication and 10, which were begun towards the close of the recess, remain in hand.

Modern material available for half-inch mapping.—All sheets of which the component 1-inch sheets are published have been put in hand and the material for 4 half-inch sheets, whose component 1-inch sheets are under publication, has been applied for.

Quarter-inch sheets compiled from modern one-inch, half-inch and old style sheets.—Five sheets were in hand, of which four were submitted for publication, leaving one recently begun sheet in hand.

Modern material available for quarter-inch mapping.—All $\frac{1}{4}$ -inch sheets of which the component $\frac{1}{2}$ -inch sheets are published have been put in hand and material for one sheet, of which the component $\frac{1}{2}$ -inch sheets are under publication, has been applied for.

Hill shaded sheets.—3 sheets were prepared and submitted. There are no arrears.

Layer guides.—None were received during the year.

Colour patterns and press order proofs.—Those of 68 sheets were received and dealt with and, in addition, 6 sheets were prepared for reprint purposes.

61. * Maymyo Drawing Office (Burma Circle).—32 sheets

PERSONNEL.

Class II Officer.

Mr. F. J. Grice.

Upper Subordinate Service.

1 Officer.

Lower Subordinate Service.

17 Draftsmen, etc.

were surveyed by parties of the Burma Circle during the year. Of these, 7 two-inch sheets were fair-mapped and received in the office before the 30th September. The

remainder, viz., 10 two-inch, 12 one-inch and 2 half-inch sheets are expected before the 30th October.

Half-inch sheets compiled from modern one-inch sheets.—Six of these sheets are in hand; 2 have been submitted for proofs and 4 remain 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, the drawing of which has not yet been put in hand.

Quarter-inch sheets compiled from modern one-inch and half-inch sheets.—None in hand.

Modern material available for quarter-inch mapping.—There is 1 quarter-inch sheet of which the component half-inch sheets have been published and the drawing of which has not been taken up.

Two-inch Forest sheets.—Two have been completed, leaving no arrears.

Colour patterns and press order proofs.—These have been received for 1 sheet and completed and submitted for 1 sheet.

Forest Index showing Gazetted Reserves.—This Index is being prepared, on the one million scale, from material taken from one-inch, half-inch and quarter-inch sheets and from that received from the Forest Department. It will show all information regarding Forest Reserves both surveyed and unsurveyed and will supersede the existing 32-mile index which is on too small a scale to be of much utility.

62. No. 6 (Simla) Drawing Office.—The *Survey Section*

PERSONNEL.

Class I Officer.

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

Class II Officers.

Mr. B. E. M. Saubolle.

„ F. H. Grant.

„ H. H. P. Butterfield.

4 European Draftsmen.

26 Indian Draftsmen, etc.

has 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.

* This office was not constituted as a separate charge during the year.

During the year 23 quarter-inch sheets and 2 half-inch sheets were fair-drawn and submitted for publication and 4 quarter-inch sheets were sent for re-publication after new material and information had been added.

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

During the year 222 maps and plans were dealt with and 63,027 copies printed on the litho-printing presses.

63. Bengal and Bihār and Orissa Drawing Office.—(Imperial Standard Mapping Section).—This section has been

PERSONNEL.

Class II Officers.

Mr. C. West, in charge from 14th June 1923.

Mr. A. B. Hunter, in charge to 13th June 1923.

Upper Subordinate Service.

1 Officer.

employed on the fair-mapping of the preliminary editions of modern 1-inch sheets in colours, compiled from modern revenue survey material and completed from old material where no modern work is available.

17 new sheets of Bengal, 8 new sheets of Bihār and Orissa and one degree sheet (preliminary edition) were fair-mapped and submitted for publication during the year.

As an experimental measure 4 one-inch sheets were drawn in colours; by this method it is hoped that the preparation of colour patterns for the Photo.-Litho. Office will be unnecessary. In addition an area of 169 [square miles in the Rāniganj coal field area was reduced from modern] revenue material for supplementary survey on the 4-inch scale by No. 4 Party in 1923-24.

The administrative control of the section was transferred from the Director of Surveys, Bengal to the Superintendent, Map Publication from 1st August 1923

PART 4.—WORK FOR OTHER GOVERNMENT DEPARTMENTS.

64. Northern Circle. No. 4 Party.—A dispute having arisen over the boundary between Pāra and Basantpur villages in Bāra Banki and Gondā districts, due to many consecutive trijunction pillars having been washed away by the Gogrā river, the services of an officer of the department were called for and furnished. A new boundary, 2,610 yards in length, was demarcated, the survey being based on trijunction pillars at some distance from the disputed area. The expenditure incurred was recovered from the civil authorities.

65. No. 22 (Riverain) Party.—The party continued the

PERSONNEL.

Class II Officer.

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

Upper Subordinate Service.

4 Officers.

Lower Subordinate Service.

33 Traversers, etc., (excluding 19 purely temporary men).

work of traversing and laying down base lines. 959 linear and 970 square miles of main-circuits along the Indus river in the districts of Muzaffargarh, Dera Ismail Khān and Dera Ghāzi Khān and along the Chenāb and Jhelum rivers in Jhang district and 2,960 linear miles and 627 square miles of minor traverse in the Indus riverain tract in Muzaffargarh district were executed, 1,304 theodolite stations of the former and 13,374 of the latter in 90 villages were fixed. 21 corners of 7 squares in 17 square miles were demarcated with permanent mark-stones on both banks of the Indus river in the districts of Muzaffargarh, Dera Ismail Khān and Dera Ghāzi Khān to serve as bases for future survey and demarcation of boundaries and fields in the bed of the river. 1,554 plotted and 476 boundary *masāvis* (settlement mapping sheets) on the scale of 1/2,640 and 40 four-inch sheets were traced and supplied to the Settlement Officer, Muzaffargarh. Besides these, 264 boundary *masāvis* were partly compiled on the scale of one inch = 220 feet for the next season's work, and 273 miscellaneous traces were prepared; all the traverse stations marked during the field season were plotted on 42 four-inch sheets.

Boundary Survey.—This work consisted in a plane-table survey of the boundaries of the newly constituted tahsils of Siālkoṭ district. For this the original field sheets of the area topographically surveyed on the one-inch scale in the years 1910—12 were used. 135 linear miles of the new boundaries were surveyed by interpolation and measurement from the surrounding detail and village trijunction pillars

shown on the original field sheets. The work was commenced on the 17th July and finished on the 14th September, the heavy monsoon rains having seriously retarded its progress.

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

PERSONNEL.
Class I Officer.
 Major R. Foster, I.A., in charge.
Class II Officers.
 Mr. Maya Das Puri, R.S.
 „ A. M. Talati, L.C.E.
 „ C. O. Picard.
 „ F. W. Smith.
 „ D. N. Banerjee, L.C.E.
Upper Subordinate Service.
 3 Officers (excluding one Supervisor on purely temporary establishment).
Lower Subordinate Service.
 18 Traversers, etc., (excluding 133 purely temporary men).

year the party was employed on rectangulation in connection with the Punjab Government's Sutlej Valley project in the districts of Multan, Montgomery, Lahore and Ferozepore and in Bahawalpur State.

A total area of 4,152·7 square miles was rectangulated, 26,554 100-acre rectangles were laid out, and 26,378 corner stones

of 100-acre rectangles were embedded. An area of 7,250 square miles or 5,844 linear miles was traversed in advance for the purpose of laying down the main corners of 2,400-acre rectangles and an area of 1,208 square miles was triangulated to supplement this traverse.

The country under rectangulation lies on both sides of the Sutlej river from Ferozepore on the north-east to the boundary of Sind on the south-west; it is bounded on the north-west by the Indus and Chenab rivers and the old bed of the Beas river and on the south-east by the dry bed of the Ghaggar river and by Bikaner State. Near both banks of the Sutlej and in the north-east portion of the area the country is well cultivated and fed by inundation canals; to the north is a large tract of level country covered by scrub jungle where water is scarce in parts and brackish; the southern portion consists of sandy desert in which wells of brackish water occur at long intervals although, during the first half of the winter, a few "tobas" or depressions are found filled with rain water.

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

67. Southern Circle. No. 5 Party.—At the request of the General Staff, Mhow, triangulation was carried out over an area of 115 square miles round Mhow cantonment to give points for artillery ranging purposes.

68. Eastern Circle.—In addition to his duties in the Imperial Department, the Superintendent, as Director of Surveys, Assam, held administrative charge of the Assam Survey Department, including the Assam Traverse Party, Drawing Office and Reproduction Office and the Assam Survey School.

69. Burma Circle. No. 10 Party.—At the request of the Coalfields of Burma, Ltd., one Upper Subordinate officer was sent on deputation to the Upper Chindwin district to survey the coal area near Kalewa belonging to the Company.

Work was begun in May and completed in July. The area was 149·52 acres which was surveyed on the scale of 100 feet to 1 inch with contours at 10 feet intervals. The traverses were connected to points of minor triangulation in the neighbourhood. A trace was made of the work and copies were vandyked by the Government Printing Press, Rangoon.

The whole cost amounting to about Rs. 2,000 was borne by the Coalfields of Burma, Ltd.

70. No. 11 Party.—At the request of the Superintending Engineer, Mandalay Circle, the survey of one square mile of the Maymyo Residential Area was undertaken on the scale of 32 inches to one mile, with contours at 5 feet vertical intervals.

71. Trigonometrical Survey.—At the request of the Punjab Government, No. 17 Party ran 1,269 miles of secondary levelling in connection with the Sutlej Valley Irrigation project, for which, in addition, 13,889 miles of tertiary levelling, covering 2,045 square miles, was done (*vide* page 28). The preparation and printing of contoured charts for the same project was begun.

For the Bombay Government, 208 miles of levelling were run, to give heights to Irrigation bench-marks in the Ghatprabha area in Dhār-wār. 392 miles of double levelling were also executed for the Sukkur Barrage project, (*vide* page 29).

For the Burma Government, (P. W. D., Irrigation), 610 miles of levelling were executed, (*vide* page 29).

The cost of levelling in all these cases was borne by the Local Governments concerned.

72. At the instance of military authorities, Mr. Jugal Behari Lal, Sub-Assistant Superintendent, was sent to undertake special triangulation over several artillery practice camp areas.

73. 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 are given in Table A of the Photo-Litho. Office report on page 43, in the "Issues" table and in Table III of the Map Record and Issue Office report on pages 35 and 36.

In addition to the special maps for other departments which are mentioned in para. 49(g) on page 34, 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 37 to 42.

74. Mathematical Instrument Office.—Repairs to range-finders, binoculars, telescopes, sight dials and directors, &c., and a certain number of manufactures were carried out for the military departments as usual. General repair and manufacture work for civil departments is well up to date.

75. No. 6 (Simla) Drawing Office.—In addition to its normal work for the Army, this office has prepared maps and plans for the Archæological, Foreign and Political, Home and Legislative Departments, Census Commissioner, Indian States Forces, 2nd Bombay Pioneers, Indian Army Ordnance Corps Magazine, Army Sports Central Board, Public Health Commissioner and Royal Air Force.

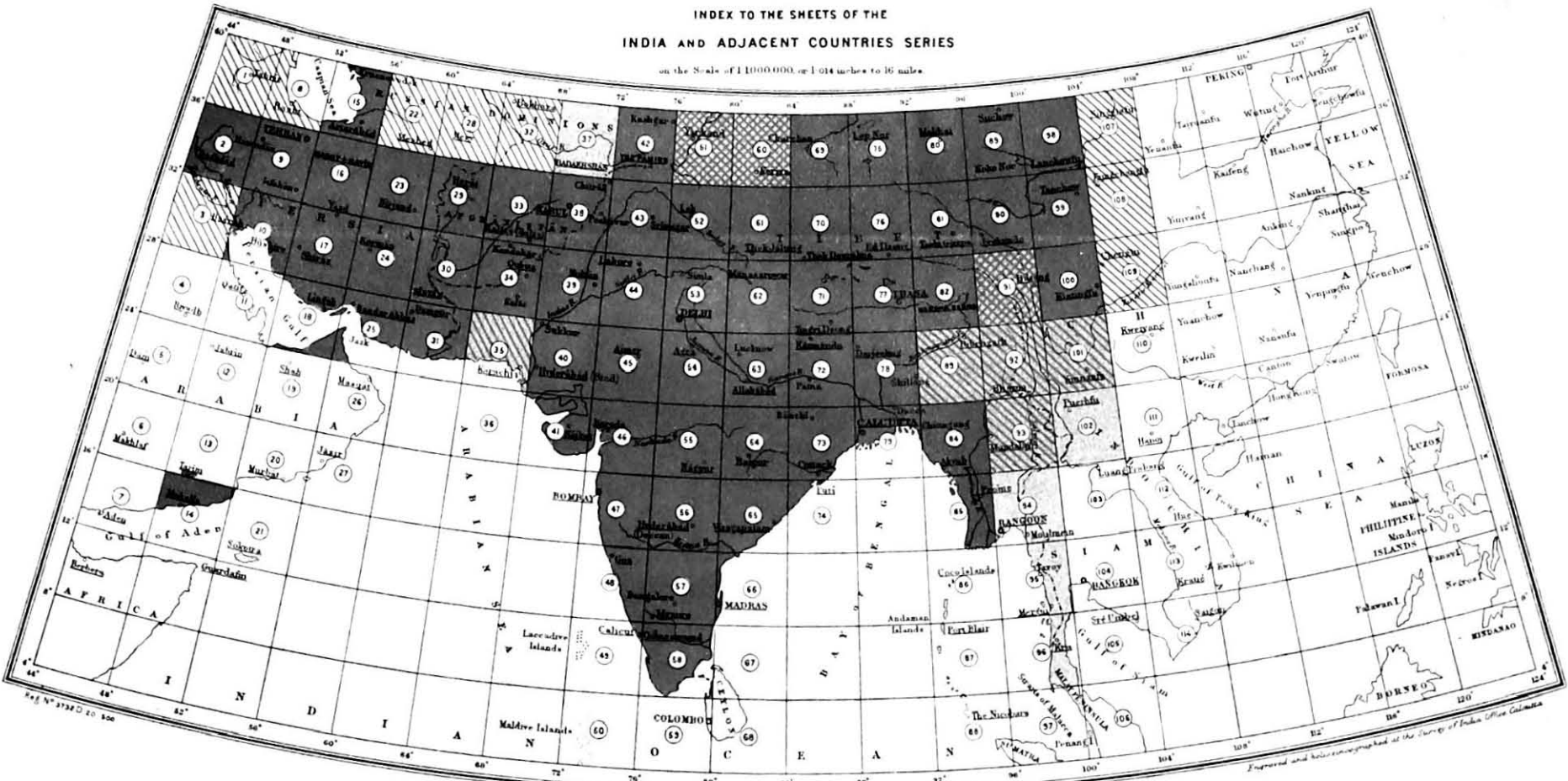
4

DEGREE SHEET SERIES

Scale 1 inch to 4 Miles.

INDEX TO THE SHEETS OF THE
INDIA AND ADJACENT COUNTRIES SERIES

on the Scale of 1:1,000,000 or 1:104 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 35 and 36, 57 and 66, are published respectively as combined sheets.

Scale 1:1,000,000
Miles 0 100 200 300 400 500

REFERENCE

Survey of India Office, Calcutta, 1927-28

Sheet published with contours A & lower

with contours A & lower

under publication

to be issued

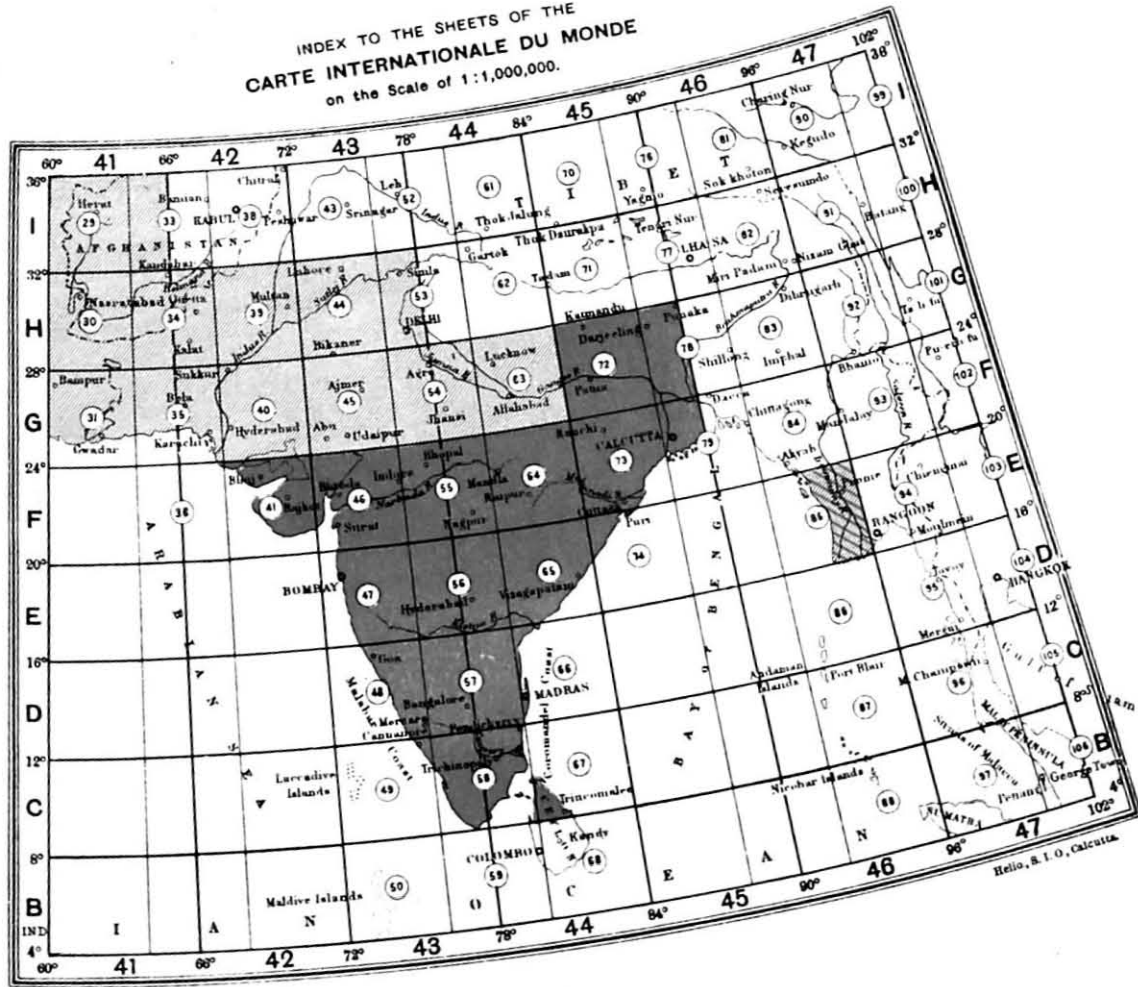


5

INDIA AND ADJACENT COUNTRIES SERIES

Scale 1:1,000,000.

INDEX TO THE SHEETS OF THE
CARTE INTERNATIONALE DU MONDE
 on the Scale of 1:1,000,000.



Rev. No. 341 D. 14. 596

EXPLANATION.

The thick lines show the margins of the sheets of the International Map of the World, Scale 1:1,000,000. Each sheet is designated by the letter N (Northern hemisphere), followed by the marginal letter and number corresponding to its position, e.g., the sheet which includes Bombay is N 43 47.



REFERENCE.

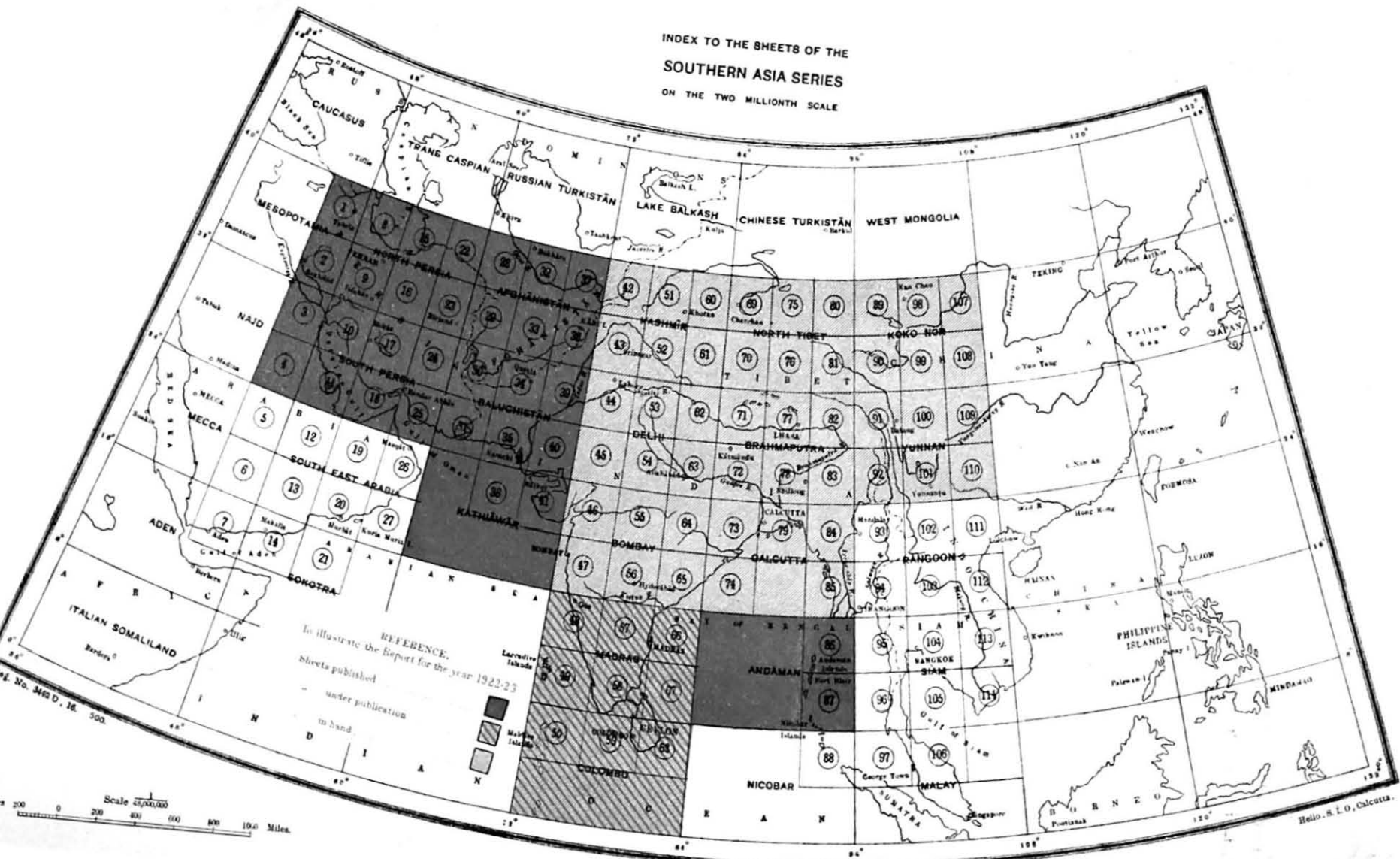
- Sheets published
 - " under publication
 - " in hand
- To illustrate the Report for the year 1922-23



6

INTERNATIONAL SERIES
Scale 1:1,000,000.

INDEX TO THE SHEETS OF THE
SOUTHERN ASIA SERIES
ON THE TWO MILLIONTH SCALE



REFERENCE.
To illustrate the Report for the year 1922-23
Sheets published
under publication
in hand



The E. portions of MESOPOTAMIA and NAJD sheets
have been published for the present as outriggers to
N. & S. PERSIA sheets

Hellö. S. I. O., Calcutta.

7

SOUTHERN ASIA SERIES

Scale 1:2,000,000.