ANNUAL
REPORTS
OF THE
DEPARTMENT
OF THE
INTERIOR

1904

TWENTY-FIFTH
ANNUAL
REPORT
OF THE
UNITED
STATES
GEOLOGICAL
SURVEY

CHARLES D. WALCOTT
DIRECTOR

ANNUAL REPORTS

OF THE

DEPARTMENT OF THE INTERIOR

FOR THE

FISCAL YEAR ENDED JUNE 30, 1904.

TWENTY-FIFTH ANNUAL REPORT

OF THE

UNITED STATES GEOLOGICAL SURVEY,

CHARLES D. WALCOTT, DIRECTOR.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1904.

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DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., August 10, 1904.

SIR: I have the honor to transmit herewith a report of the operations of the United States Geological Survey for the fiscal year 1903–4.

Thanking you for continued counsel and support in the administration of the Survey, I am, with respect, your obedient servant,

Chas. D. Walcott,
Director.

HON. E. A. HITCHCOCK,
Secretary of the Interior.

TWENTY-FIFTH ANNUAL REPORT

OF THE

DIRECTOR OF THE UNITED STATES GEOLOGICAL SURVEY.

CHARLES D. WALCOTT, Director.

INTRODUCTION.

The United States Geological Survey was created by an act of Congress that was approved on March 3, 1879, so that March 3, 1904, may be said to have marked the twenty-fifth year of its existence. There was recently issued by the Survey, partly in recognition of the quarter-century anniversary, a bulletin (No. 227) describing its origin, development, organization, and operations, and it will not be inappropriate to quote here, in this twenty-fifth annual report, a few paragraphs of that publication.

ORIGIN AND DEVELOPMENT OF THE SURVEY.

Prior to the date of the act above mentioned [March 3, 1879] five Federal surveys had been engaged in mapping portions of the territory of the United States. The oldest of these, the Coast and Geodetic Survey, had restricted its mapping to the coast line, but had extended certain geodetic and scientific investigations over various portions of the country. The other four organizations had made topographic, geologic, and other scientific and economic surveys in the Territories west of the one hundredth meridian. The Geological Exploration of the Fortieth Parallel was engaged from 1867 to 1872, under the direction of Mr. Clarence King, in surveying a zone, 105 miles wide, extending from the meridian of 104° to that of 120° west of Greenwich, and comprising an area of 86,390 square miles. The Geological and Geographical Survey of the Territories, under Dr. F. V. Hayden, between 1873 and 1878, surveyed areas in Colorado, New Mexico, Utah, Wyoming, and Idaho, comprising about 100,000 square miles. The Geographical Survey west of the One Hundredth Meridian, under Capt. George M. Wheeler, U. S. Army, was engaged in extending surveys in various portions of the country west of the meridian named in its title. It surveyed an area of about 359,000 square miles. The work of the Geographical and Geological Survey of the Rocky Mountain Region, under Maj. J. W. Powell, covered an area of about 67,000 square miles, in Wyoming, Utah, and Arizona.

Before the creation of these more elaborate Federal surveys exploration parties, mainly under the War Department, were dispatched in various directions over the mountain regions of the Far West, where they made topographic and geologic surveys and examinations of the natural resources. In these expeditions the parties followed the more important Indian trails, river basins, and mountain passes.

When the United States Geological Survey was created all these earlier surveys were discontinued except the Coast and Geodetic Survey, which, as a part of the new Department of Commerce and Labor, continues to make surveys of the coast, and geodetic and scientific investigations on lines which have been followed for more than half a century.

The first Director of the Geological Survey was Mr. Clarence King, formerly Director of the Exploration of the Fortieth Parallel. Mr. King held the office until 1881, when he resigned, and was succeeded by Maj. J. W. Powell, formerly Director of the Survey of the Rocky Mountain Region. Major Powell held the office until 1894, when he resigned and was succeeded by the present incumbent, Mr. Charles D. Walcott.

The paragraph of the organic act creating the office of the Director of the United States Geological Survey reads, in part, as follows:

> * * * this officer shall have the direction of the Geological Survey, and the lassification of the public lands and examination of the geological structure, mineral resources, and products of the national domain.

The first Director had doubt concerning the precise intention of Congress, regarding both the functions of the organization and its field of operations. In respect to the first point, he concluded "that the intention of Congress was to begin a rigid scientific classification of the lands of the national domain, * * * for the general information of the people of the country, and to produce a series of land maps which should show all those features upon which intelligent agriculturists, miners, engineers, and timbermen might hereafter base their operations and which would obviously be of the highest value to all students of the political economy and resources of the United States." Doubt arose respecting the field of operations of the new organization because of ambiguity in the term "national domain," which might be taken to mean either the land actually owned by the nation, or the area within its boundaries. The Director adopted a conservative course and planned to survey only areas within the limits of the public lands. This limitation, however, was removed by an act of Congress approved August 7, 1882 which contained a clause reading, in part, "to continue the preparation of a geological map of the United States." This was accepted as authority for the extension of the geologic and topographic surveys and other investigations into all portions of the United States.

The Director, advised by the Secretary of the Interior and the interested committees in Congress, at once recognized the necessity of making a good topographic map as a basis for classifying the public lands. A satisfactory classification of the lands, and especially of the products of the national domain, requires an indication on the base maps of the cleared and the cultivated lands, with subclassifications of these. Water is regarded as one of the most valuable resources of the country, and under the clause requiring an examination of the mineral resources a hydrographic survey has been made to ascertain the amount and quality of the water supplies. From time to time Congress has definitely recognized these various functions by specific legislation providing for the making of "topographic surveys in various portions of the United States," for "gauging the streams and determining the water supply of the United States," for "the survey of the public lands that have been or may hereafter be designated as forest reserves," for preparing "maps of Alaska showing all known topographic and geologic features," etc.

The growth of the work of the United States Geological Survey may be well illustrated by the increase of its annual appropriations and by the increase in the amount of topographic mapping accomplished within a year. The first appropriation amounted to $106,000, and provided, in addition to the Director's salary, $19,624 for topographic surveys, $56,000 for geologic surveys, and $24,376 for pay of temporary employees and for contingent expenses. Ten years later the appropriation (for the fiscal year 1889–1890) amounted to $801,240, exclusive of that for publications. The specific purposes mentioned were topography, geology, paleontology, chemistry, illustrations, mineral resources, library, irrigation, and engraving geologic maps. This appropriation was much greater than that for the years immediately preceding and succeeding, because of a large item ($250,000) for irrigation, which was succeeded by much smaller appropriations for hydrographic surveys. The appropriations were, however, increased from year to year, until ten years later (fiscal year 1899–1900) the total reached the sum of $844,740. For the fiscal year 1903–4 there was appropriated a total of $1,377,820, the larger items being:

Topography	$300,000
Geology	150,000
Alaska	60,000
Hydrography	200,000
Chemical and physical researches	20,000
Mineral resources	50,000
Engraving and printing geologic maps	100,000
Surveying forest reserves	130,000

During the first year (1879–80) the topographers mapped, on the small scale of about 4 miles to the inch and with the large contour interval of 200 feet, 3,400 square miles. During the last year (1902–3) there were mapped approximately 31,000 square miles, on, however, the much larger and more detailed scales of 1 mile and 2 miles to the inch and with relief shown by contours having intervals varying between 10 and 100 feet.

GENERAL RESULTS ACHIEVED.

Among the more important results achieved by the organization are the following:

A complete topographic map of 929,850 square miles of the area of the United States, which, including Alaska, amounts to 3,622,933 square miles. In other words, the Survey has finished the mapping, on more or less detailed scales, of 26 per cent of the area of the country, including Alaska, and 31 per cent excluding Alaska.

This map is published in the form of 1,327 separate atlas sheets, printed in three colors from copperplate engravings. The topographic maps of the Geological Survey have greatly expedited investigations by cities of their water supply, and have been of the highest value to railway companies and State highway bureaus in designing and planning their projects. The improvement of highways in New York, Maryland, Massachusetts, and other States has been greatly facilitated and the cost of the State work materially reduced by these maps. The elaborate and valuable reports recently completed on the future water supply of the city of New York and on the New York State Barge Canal have been rendered conclusive in large measure only through the agency of the existing topographic maps.

Many of the broader problems whose solution must necessarily precede the final geologic mapping of the country have been solved. The geologic mapping of the surface formations has been extended over about 171,000 square miles, and 106 geologic folios have been published, while nearly an equal number are in various stages of preparation. These folios consist of descriptive text, a topographic sheet, geologic sheets for areal and economic geology, structure sections, columnar sections, etc. Each folio thus presents a practically complete history of the topography, geology, and mineral resources of the area described.

Coincident with the geologic work, important experiments and investigations into the physical characteristics of rocks in various processes of formation, and of volcanic and geyser action, have been conducted in the physical laboratory, and many important conclusions have been reached. The chemical laboratory and the petrographic laboratory have been engaged in solving, chemically and microscopically, the more important problems connected with rock composition and structure, while the paleontologic section has aided in solving stratigraphic and structural problems by the classification and identification of the fossil remains of plants and animals.

The engraving and printing division has engraved 1,421 series of copperplates for as many topographic atlas sheets, each series consisting of three plates, one for each color. It has lithographed on stone the colors, ranging in number from 10 to nearly 30, necessary for distinguishing in each of about 100 geologic folios the various formations and outcrops. It has printed several editions of most of the topographic maps and at least one edition of the geologic folios, besides revising both as occasion therefor has arisen, and engraving and printing miscellaneous State and United States maps.

The hydrographic branch, including the reclamation service, has recorded during the last fifteen years the maximum, minimum, and mean discharges of all the more important rivers, and for shorter periods the same facts concerning all the lesser tributaries of the many hundreds of streams in the United States. These results have been assembled and studied, and the flow of the streams has been compared with the precipitation as shown by the records of the Weather Bureau. The physical characteristics of the river basins have been studied in respect to their forestation, soil covering, etc., and there has been accumulated a vast amount of data from which it is possible to estimate closely the volume or run-off of each of the streams. The development of the water powers of the country, especially in the Southern States, has received a great impetus in the last few years through the facts brought to light by the hydrographic branch in respect to the volume and regularity of the discharge of, and the amount of fall in, the various streams of the country. Many unknown water powers have been found, and projects already commenced have had their value or their defects made manifest through the evidence resulting from the surveys of this branch. Data have been gathered concerning the public lands which are irrigable and their relation to possible water supplies. A large number of reservoir sites have been examined and surveyed in a preliminary way, and the lands withdrawn from sale or occupation pending more detailed studies. A number of these reservoir and irrigation projects have been studied in greater detail, surveys of the irrigable lands, as well as of canal lines, have been made, and some have been finally approved for construction by the reclamation service.

The division of geography and forestry has made detailed examinations of 110,000 square miles, including a classification of the lands, as forested (with stand and kind of timber), grazing, desert, and cultivable, and has prepared final reports on these reserves, showing the character and amount of the timber and many other facts which will serve as a basis for the future forest management of these properties.

Perhaps the immediate value to the people of the work of the Geological Survey is best shown by the aid it extends in developing the mineral resources and in forwarding important engineering projects in which the people, as well as the State and Federal governments, are interested. To instance a few cases: The work of the geologic branch has had a wide educational influence upon the public at large, but more directly upon those engaged in the mining industry. Among the many direct practical benefits which it has conferred upon this industry may be mentioned the investigation of the mining geology of Leadville, which has not only guided exploration and secured economical mining in a district that has produced between $200,000,000 and $300,000,000, but has been of even more beneficial result in teaching the mining engineer and the miner the practical importance of geologic study in carrying on their work; in other words, it has greatly improved mining methods throughout the whole country. The investigation of the origin and geologic relations of the Lake Superior iron ores and the publication of numerous reports on that region have so effectively directed the prospector in the discovery of the deposits and the miner in economical methods of development that this region now leads the world in the production of iron ore. The detailed areal mapping and the determination of underground structure in the Appalachian coal field are placing the development of its coal, petroleum, and gas resources upon a scientific basis and relieving these branches of the mineral industry of a large part of the hazard and uncertainty which has always hitherto been associated with them. The collection and publication of reliable statistics of mineral production have furnished a sound commercial basis for all branches of the mineral industry.

REMARKS ON THE WORK OF THE YEAR.

The energy manifested by all the branches of the Survey during the last fiscal year is worthy of note. There was marked activity on the part of the scientific corps, and this was reflected in the work of the administrative and publication branches. Large increases may be noted in the amount of manuscript accepted and prepared for publication, the number of geologic folios published, the number of topographic atlas sheets and maps completed by the engraving and printing division, the number of illustrations prepared for the various reports, and the amount of map work done by the photographic laboratory. Emphasis is not placed on quantity, however. Year by year the qualitative standard has been raised. It is recognized that the map work done a few years ago is inadequate for the demands of to-day; earnest effort has been made to attain a higher literary quality, especially greater conciseness, in the papers published by the Survey; and although, as stated above, a greater number of illustrations were prepared during the last fiscal year than in any previous year, it is true, also, that, of those submitted by authors, a greater number than ever before were rejected.

State cooperation, as explained in previous reports, continued. Arrangements for cooperation in geologic work were made with six States, the total amount contributed by them being nearly $12,000, and arrangements for cooperative topographic surveys were made with eleven States, the amount available for such surveys being thus increased by more than $100,000.

During the year the important work of the reclamation service was rapidly advanced in many of the western States and Territories, and actual construction of works was begun and is in progress on the Salt River project, in Arizona, and on the Truckee-Carson project, in Nevada. Plans were perfected for important researches by the division of chemistry and physics. The valuable petrographic reference collection of the Survey was enlarged and made more accessible. New processes, securing greater expedition and economy, were devised in the photographic laboratory and in the division of engraving and printing. These and other accomplishments are more fully described in the following pages.

ORGANIZATION.

The following table exhibits the organization of the Survey at the close of the year:

Organization of the Geological Survey.

Branch.	Division.	Section.
Geologic	Geology and paleontology	Areal geology. Physiographic and glacial geology. Pre-Cambrian and metamorphic geology. Petrology. Economic geology of metalliferous ores. Economic geology of nonmetalliferous minerals. Paleontology.
	Alaskan mineral resources.	
	Mining and mineral resources.	
	Chemical and physical researches.	Chemistry. Physics.
Topographic	Eastern topography Western topography	Triangulation and computing. Inspection of surveying and mapping. Instruments and records.
	Geography and forestry.	
Hydrographic	Hydrography.	
	Hydrology	Eastern. Western.
	Hydro-economics.	
	Reclamation service	(Sixteen arid States and Territories.)
Publication	Editorial	Texts. Geologic maps. Topographic maps. Illustrations. Photography.
	Engraving and printing.	
	Documents.	
Administrative	Executive	Correspondence, records, supplies, and shipments. Steam engineer, firemen, mechanics, and messenger, watch, and labor force.
	Disbursements and accounts.	
	Library.	

OBITUARY.

Mention should here be made of the death, on December 12, 1903, of Mr. Marcus Baker, who had been a prominent member of the Geological Survey for many years. Although at the time of his death he was on leave of absence, without pay, serving as assistant secretary of the Carnegie Institution, he remained in close touch with the Survey and was daily associated with its chief officers. An account of his life and work will be found on pages 369–371.

PLAN OF OPERATIONS.

The plan of operations for the fiscal year 1903-4 was laid before the Secretary of the Interior on May 25, 1903, and was approved by him on June 3. This detailed plan is on file in the Department. The work of the year, hereinafter reviewed, was executed in conformity with the plan submitted and approved.

APPROPRIATIONS.

There was appropriated for the work of the United States Geological Survey for the fiscal year 1903-4 the sum of $1,391,020. The acts making the appropriations set apart separate amounts for specific branches of work and for the salaries of persons connected with these branches. For convenience of reference these separate appropriations are here brought together and classified.

The legislative, executive, and judicial act contained the following item:

For rent		$28,400

The sundry civil act included the following items:

For salaries of Director, chief clerk, chief disbursing clerk, librarian, and photographer, together with clerks, messengers, watchmen, et al		$32,740
For pay of skilled laborers, etc		20,000
For topographic surveys	$300,000	
For pay of 2 geographers and 2 topographers	9,200	
Total for topographic work		309,200
For geologic surveys	$150,000	
For pay of 4 geologists	13,700	
Total for geologic work		163,700

For paleontologic researches	$10,000	
For pay of 2 paleontologists	4,000	
Total for paleontologic work		$14,000
For chemical and physical researches	$20,000	
For pay of 1 chemist	3,000	
Total for chemical work		23,000
For gaging streams, etc		200,000
For preparation of illustrations		18,280
For preparation of report on mineral resources		50,000
For purchase of books and distribution of documents		6,000
For engraving and printing maps		100,000
For survey of forest reserves		130,000
For investigation of mineral resources of Alaska, etc		60,000

In the same act there was appropriated for engraving, printing, and binding publications of the Geological Survey, $215,000, this sum to be disbursed not by the Geological Survey but by the Public Printer. The items are as follows:

For engraving illustrations for report of Director and for monographs, professional papers, bulletins, water-supply papers, and report on mineral resources	$65,000	
For printing and binding report of Director, monographs, professional papers, bulletins, water-supply papers, and report on mineral resources	150,000	
Total for printing and engraving		215,000

The deficiency bills approved February 18, 1904, and April 27, 1904, carried for the Geological Survey two items pertaining exclusively to the fiscal year for which this report is made, viz:

For completion of roster of mines of United States	$10,000	
For replacing articles destroyed by fire	10,200	
For installation of a fire-alarm system	500	
Total in deficiency bills		20,700
Grand total		1,391,020

The urgent deficiency bill approved February 18, 1904, and the general deficiency bill approved April 27, 1904, made the following additional appropriations for the Geological Survey, but their use was not limited to the fiscal year ending June 30, 1904:

In the urgent deficiency bill—

For investigation of the mineral resources of Alaska	$80,000	(1904–5)
For coal tests at the Louisiana Purchase Exposition	30,000	(1904–5)

In the general deficiency bill—

For coal tests at the Louisiana Purchase Exposition	$30,000.00	(1904–5)
For furnishing new building	10,500.00	(1904–5)
For judgment *v.* Robert Muldrow, including costs	157.77	(claim)

ALLOTMENTS.

ALLOTMENTS TO GEOLOGIC WORK.

The total appropriation for geologic work for the fiscal year 1903–4 was $163,700, which was allotted as follows:

Allotments to geologic parties.

Party, etc.	Amount.
Executive office	$14,485.92
Purchase and repair of instruments	600.00
Adams, G. I. (Kansas, Arkansas, Texas)	4,400.00
Arnold, Ralph (California)	1,200.00
Bain, H. F. (Illinois, Kentucky, Wisconsin)	3,200.00
Bascom, F. (Pennsylvania, New Jersey)	830.00
Bayley, W. S. (New Jersey)	1,810.00
Becker, G. F. (supervision of division of chemistry and physics)	3,000.00
Boutwell, J. M. (Utah)	5,200.00
Branner, J. C. (California)	350.00
Campbell, M. R. (Pennsylvania, West Virginia, Ohio, Kentucky)	11,402.20
Chamberlin, T. C. (North Central and Rocky Mountain States)	8,500.00
Clark, W. B. (Maryland, Delaware, New Jersey)	1,150.00
Cross, Whitman (Colorado, and general scientific supervision)	9,425.00
Dale, T. N. (Vermont, West Virginia, Virginia, Maryland)	2,700.00
Diller, J. S. (California)	4,250.00
Eckel, E. C. (United States in general)	3,950.00
Eldridge, G. H. (California, Florida)	5,700.00
Emerson, B. K. (Massachusetts)	500.00
Emmons, S. F. (Colorado, and general scientific supervision)	4,400.00
Fenneman, N. M. (Colorado)	550.00
Gilbert, G. K. (California, and general scientific supervision)	5,420.00
Gregory, H. E. (Connecticut)	500.00
Hague, Arnold (Yellowstone National Park)	2,000.00
Hayes, C. W. (general administrative supervision)	5,600.00
Hobbs, W. H. (Connecticut)	500.00
Jaggar, T. A., jr. (South Dakota, Nevada)	500.00
Keith, Arthur (North Carolina, South Carolina, Georgia, Tennessee)	5,200.00
Kemp, J. F. (New York)	150.00
Lindgren, Waldemar (Colorado)	3,500.00
Osborn, H. F. (Colorado, and monographs on Ceratopsia and Sauropoda)	4,600.00

Allotments to geologic parties—Continued.

Party, etc.	Amount.
Ransome, F. L. (Colorado, Idaho)	$5,735.00
Reid, H. F. (earthquake records)	125.00
Russell, I. C. (Idaho, Oregon, Michigan)	800.00
Schuchert, Charles (catalogue of Paleozoic fossils)	700.00
Smith, G. O. (Washington, Vermont, Maine)	2,750.00
Smith, J. P. (monograph on the Triassic of North America)	500.00
Smith, W. S. T. (Missouri, South Dakota)	2,400.00
Spurr, J. E. (Nevada)	4,750.00
Stanton, T. W. (Wyoming, Colorado, and general scientific supervision)	2,700.00
Stose, G. W. (Pennsylvania, and editing geologic maps)	2,350.00
Taff, J. A. (Indian Territory)	2,660.00
Ulrich, E. O. (Kentucky, Illinois, Missouri, Indian Territory, Texas)	2,400.00
Van Hise, C. R. (Lake Superior region, and general scientific supervision)	6,600.00
Walcott, C. D. (Utah, and general scientific supervision)	1,500.00
Weed, W. H. (Montana, Appalachian region)	3,420.00
White, C. D. (Appalachian coal fields)	3,090.00
Williams, H. S. (New York, Pennsylvania)	3,700.00
Willis, Bailey (general scientific supervision)	303.30
Wolff, J. E. (New Jersey, New Hampshire)	700.00
Contingent	943.58
Total	163,700.00

ALLOTMENTS TO PALEONTOLOGIC WORK.

The total appropriation for paleontologic work for 1903–4 was $14,000, which was allotted as follows:

Allotments to paleontologic work.

Party.	Amount.
Dall, William H	$2,950
Girty, George H	2,810
Knowlton, F. H	2,500
Vaughan, T. W	2,480
Ward, Lester F	2,650
Contingent fund	610
Total	14,000

CONTRIBUTIONS BY STATES FOR COOPERATIVE WORK IN GEOLOGY AND PALEONTOLOGY.

In addition to the sums appropriated for geology and paleontology ($163,700 and $14,000) there were available for the work of the division during the year the following sums appropriated by the various States for cooperation:

State.	Amount.
Colorado	$3,500
Pennsylvania	5,000
Maine	750
Kentucky	1,100
Maryland	1,000
Mississippi	500
Total	11,850

The conditions under which cooperation with the various States is undertaken have been fully explained in former reports.[a]

ALLOTMENTS TO TOPOGRAPHIC WORK.

The sum appropriated for topographic surveys was $300,000. Besides this general appropriation, certain stated salaries, aggregating $9,200, were appropriated for men engaged in topographic work, making the total appropriation for topography $309,200, which was allotted as follows:

Allotments to topographic work.

Section, etc.	Amount.
Eastern section	$179,300
Western section	77,800
Scientific salaries designated	9,200
Inspection of topography	6,400
Purchase and repair of instruments	11,000
Triangulation and computing section	1,200
Contingent expenses	24,300
Total	309,200

[a] See Twenty-second Ann. Rept. U. S. Geol. Survey, pt. 1, 1901, pp. 13–35.

ALLOTMENTS TO FORESTRY WORK.

The appropriation for the survey and investigation of forest reserves was $130,000, which was allotted as follows:

Allotments to forestry work.

Section, etc.	Amount.
Western section of topography	$93,300
Forest examination	20,000
Purchase and repair of instruments	3,000
Office and contingent expenses	13,700
Total	130,000

ALLOTMENTS TO HYDROGRAPHIC WORK.

For the gaging of streams, determination of the water supply of the United States, etc., there was appropriated the sum of $200,000, which was allotted as follows:

Allotments to hydrographic work.

Region, etc.	Amount.
Administration	$55,000
Arid region	67,000
Semiarid region	25,000
Eastern humid States	22,500
Southern and central humid States	20,000
Miscellaneous and contingent	10,500
Total	200,000

ALLOTMENTS TO ALASKAN WORK.

The appropriation of $60,000 for investigation of the mineral resources of Alaska was allotted as follows:

Allotments to work in Alaska.

Region, etc.	Amount.
Juneau and Porcupine districts, Arthur C. Spencer	$5,000
Petroleum fields of southern Alaska, G. C. Martin	2,000
Northeastern part of Seward Peninsula, D. C. Witherspoon and F. H. Moffit	14,500
Southern part of Seward Peninsula, Arthur J. Collier	7,500
Yukon-Tanana placer fields, L. M. Prindle	6,000
Yukon-Tanana topographic surveys, T. G. Gerdine	13,000
Yukon River paleontologic work, Arthur Hollick	2,500
Copper River district office work, F. C. Schrader	2,000
Administrative expenses, Alfred H. Brooks	3,200
Clerical and stenographic work	3,600
Contingent expenses	700
Total	60,000

MISCELLANEOUS ALLOTMENTS.

Chemistry and Physics.

The appropriation of $20,000 for chemical and physical researches was exclusive of the salaries of the physicist in charge and the chief chemist, which were provided for in terms, and the entire amount was allotted for the pay of persons connected with the division and for the purchase of supplies, apparatus, etc.

Mineral Resources.

The appropriation of $50,000 for the preparation of the report on Mineral Resources was allotted to the gathering and compiling of statistical data for the calendar year 1903 and the preparation of the report thereon.

Engraving and Printing Maps, etc.

The appropriations for map engraving and printing, for the purchase of books and distribution of documents, for the preparation of illustrations, for the pay of skilled laborers, etc., and the special appropriations, were all expended for the specific purposes named in the act.

WORK OF THE YEAR.

FIELD AND OFFICE WORK BY THE DIRECTOR.

In addition to the usual administrative work, the Director was occupied during June and most of July, 1903, by duties incident to the chairmanship of a committee appointed by the President to investigate and report upon the work, scientific or partly scientific, conducted by the Government. This committee also held a number of meetings in November and December.

Late in July the Director went to the Bighorn basin, Wyoming, for the purpose of studying the conditions connected with the development of a large irrigation project on the Shoshone River, below Cody. From there he proceeded across the mountains to the Snake River country, south of the Yellowstone Park, and thence to Pocatello, Idaho. Late in August he made a trip to the western end of the Uinta Mountains, and in September he was engaged in geologic work in the House Range of Utah and the Snake Range of Nevada.

Most of the time in the office the Director was occupied with administrative matters, only a few days being available for research work.

GEOLOGIC BRANCH.

Division of Geology and Paleontology.

ADMINISTRATION.

The organization of the division of geology and paleontology remained essentially the same as described in the last annual report. Mr. C. W. Hayes, geologist in charge of geology, continued throughout the year in administrative charge of the division. The sections established for scientific supervision remain as enumerated in the last report, except that the section of Pleistocene geology has been discontinued and a new section of physiographic and glacial geology created in its stead. The field occupied by the new section is somewhat broader than that occupied by the section it replaced. It distinctly recognizes the geographic aspects of geology, embracing both geomorphology and geomorphogeny, and hence the consideration of all natural agencies by which the surface of the earth has been and is being modified. Full recognition of the importance of ice as a geologic agent is made in the designation of the section.

The organization of the division of geology and paleontology is as follows:

Section of areal geology; Bailey Willis in charge.

Section of petrology; Whitman Cross in charge.

Section of paleontology; T. W. Stanton in charge.

Section of economic geology of metalliferous ores; S. F. Emmons in charge.

Section of economic geology of nonmetalliferous minerals; C. W. Hayes in charge.

Section of physiographic and glacial geology; G. K. Gilbert in charge.

Section of pre-Cambrian and metamorphic geology; C. R. Van Hise in charge.

DETAILED STATEMENT OF GEOLOGIC AND PALEONTOLOGIC WORK.

WORK OF GEOLOGISTS IN CHARGE OF SECTIONS.

Section of areal geology.—Mr. Bailey Willis, geologist in charge, was granted leave of absence, without pay, for one year from July 1, 1903, in order to carry on investigations in the stratigraphy of the pre-Paleozoic and Paleozoic formations of China, under the Carnegie Institution. In his absence matters relating to areal geology were referred to various geologists, but chiefly to Mr. H. Foster Bain, who had charge of the editing of geologic folio texts. The compilation of a preliminary geologic map of the United States, which forms a part of the Survey's exhibit at the Louisiana Purchase Exposition, was in charge of Mr. George W. Stose, who was assisted by Mr. Laurence La Forge and others.

Section of Pleistocene geology.—Prof. T. C. Chamberlin, geologist in charge, was chiefly occupied throughout the year in the supervision of the work of the section, consisting of the organization and direction of field parties, consultation with State geologists who are cooperating with the Geological Survey in the study and mapping of Pleistocene formations, and the reading and revision of resulting manuscripts.

During the year detailed studies were made of the Pleistocene geology of the Bighorn Mountains, Wyoming (Salisbury and assistants), of the Uinta Mountains, Utah (Atwood party), of the Bear River Range, Idaho (Peterson party), of the Great Falls region in Montana (Calhoun party), and of various counties in Michigan (Leverett and Taylor parties) and in Wisconsin (Alden party).

Toward the end of the fiscal year the section was discontinued and matters relating to Pleistocene geology were thereafter referred to the new section of physiographic and glacial geology.

Section of physiographic and glacial geology.—Mr. G. K. Gilbert was designated geologist in charge of this section upon its organization in May, 1904, but owing to the fact that plans for the remainder of the fiscal year had already been approved, he had few duties in connection with the section except the critical reading of a number of referred manuscripts.

Section of pre-Cambrian and metamorphic geology.—Prof. C. R. Van Hise, geologist in charge, devoted considerable time to the supervision of this section, both in the field and in the office. Under his direction field work was continued in the iron-bearing districts of the Lake Superior region, and much time was spent in the compilation and revision of the maps of the iron ranges; a series of charts illustrating the origin and development of ores was prepared and installed at the Louisiana Purchase Exposition; a study of iron-ore deposits in Utah was begun in accordance with the plan for a systematic study of the metamorphic iron-ore deposits of the United States; the rough draft of a new and enlarged edition of a correlation paper of Archean and Algonkian formations was prepared; and much time was given to the revision of manuscripts submitted for publication and to reading and correcting the proofs of Monograph XLVII, entitled "A Treatise on Metamorphism."

Throughout the year Professor Van Hise was ably assisted by Prof. C. K. Leith and Mr. W. N. Smith.

Section of petrology.—Mr. Whitman Cross, chief of this section, had supervision of the petrologic investigations of the Survey. He devoted much time to the critical reading of folio texts and other manuscripts containing petrologic discussions; also to conferences with geologists, both in the field and in the office, and to either the preparation or the supervision of reports on petrographic material submitted for examination.

During the year the valuable petrographic reference collection of the Survey was considerably enlarged and rendered more accessible. In the care of this collection Mr. Cross was efficiently assisted by Mr. Albert Johannsen.

The petrographic laboratory, which is also in charge of Mr. Cross, assisted by Messrs. F. C. Ohm, W. S. Robbins, and William Ohm, maintained its high record of efficiency. The number of thin sections made was 5,724; large and difficult specimens cut, 1,020; saw cuts made, 1,334; surfaces polished, 90. The process of making thin sections of rocks for microscopic study forms one of the features of the Survey exhibit at the Louisiana Purchase Exposition, the machinery being installed and operated by Mr. W. S. Robbins, detailed from the petrographic laboratory.

Section of economic geology of metalliferous ores.—Mr. S. F. Emmons remained in charge of this section and devoted the greater part of his time to its supervision. Owing to the expansion of the work of the Survey in economic geology, Mr. Emmons's labors as chief of this section were greatly increased. During the year about thirty manuscripts were read and criticised, considerable time was spent in the preparation of a circular containing suggestive notes and definitions designed to simplify and unify the treatment of economic subjects, especially in the short papers prepared for the annual economic bulletin, and a large amount of official correspondence received attention.

During the months of July, August, and September Mr. Emmons was on leave of absence, attending the Ninth International Geological Congress, at Vienna, Austria, of which he was one of the vice-presidents, and making geologic excursions in the eastern Alps.

The remainder of Mr. Emmons's time was occupied in the preparation of maps showing the underground geology of the Leadville district, Colorado, in which he was assisted for two months by Mr. J. D. Irving; in supervising the completion of the report on the Bingham mining district of Utah; in reading and correcting proof of the professional paper on the mineral resources of the Black Hills; and in original research. A paper entitled "Theories of Ore Deposition Historically Considered," a subject germane to the work of the section, was prepared and published in the Bulletin of the Geological Society of America, being Mr. Emmons's address as retiring president of the society.

Section of economic geology of nonmetalliferous minerals.—Mr. C. W. Hayes, in charge of this section, was so fully occupied with administrative duties as geologist in charge of geology that he was able to devote comparatively little time to the section.

In accordance with the policy of summarizing each year information regarding some important class of nonmetalliferous deposits, a large amount of work was done on cements by Mr. E. C. Eckel, and a report is ready for publication which will give full information regarding the cement industry, particularly the geologic relations of the raw materials. Mr. Eckel, assisted by Mr. T. Nelson Dale, has also collected nearly complete data for a report on the slate industry, and has made considerable progress with a report on the salt industry of the United States. Both of these reports will be completed during the coming year.

A large amount of detailed work in the Appalachian coal field, and in the Ohio, West Virginia, and Pennsylvania oil fields was accomplished by Mr. M. R. Campbell and his assistants. Reports were also prepared on other mineral products, particularly the clays and limestones of western Pennsylvania, in connection with the folio work in that region.

The survey of the Iola (Kansas) quadrangle was completed, and a report on the economic geology, by Mr. George I. Adams and Prof. Erasmus Haworth, is now ready for publication. It contains valuable information, particularly relating to the conditions under which the oil and gas of this rapidly developing field occur.

Mr. N. M. Fenneman completed his investigation of the Boulder oil field and submitted a final report. He then undertook the resurvey of the Texas-Louisiana Gulf coastal plain oil fields, made necessary by their rapid development since the preliminary report was published in 1902.

Mr. J. A. Taff continued his investigations in the Indian Territory coal field, and his familiarity with this field has been utilized by the Secretary of the Interior in the segregation of the Indian coal lands for sale and the preparation of descriptive matter relating to them.

Numerous other investigations of nonmetalliferous minerals were carried on during the year, chiefly in connection with areal surveys for folio publication.

Section of paleontology.—Mr. T. W. Stanton continued to have charge of this section, and devoted considerable time to administrative duties. In addition to the routine work of the office, including the examination of and report on several large collections of Mesozoic fossils for members of the Survey, Mr. Stanton spent much time, both in the field and in the office, in a study of the stratigraphic position of the Judith River beds in Montana and their relation to the Belly River beds of Canada. In this work he was assisted by Mr. J. B. Hatcher. Prior to July 1 considerable field work had been done on this problem, but the month of July was devoted to the reconnaissance of outcrops not before visited. The numerous fossils obtained have all been carefully studied in the office and labeled, the work on the invertebrates being done by Mr. Stanton, that on the vertebrates by Mr. Hatcher, and that on the fossil plants by Mr. F. H. Knowlton. This investigation has proved that the Judith River beds are the equivalent of the Belly River beds in Canada, and are considerably older than the Laramie formation, with which they have heretofore been confused. The results of the study are embodied in a paper entitled "Geology and Paleontology of the Judith River Beds, by T. W. Stanton and J. B. Hatcher, with a Chapter on the Fossil Plants by F. H. Knowlton," which has been transmitted for publication and will appear as a bulletin of the Survey.

After the completion of field work in Montana Mr. Stanton proceeded to southeastern Idaho, where a stratigraphic study was made of lower Triassic beds in Wood Canyon. Two weeks were then spent in studying the upper Paleozoic and lower Mesozoic sections in the vicinity of Park City, Utah, for the purpose of aiding Mr. J. M. Boutwell in the determination of stratigraphic problems arising in connection with his report on the economic geology of that district.

Early in May Mr. Stanton left Washington with the field party of Mr. George C. Martin, of the Alaska division, for the purpose of studying the Mesozoic rocks of southwestern Alaska, from Cook Inlet westward along the Alaskan Peninsula. It is hoped that with the aid of the paleontologic evidence sought the questions regarding the Mesozoic succession will be settled.

Mr. T. E. Williard continued to act as general assistant in the paleontologic section, aiding in the preparation and care of the large collections of fossils. He spent the months of July and August in the field, making collections from the Carboniferous of Pennsylvania, Ohio, and West Virginia, under the direction of Mr. David White.

WORK OF GEOLOGIC AND PALEONTOLOGIC PARTIES.

Adams party.—Mr. George I. Adams began, on July 1, the areal and economic survey of the Iola (Kansas) quadrangle. He was associated in this work with Prof. Erasmus Haworth, who gave particular attention to the investigation of the geologic conditions under which the oil and gas of the district occur. Mr. Adams was assisted by Messrs. A. H. Purdue and M. K. Shaler, and Professor Haworth by Mr. W. R. Crane. Field work on the Iola quadrangle was completed September 16, and Mr. Adams spent the following six weeks in a reconnaissance of the Carboniferous and Permian of northern Texas, being associated with Mr. E. O. Ulrich. In the office a report on the economic geology of the Iola quadrangle was prepared by Messrs. Adams and Haworth and submitted for publication as a bulletin. Mr. Adams also completed and submitted the Yellville and Fayetteville (Arkansas) folios.

At the request of the Peruvian Government, Mr. Adams was granted leave of absence, and on April 1 left for Peru, to undertake the organization of hydrographic investigations for that Government.

Alden party.—Mr. William C. Alden, under the direction of Prof. T. C. Chamberlin, continued his studies of the Pleistocene formations of Wisconsin. During the year he completed a folio covering the Bayview, Racine, Muskego, Silver Lake, Eagle, and Geneva quadrangles, and a folio covering the Whitewater, Koshkonong, Shopiere, and Delavan quadrangles.

In addition to supplemental field work in quadrangles previously surveyed, original surveys were made of the Waterloo and Sun Prairie quadrangles. In this work Prof. John L. Tilton and Messrs. Edson Bastin, Rollin T. Chamberlin, Howard E. Simpson, and George F. Kay served as volunteer assistants for various periods.

In connection with the survey of the Waterloo quadrangle a detailed study was made of the derivation and distribution of the bowlder fans which head in the quartzite ledges. The results will be correlated with the earlier studies of bowlder fans by Mr. Ira M. Buell, and will be published, under joint authorship, by the Survey.

Ashley party.—Mr. George H. Ashley spent most of the field season in geologic and economic surveys of quadrangles in Pennsylvania, in cooperation with the State authorities and under the supervision of Mr. M. R. Campbell. Assisted by Mr. F. G. Clapp, the Curwensville quadrangle was first surveyed, and upon the completion of that work Mr. Ashley assisted Mr. Campbell in the survey of the Patton quadrangle. Although some progress was made in the preparation of the maps and text of the Curwensville folio, the work has been delayed in order that Mr. Ashley might complete his report on the Middlesboro (Kentucky) coal field, the field work for which was done during the preceding summer.

The new topographic base map of the Middlesboro region being completed, Mr. Ashley spent a month in the fall in a resurvey of the areal geology of that field, and devoted most of the office season to the preparation of his report, which is now nearly finished. In the office he was assisted by Mr. Cleveland Abbe, jr.

Atwood party.—Under the direction of Prof. R. D. Salisbury, Mr. W. W. Atwood spent several weeks in Utah, continuing his study of the glacial geology of the Uinta Mountains. He was accompanied by Dr. H. B. Kümmel and Mr. R. D. Calkins, volunteer field assistants. During the fall and winter he was engaged a portion of the time in the preparation of his report, on which considerable progress has been made.

Bain party.—During the year Mr. H. Foster Bain continued his study of the lead and zinc deposits of the Mississippi Valley, devoting special attention to those of Illinois. The months of July, August, and September were spent in the field. In the work in the northern part of the State, Mr. Bain cooperated with Prof. U. S. Grant, of the Wisconsin survey, and was assisted by Messrs. E. E. Ellis and A. F. Crider. In the southern portion of the State he worked in cooperation with Mr. E. O. Ulrich and was assisted by Mr. Crider. As a result of these investigations a brief report on the zinc and lead deposits of northwestern Illinois has been prepared and will be published as a bulletin, and a short paper on the fluorspar deposits of southern Illinois is also completed. Preliminary statements of the results of these studies were published in tne annual economic bulletin, entitled "Contributions to Economic Geology, 1903."

In October Mr. Bain made a special examination of the reputed ore deposits of the Wichita Mountains, Oklahoma. Many samples of rock were collected and carefully assayed in the Survey laboratory. The result was the failure to find even a trace of gold, though unimportant amounts of silver, lead, and copper were discovered. Reports on this investigation have been published in Professional Paper No. 31, of the Survey, entitled "Preliminary Report on the Geology of the Arbuckle and Wichita Mountains," and in Senate Document No. 149.

In the absence of Mr. Bailey Willis, Mr. Bain continued to act as editor of geologic folio texts, and during the year read and revised thirty folios. He also served as a member of the committee on geologic names and on other committees.

Bascom party.—Prof. Florence Bascom was engaged, under the supervision of Professor Van Hise, in the completion of field work in the West Chester, Norristown, Germantown, Chester, and Philadelphia (15-minute) quadrangles, and in the preparation, in cooperation with Messrs. N. H. Darton and

W. B. Clark, of the maps, sections, and text of the Philadelphia special folio. Professor Bascom was assisted for a short time by Mr. B. L. Miller, who gave special attention to the Pleistocene geology of the region. The maps and manuscript for this folio have been completed and transmitted for publication.

Bayley party.—Prof. W. S. Bayley devoted his attention to a study of the crystalline rocks of the Raritan (30-minute) quadrangle in the Highlands of New Jersey, with reference to the preparation of maps and text for a geologic folio of the area, in cooperation with the State survey. This quadrangle comprises four 15-minute quadrangles—the Hopatcong, the Hackettstown, the Somerville, and the High Bridge. Small portions of the area had been previously surveyed by Profs. J. E. Wolff and R. S. Tarr. The mapping of the remaining portions was completed by Professor Bayley, who also made a rapid reconnaissance of the areas already mapped. In this work he was assisted by Mr. Laurence La Forge.

In the office Mr. Bayley spent as much time as he could spare from his college duties at Waterville, Me., in the microscopic study of the rock specimens collected in the Raritan area. During the fall he read the proof of his monograph on the geology of the Menominee iron-bearing district of Michigan (Monograph XLVI).

Boutwell party.—Mr. J. M. Boutwell, assisted by Mr. L. H. Woolsey, and, for a short time, by Mr. A. M. Rock, spent the field season in Utah, continuing his investigation of the areal and economic geology of the Park City mining district. The mapping of the areal geology was completed in November, and the mapping of the underground geology and a critical study of the lead, silver, and copper deposits were finished, excepting three of the larger properties, by the 1st of March.

One of the most important results of the season's work was the discovery that the Pennsylvanian ("Upper Carboniferous") limestone, the main ore-bearing formation, owing to folding, reversed faulting, and extensive overthrust faulting, has a much greater extent in this locality than has hitherto been supposed. Among other interesting results, precise measurement was made of several extensive faults which traverse the main mineralized region and dislocate the ore-bearing beds; significant new facts were learned about igneous and glacial activity in the region; while from limestones intercalated in the basal portion of the "Weber" (?) quartzite (considered "Upper Carboniferous" by the Fortieth Parallel geologists) distinctive "Lower Carboniferous" or Mississippian faunas were collected, thus establishing the age of these beds. During a reconnaissance of the mining camps along the main divide of the Wasatch Range southwest of the Park City area, Mr. Boutwell made a broad correlation of the ore-bearing formations and determined the general character and occurrence of the ores.

On the conclusion of field work in the Park City region, Mr. Boutwell made a reconnaissance of the oil and asphalt fields in Salt Lake Valley, and, en route to Washington, visited New Hampshire, at the request of the Quartermaster-General, for the purpose of ascertaining the possibilities of obtaining an artesian-water supply for the forts which guard Portsmouth Harbor.

In the office Mr. Boutwell was chiefly occupied in the final revision of his report on the economic geology of the Bingham mining district, Utah (which will soon appear as a professional paper, and to which contributions on the general and the areal geology will be made by Mr. S. F. Emmons and Mr. Arthur Keith), and in the preparation of several short papers for the annual economic bulletin of the Survey, while Mr. Woolsey devoted much time to the Park City report, completing a thorough study of the igneous rocks of the area.

Calhoun party.—Under the direction of Professor Chamberlin, Mr. F. H. H. Calhoun continued his work in Montana, making a detailed study of the glacial geology and drainage problems of the Great Falls area, a reconnaissance of which was made during the preceding season. In the office he practically completed the maps and manuscript for a paper on the glacial formations of western Montana, which will be published as a professional paper of the Survey.

Calkins party.—Mr. Frank C. Calkins spent the field season in the Coeur d'Alene mining district, Idaho-Montana, making a survey of the areal geology, under the supervision of Mr. F. L. Ransome. In this work he was assisted by Messrs. W. A. Williams and D. F. McDonald. A general reconnaissance of the entire district was made, and detailed maps for about half the area, which embraces two 15-minute quadrangles, were completed. The remainder of the mapping and the determination of structural problems will be finished this season, when Mr. Ransome will be able to devote his entire attention to the work.

In the office Mr. Calkins was occupied in the preparation of a preliminary report on the general geology of the Coeur d'Alene district, in the revision of his part of a forthcoming bulletin entitled "A Geologic Reconnaissance Across the Cascade Mountains near the Forty-Ninth Parallel," of which he and Mr. George Otis Smith are joint authors, and in assisting Mr. Smith in the preparation of the Snoqualmie (Washington) folio.

Campbell party.—Mr. M. R. Campbell continued in charge of cooperative surveys in the States of Pennsylvania, Maryland, and Kentucky, supervising, in the field and in the office, the work of several parties engaged in areal and economic studies.

In Pennsylvania surveys were made of four 15-minute quadrangles—the Barnesboro, Patton, Curwensville, and Ebensburg—along the eastern edge of the great bituminous coal field and upon the crest of the Allegheny Mountain.

The Barnesboro and Patton quadrangles were surveyed by Mr. Campbell, assisted by Mr. J. S. Burrows, and, part of the time, by Messrs. George H. Ashley and F. G. Clapp. The field work was completed in October, and the maps and folio texts will be finished in July.

The survey of the Curwensville quadrangle was made by Mr. George H. Ashley, assisted by Mr. F. G. Clapp. The field work was completed in September, but the preparation of the folio has been greatly retarded owing to the fact that most of Mr. Ashley's time has been devoted to the completion of his report on the Middlesboro (Kentucky) coal field, which was begun prior to the survey of the Curwensville quadrangle.

The Ebensburg quadrangle was surveyed by Mr. Charles Butts, assisted by Mr. W. C. Phalen. The field work was completed in October, and the maps and folio texts will be finished this summer.

Geologic folios of several quadrangles in Pennsylvania which were surveyed prior to July 1, 1903, were completed and submitted for publication during the fiscal year just ended, namely, the Elders Ridge and Waynesburg folios, by Mr. Ralph W. Stone; the Beaver folio, by Mr. L. H. Woolsey; and the Kittanning and Rural Valley folios, by Mr. Charles Butts.

The cooperative survey of the Accident-Grantsville and the Frostburg-Flintstone quadrangles in Maryland has been delayed by the detail of Mr. George C. Martin, who has charge of the work, to an examination of the oil and coal fields of southern Alaska for the division of Alaskan mineral resources. The field work in the Accident-Grantsville area has been completed, and the folio text and maps are in an advanced state, but can not be finished until the return of Mr. Martin from Alaska.

In Kentucky cooperative work consisted in the completion of the report on the Middlesboro coal field, by Mr. George H. Ashley. This area was surveyed during the summer of 1902, but a new topographic base map was found necessary. Upon its completion Mr. Ashley spent a month in the verification, in the field, of his notes on the areal geology, and during the office season finished his maps and report.

In Ohio detailed areal surveys of the oil field in the eastern part of the State were continued by Mr. W. T. Griswold, in connection with his topographic work, the object being the determination of the conditions under which oil and gas accumulate. Surveys of the Steubenville quadrangle and of the southern half of the Wellsville quadrangle were made, and served to throw much light on the oil and gas problem. The work, however, was hurried, in order that a model of the region, showing the underlying oil-bearing rock, might be prepared for the Louisiana Purchase Exposition, and therefore the results of the survey are not sufficiently detailed for folio publication. Mr. Griswold will, however, this summer complete the field work necessary for the preparation of geologic folios of these quadrangles.

In September Mr. Campbell visited the Deer Creek coal field of Arizona, and although his examination was hurried it was sufficiently complete to determine the presence and extent of two small beds. Samples of the coal were obtained for chemical analyses, and a brief report of the results was prepared and published in the annual economic bulletin.

Throughout the year Mr. Campbell served as a member of the committee on geologic names, and upon the resignation of Mr. Gilbert, in May, he was appointed chairman.

Cross party.—Mr. Whitman Cross, assisted by Messrs. Ernest Howe and Albert Johannsen, continued areal surveys in the San Juan district in Colorado. This is a region of rugged mountains, deep canyons, and, in certain portions, highly complex geologic structure, so that the mapping is a rather slow and laborious process. The survey of the Needle Mountains quadrangle was, however, completed in October, and the remainder of the season was spent in the adjacent Engineer Mountain quadrangle. In the office the map and text for the former folio, which is under the joint authorship of Mr. Cross and Mr. Howe, were completed and transmitted for publication. Mr. Cross also completed and transmitted the folio descriptive of the Rico quadrangle, which was surveyed the preceding season, and throughout the year he served as a member of various committees.

Dale party.—Mr. T. Nelson Dale spent the field season between July 1 and September 15 in Vermont, where he mapped 205 square miles of the Brandon quadrangle. In this work he was assisted by Mr. Nelson C. Dale. In the office considerable time was devoted to the study of the material collected in the field, and Mr. Dale also completed and revised the manuscript for his forthcoming bulletin, entitled "Geology of the Hudson Valley between the Hoosic and the Kinderhook," which describes the geology of about 315 square miles, surveyed several years ago. He also prepared a brief paper on the microscopic characteristics of certain roofing slates from Polk County, Ark., which was published in the annual economic bulletin of the survey.

In May and June visits were made to the slate districts of Fauquier, Amherst, Buckingham, and Fluvanna counties, in

Virginia, of Berkeley County, in West Virginia, and of Frederick and Montgomery counties, in Maryland; also to the Peach Bottom district of Maryland and Pennsylvania and the Bangor district of the latter State, for the purpose of collecting information for the contemplated economic bulletin on the slate industry of the United States, the preparation of which is in charge of Mr. E. C. Eckel.

Dall party.—Mr. William H. Dall devoted his entire time throughout the year to office work, consisting of the identification and classification of material sent in for examination; correspondence with various State officials, private students, and members of the Survey regarding collections submitted; and original research and the preparation of manuscripts for publication.

During the year more than 40,000 specimens were identified, labeled, and registered, a large proportion of them being for the hydrologic division of the Survey, which is conducting investigations of the underground water resources of the country. In this work Mr. Dall was assisted by Mr. Frank Burns until about the 1st of May, when Mr. Burns, in accordance with arrangements for cooperative work in South Carolina, entered the field to collect material and to assist in the study of a supposed new Tertiary deposit in that State.

Mr. Dall's labors in original research were directed chiefly to continuing his investigations with reference to the preparation of a standard column of the Tertiary formations of the Pacific coast. Some field work on this problem had previously been done in Oregon and the extreme northwestern part of California, and in May Mr. Ralph Arnold began field work in the latter State, for the purpose of obtaining needed data. Mr. Dall also has in preparation a review of the nonmarine fossils of the Northwest coast Tertiary, in the study of which he has been greatly aided by the material obtained by the Harriman Alaska Expedition and by that sent in by the Survey field parties.

Proof of the monograph on the Tertiary fauna of Florida, which is being published by the Wagner Free Institute of Science, Philadelphia, was also read and corrected. This report completes the task of reviewing the Tertiary fauna of the southeastern Coastal Plain of the United States.

The manuscript for a volume on the Miocene of Maryland, prepared under the direction of the State geologist, was, in accordance with the cooperative relations existing with that State, read and revised by Mr. Dall, who also wrote an introductory chapter on the Miocene in general and on the relations of the Miocene of Maryland to other Miocene deposits.

After October 6, 1903, Mr. Ralph Arnold acted as assistant to Mr. Dall. Most of his time was devoted to the classification and arrangement, for easy reference, of the Miocene material belonging to the Survey. On the completion of this work, in May, Mr. Arnold entered upon field work in California, his principal study being Tertiary problems.

Mr. T. Wayland Vaughan on several occasions rendered valuable assistance in certain special investigations.

Diller party.—Mr. J. S. Diller devoted the earlier part of the field season to the completion of the mapping of the areal geology of the Redding quadrangle, in California, which was begun the preceding year, when Mr. G. B. Richardson acted as Mr. Diller's assistant. During the winter the text and maps for the Redding folio were practically completed; but microscopic examination of thin sections of the rocks revealed the desirability of subdividing the igneous formations on the maps, and Mr. Diller accordingly spent the month of June in the field for the purpose of reexamining those rocks.

The latter part of the field season of 1903 was spent in a reconnaissance of the Klamath Mountains, in California, for the purpose of obtaining data for the general geologic map of the United States. In the office a preliminary map of the region surveyed was made, special attention being given to the Tertiary and older deposits.

Mr. Diller also prepared, for the annual economic bulletin, a brief paper entitled "Mining and Mineral Resources in the Redding Quadrangle, California, in 1903," and spent considerable time in studying notes and collections made several years ago in the Taylorville region and the country lying between Indian Valley and Honey Lake, in Plumas County, Cal., with reference to the preparation of a bulletin descriptive of the area.

Eckel party.—Mr. E. C. Eckel spent July and August in the office, being occupied largely with administrative duties, in the absence of the geologist in charge. He also worked up the notes collected during the two preceding months, when several natural-cement plants and cement-producing areas were visited. September and October were devoted to a field study of the cement districts of the Western States, much attention being also paid to the salt industry and the roofing-slate quarries of Utah and California. During the winter Mr. Eckel was engaged in preparing a report entitled "Cement Materials and Industry of the United States," which is now practically completed. He also wrote several brief papers for the annual economic bulletin (No. 225), which was prepared under his immediate supervision.

The last two months of the fiscal year were devoted to an inspection of certain cement-producing areas, particular attention being given to the Lehigh district of Pennsylvania and New Jersey, in the study of which Mr. R. S. Bassler rendered efficient assistance, and to the marl deposits of the Middle West. During this trip the slate deposits of northern Minnesota were also studied with reference to a proposed bulletin on the slate industry of the United States.

In accordance with the terms of an agreement entered into with the Louisiana Purchase Exposition commissioner of the State of Mississippi for limited cooperative geologic work in that State, a reconnaissance survey of the region was made by Mr. A. F. Crider, under Mr. Eckel's direction, special attention being given to the clay and cement resources. The resulting report and accompanying geologic map of the State have been completed and submitted to the State officials, in accordance with the terms of the agreement.

Eldridge party.—Mr. George H. Eldridge was occupied throughout the year in the completion of his report on the petroleum fields of California. This report, although of a preliminary nature, will discuss rather fully the conditions of the occurrence of petroleum in the many fields of the State, and will present a general view of the industry as it is conducted on the Pacific coast. Owing to the large amount of material collected, more time has been consumed in the preparation of the report than was originally expected, but the manuscript is now in an advanced state and will be submitted for publication early in the present fiscal year.

Emerson party.—Prof. B. K. Emerson completed his field work in the Becket and Tyringham quadrangles during the autumn, and spent the winter and spring in preparing the map and text for the Housatonic folio, which will include the geology of those quadrangles; in making a detailed map of Worcester County, as a preliminary to his proposed monograph on that county and to the preparation of the Ware and Quinsigamond folios; and in studying the eruptive rocks of the Worcester area, a special study being made of the Belchertown tonalite series, which resembles the classical Cortlandt series of New York.

Fenneman party.—During the field season Prof. N. M. Fenneman completed his examination of the Boulder (Colorado) oil field. The total area covered in his investigations was about 150 square miles, near the center of which is located the developed portion of the field. The results of greatest and most immediate economic importance were the discovery and delineation of folds of the echelon type, on the east limb of one of which are situated the present producing wells.

Mr. Fenneman's detailed report, which covers the general geology, structural relations, and economic products (notably oil, clays, building stones, and artesian water) of the region, has been completed and will be published as a bulletin of the Survey. Two brief preliminary papers relating to this field were published in economic bulletins Nos. 213 and 225.

Fuller party.—Mr. M. L. Fuller devoted only a small portion of his time during the year to work for the division of geology. This consisted chiefly of assisting in the solution of Pleistocene problems in the Elmira, Watkins, and Ithaca quadrangles (New York), and in certain localities in Massachusetts, Rhode Island, Connecticut, and Long Island. In the New York quadrangles the main features regarding the origin and history of certain glacial deposits of peculiar topography and associations were worked out in collaboration with Prof. R. S. Tarr, and as a result of the work in the New England States much light was obtained on the distribution of the "pre-Wisconsin" deposits, enabling correlations to be made.

In the Long Island work, which consisted of a careful study of the coast line, Mr. Fuller was aided by Messrs. A. C. Veatch and B. L. Johnson. A detailed report on the geology of this island is now in preparation, and will be published by the Survey.

In the office the proof of the text and maps of the Patoka (Indiana) folio was read, also a number of referred manuscripts, and a brief report on the Hyner gas pool, located on the crest of an anticline in Clinton County, Pa., was prepared for the annual economic bulletin.

Gilbert party.—Mr. G. K. Gilbert spent three and one-half months in field work and the remainder of the year in office work in Washington.

In the summer of 1903 two trips were made in the High Sierra of California, the first, in conjunction with a party of the Sierra Club, in the Kern basin, the second in the Tuolumne and Merced basins. The subjects of special study were a system of upland plains or terraces recording stages in the uplift of the Sierra Nevada, glacial sculpture and evidences of the relative importance of glacial and aqueous erosion in the development of the topography, and the so-called "dome structure" of certain granite masses.

Work in the Sierra was resumed near the end of the fiscal year, and other subjects received field attention during the journey westward. Water-level gages of the United States Lake Survey on the shores of Lakes Huron and Michigan were inspected, with a view to the resumption of the investigation of recent earth movements in the Great Lakes region; supplementary observations were made on the geology of the Apishapa (Colorado) quadrangle; and a short study was made of El Solitario, an annular ridge in the Terlingua (Texas) quadrangle.

In cooperation with the Carnegie Institution, Mr. Gilbert visited the granite districts of Georgia, in search of a locality suitable for the investigation of subterranean temperature gradients by means of a deep boring.

Office work included the continuance of various studies made in the field in previous years, especially a study of the structure of the Basin ranges of Utah. A paper was published on the variation of glaciers in the Sierra Nevada, and another on domes and dome structure. The preparation of the Apishapa folio was also begun.

In addition, Mr. Gilbert gave much time to the work of the committee on geologic names, of which he was chairman. This committee succeeded the committee on formation names, and is charged with the consideration of questions arising under the rules of stratigraphic nomenclature adopted for the Geologic Atlas and other Survey publications. By reason of the recent revision of the rules of nomenclature, the work of the committee this year involved the establishment of important precedents.

Girty party.—Mr. George H. Girty spent the early portion of the year in the office, engaged in an investigation of the Permian fauna of the Guadalupe Mountains of Texas. During October he was occupied in field work in northwestern Pennsylvania, studying the stratigraphic relations of the Devono-Carboniferous rocks and making collections of fossils. These rocks prove to be a new series, intermediate between the Devonian Chemung and the Carboniferous Waverly group.

The remainder of the year was devoted to office work, consisting of the identification of and report on collections of fossils sent in by members of the Survey; the preparation of a report on the stratigraphy and paleontology of the Devono-Carboniferous, so far as field work has progressed; and the preparation of a report on the fauna of the Morrow formation of Arkansas, which proves to be intermediate between the fauna of the Mississippian series and that of the Coal Measures, and to belong in the Pottsville group of the Pennsylvania section.

In the field Mr. Girty was assisted for a short time by Mr. Thomas Piwonka, while Mr. R. D. Messler and Mr. James Storrs made collections of fossils under his direction, the former working in the Pottsville group of Arkansas and the latter in the Carboniferous of California.

Gregory party.—During the field season Prof. Herbert E. Gregory completed the mapping of the areal geology and the study of the crystalline rocks and the Pleistocene formations of the Granby, Hartford, Meriden, and Middletown quadrangles in Connecticut, composing the Farmington (30-minute) quadrangle, and during the office season he finished and submitted the Farmington folio text. In the field Professor Gregory was assisted by Mr. G. F. Laughlin, and for a short period by Mr. C. J. Sarle. Mr. Laughlin made a special study of the clay deposits of the Farmington area, descriptions of which are contained in the folio.

Hague party.—Mr. Arnold Hague undertook no field work during the last fiscal year. He was engaged for the greater part of the time in preparing the first volume of the monograph on the Yellowstone National Park, which he expects to complete the coming fiscal year. In addition to his own work, this volume will comprise chapters descriptive of the more important geyser and hot-spring areas, by Walter H. Weed; a report on the algous growths of the thermal waters, by W. A. Setchell; a chapter on the physics of geysers, by William Hallock; and a report on the microscopic petrography of the Absaroka Range, by T. A. Jaggar, jr.

Much time has been given to the preparation of the atlas to accompany this monograph. It will consist of topographic and geologic sheets; detailed maps of Norris, Firehole, Midway, and Upper Geyser basins, the Shoshone basin, and the travertine areas of Mammoth Hot Springs; a map, on a large scale, of Mammoth Hot Springs and vicinity, showing the relations of the great travertine deposits to the adjoining sedimentary and volcanic rocks; and a map of Yellowstone Lake, indicating the Pleistocene and recent formations along the shore, and showing clearly the Quaternary history of the lake. This atlas will be ready for publication this summer.

Hobbs party.—Mr. William H. Hobbs spent eight weeks of the field season in a revision of the geologic maps and a study, with special reference to origin, of the iron-ore deposits of the Litchfield (30-minute) quadrangle, in Connecticut, composed of the Cornwall, Winsted, New Milford, and Waterbury

(15-minute) quadrangles. The revision of the maps was completed, and during the office season considerable progress was made in the preparation of the Litchfield folio text; also of a manuscript for a professional paper on the geology of the Salisbury iron district, Connecticut.

Jaggar party.—Prof. T. A. Jaggar, jr., devoted the early part of the last fiscal year to the completion of the maps and text for the Bradshaw Mountains (Arizona) geologic folio. In this work he was assisted by Prof. Charles Palache. During the office season the map and text for the Sturgis-Spearfish (South Dakota) folio were finished, the map being used as the basis for the model of the Black Hills which was prepared for the Louisiana Purchase Exposition.

Keith party.—Mr. Arthur Keith was engaged in field work in North Carolina, South Carolina, and Georgia, from August 15 until November 25, and from May 26 until June 13. The areal survey of the Cowee quadrangle and of part of the Pisgah quadrangle was completed, although some revision will be necessary in order to adjust the results to the new topographic base map which was found necessary, the survey for which was carried on by Mr. Keith and his assistants simultaneously with the geologic survey. The special problems involved in this area comprised the study of deposits of precious stones, of the Archean complex of granites and gneisses, and of the form and structure of the granite batholiths and laccoliths. In the solution of these problems it was found necessary to extend field work into adjoining quadrangles.

In the office Mr. Keith directed his attention to the completion of maps and texts for the Mount Mitchell and Mount Guyot folios, which were submitted before the close of the fiscal year, and to the compilation of field notes obtained in the Cowee and Pisgah quadrangles.

During the winter a brief paper entitled "Recent Zinc Mining in East Tennessee" was prepared for the annual economic bulletin (No. 225).

Throughout the year Mr. Keith was ably assisted by Mr. Hoyt S. Gale.

Kemp party.—Prof. J. F. Kemp spent about two weeks in the field, engaged in revisionary work on the maps of the crystalline rocks in the western portions of the Whitehall and Ticonderoga (New York and Vermont) quadrangles for the Fort Ticonderoga folio. During the winter this folio was practically completed, and Professor Kemp also prepared and submitted a brief report on the graphite deposits of the Adirondack region, which was published in the annual economic bulletin.

Knowlton party.—The major portion of Mr. F. H. Knowlton's time was occupied in the identification of material collected by various members of the Survey in the prosecution of their field work, but he was also able to make considerable progress in the studies of Cretaceous and Tertiary floras. During the year he prepared a paper on the fossil flora of the Judith River beds of Montana, to accompany the report, by Messrs. T. W. Stanton and J. B. Hatcher, on the geology and paleontology of those beds, which have been proved to be the equivalent of the Belly River beds in Canada, and to be considerably older than the Laramie formation, with which they have hitherto been correlated. Several weeks were also spent on the manuscript for the monograph on the flora of the Puget and allied formations in Washington, which is now in an advanced state, and in all probability will be completed and submitted before the close of the next year. Mr. Knowlton also identified a large collection of plants from various high Tertiary beds of Montana for the Carnegie Museum.

Mr. Knowlton spent the months of August and September in field work in the Needle Mountains, Colorado, assisting Mr. Whitman Cross in the solution of intricate stratigraphic problems.

La Forge party.—Mr. Laurence La Forge was engaged in field work in New Jersey from July 16 until September 11, assisting Prof. W. S. Bayley in mapping the pre-Cambrian crystalline rocks of the Raritan (30-minute) quadrangle. On October 3 he entered the Washington office, and spent a short time in the review of field notes. Later in the month he took up field work in the Cartersville (Georgia) quadrangle for the purpose of revising the maps of the areal and structural geology of that area, so that they will conform to the new topographic sheets.

In the office Mr. La Forge was occupied in the compilation of his field notes of the Cartersville area, in assisting in the preparation of the geologic map of the United States which is displayed at the Louisiana Purchase Exposition, in the preparation of several short papers on hydrologic subjects, which will be published in the series of water-supply papers, and in correspondence relating to economic subjects.

Leith party.—Prof. C. K. Leith, acting under the supervision of Professor Van Hise and assisted by Messrs. A. E. Seaman and W. N. Smith, spent several weeks in the Lake Superior region in field work necessary for the completion of the monograph on the iron-bearing districts of that area, and devoted part of the month of October to a field study of the iron-ore deposits in Iron County, Utah.

During the winter much time was spent in the revision of the maps of the Lake Superior region, and in the preparation of a series of charts, illustrating the origin and development of ores, for the Louisiana Purchase Exposition. Mr. Leith also prepared the first draft of the manuscript for a new edition of the bulletin on Archean and Algonkian correlation. This bulletin, which it is expected will be ready for publication during the coming year, will include the material contained in Bulletin No. 86, published in 1892, and summaries of subsequent work. Mr. Leith revised, finally, his paper on rock cleavage, which will be published as a bulletin of the Survey, and also assisted Professor Van Hise in reading the proof of Monograph XLVII, entitled "A Treatise on Metamorphism."

Leverett party.—Under the direction of Professor Chamberlin, Mr. Frank Leverett devoted several weeks of the field season to a survey of the Ann Arbor (30-minute) quadrangle, in Michigan, for folio publication. This field work was completed about the middle of October, and the maps and texts, which have been prepared in conjunction with Profs. I. C. Russell and C. A. Davis, are now nearly ready for transmission.

In the fall several weeks were also spent in the extreme eastern counties of Michigan in field work necessary for the completion of the monograph on the glacial formations and associated lacustrine features of Indiana and Michigan, of which Mr. Leverett and Mr. F. B. Taylor are joint authors. In November a field conference was held with State geologist A. C. Lane, in Huron and Sanilac counties, for the purpose of adjusting the correlation of the shore lines of Lake Warren in the Saginaw basin with those in the southern part of the Lake Huron basin. A small amount of field work still remains to be done before this monograph can be completed, but it is expected that the manuscript will be finished and transmitted for publication during the coming winter.

Lindgren party.—Mr. Waldemar Lindgren spent the latter half of the month of June and the first half of the month of July, 1903, in the Cripple Creek mining district, Colorado, initiating, in collaboration with Mr. F. L. Ransome, a resurvey of that area. From July 15 until February 1 Mr. Lindgren was absent (on leave without pay), Mr. Ransome continuing the investigation until the close of the field season. On February 1 Mr. Lindgren resumed field work in the Cripple Creek district, and remained until the completion of the survey, the last of April.

The months of May and June were devoted to office work at Washington. During this time the report on the copper deposits of Clifton, Ariz., was completed, and considerable progress was made in the compilation of the field maps and notes of the Cripple Creek district and in the study of the rocks collected in that district.

Mr. Lindgren was ably assisted, both in the field and in the office, by Mr. L. C. Graton, who, in addition to other work, made a preliminary study of the petrography of the Cripple Creek district.

Mendenhall party.—On July 1 Mr. W. C. Mendenhall was transferred to the division of hydrology and assigned to hydrologic investigations in southern California. In carrying on field work for that division he was able also to conduct various investigations for the division of geology and paleontology. The month of July was spent in a geologic reconnaissance of the region south and east of Los Angeles, where the Cretaceous and Tertiary sediments are well displayed and their relations to older rocks clearly exhibited, and in a brief study of the gem deposits at Pala, which have recently attracted much attention. Under his direction extensive collections of Tertiary fossils were made by Dr. Stephen Bowers, of Los Angeles, from the north and south flanks of the Santa Ana Mountains, in the valleys of Temescal and Aliso creeks. It is expected that these collections, when studied by the Survey paleontologists, will fix certain points in the Tertiary column of this part of the State, and serve as datum planes in working out the complex Cenozoic stratigraphy.

In January and February Mr. Mendenhall spent about four weeks, in company with Doctor Bowers, in a study of the geology of the Carriso Mountains, just north of the Mexican boundary line. Large collections of fossils were made from this area, and are now being studied by Survey paleontologists. Some new Tertiary corals, closely allied to West Indian forms, have been discovered in these collections.

In February and March Mr. Mendenhall's work took him into the Redlands and San Bernardino areas, and in connection with it he was able to make considerable progress in mapping the areal geology of the mountainous portions of the San Bernardino quadrangle.

Owing to his other duties, Mr. Mendenhall has not been able to make much progress in the preparation of his reports on the geology of the regions visited, but the report on the Carriso Mountains area has been begun and will be continued as rapidly as possible.

Osborn party.—Prof. Henry Fairfield Osborn continued to have supervision of work in vertebrate paleontology.

With the assistance of Messrs. W. K. Gregory and A. E. Anderson considerable progress was made on the titanothere monograph. The systematic description of both the Eocene and the Oligocene titanotheres has been completed, and connections between two of the Eocene and Oligocene series have at last been traced. The discovery that the Eocene titanotheres embraced four independent lines suggested the necessity of additional research in the field. Mr. Walter Granger was accordingly placed in charge of special exploration (the funds being contributed by the American Museum of Natural History, of New York) in the Bridger basin, Montana, Professor Osborn visiting the region while the work was in progress. Owing to the irregular nature of the deposition, the life succession in the middle Eocene stage is very perplexing, and in order to present in this monograph an approximate theory of the succession and deposition of titanothere species, it has been found necessary to continue stratigraphic and paleontologic work in the Bridger basin during the coming year.

Work on the monograph on the Ceratopsia, begun by Mr. J. B. Hatcher[a] in 1902, was continued during the fiscal year, and is now nearly completed. In connection with his researches Mr. Hatcher visited the American, Yale, and Ottawa museums, and reached important results as to the phylogenetic succession, which prove that there were at least two contemporaneous series of these animals.

Substantial progress was also made on the monograph on the Sauropoda, although much work remains to be done. The systematic summary of the Sauropoda as recorded in various parts of the world was completed by Mr. Gregory, as was also the bibliography begun by the late Prof. O. C. Marsh. The Sauropoda types of the late Prof. E. D. Cope from the vicinity of Canyon, Colo., are being carefully prepared and studied for the solution of both morphologic and taxonomic questions. Exploration in the Como region of Wyoming was continued, but the desired geologic sections at Canyon and in the Southwest have not yet been completed.

Ransome party.—In the original plans for field work for the last fiscal year Mr. F. L. Ransome was assigned to the investigation of the geology of the Coeur d'Alene mining district of Idaho, with Mr. F. C. Calkins as assistant. When, however, arrangements were consummated for the resurvey of the Cripple Creek mining district, in cooperation with the State of Colorado, it was considered advisable, in view of the extent of

[a] Mr. Hatcher died on July 3, 1904, from typhoid fever, at the age of 46.

the underground developments at Cripple Creek and the importance and delicacy of the questions involved, to place two geologists in that field. Accordingly, Mr. Ransome was instructed to associate himself with Mr. Waldemar Lindgren, and to apportion his time between the Cripple Creek and the Coeur d'Alene districts in such a manner as to obtain the best results. By mutual agreement Messrs. Lindgren and Ransome divided the Cripple Creek field work, it being understood that each geologist should study particularly the mines in the area assigned to him, and at the same time do sufficient work in the other area to become cognizant of the important economic problems of the whole district.

Mr. Calkins therefore undertook the areal survey of the Coeur d'Alene district, embracing an area equivalent to two 15-minute quadrangles, with Mr. W. A. Williams as assistant, Mr. Ransome spending a short time with the party, and visiting a few of the larger mines, preparatory to making a detailed study of ore deposits and structural problems during the next field season. The greater part of the areal survey, however, was completed by Mr. Calkins, who, during the office season, prepared a preliminary report on the general geology.

Mr. Ransome, assisted by Messrs. L. C. Graton and A. M. Rock, continued field work in the Cripple Creek district from July until October, when work was suspended on account of the labor conditions existing in the region and the consequent closing of many of the mines. Field work, however, was resumed in January and continued until its completion, Mr. Ransome returning to the office in February and Mr. Lindgren in April.

In the office Mr. Ransome's time was devoted chiefly to the compilation of his notes on the gold deposits of the Cripple Creek district, to the preparation of the Globe (Arizona) and the Silverton (Colorado) folios, and to reading the proof of a professional paper (No. 21) descriptive of the economic geology of the Bisbee district. He also served throughout the year as a member of the committee on geologic names. During the winter a study of the petrography of the Cripple Creek district was made by Mr. Graton.

Reid party.—Prof. Harry Fielding Reid continued his work as special expert in charge of earthquake data. During the year a careful record, in the form of a card catalogue arranged chronologically, was kept of all earthquakes occurring in the United States about which any information could be obtained, either from the newspapers, the reports of the Weather Bureau and the Light-House Board, or by correspondence. Special information was collected regarding the earthquake of November 4, 1903, which was felt throughout a large section southeast of St. Louis, and also regarding that of March 21, 1904, which was felt in the extreme northeastern part of this country and in Nova Scotia.

Upon the invitation of the German Government, an international seismologic conference was held at Strassburg from July 24 to July 28. The official delegates represented nineteen countries in various parts of the world, Professor Reid being the delegate from the United States. As a result of this conference the International Seismological Association was formed for the purpose of cooperative earthquake investigations, and it is expected that seismologic studies will be stimulated, especially in countries which have not heretofore been active in this field.

Russell party.—Prof. I. C. Russell continued explorations in Idaho and Oregon, for the purpose of studying the geology, water resources, and, especially, the artesian conditions of an extensive and previously little-known region. He left Boise on June 28, with Messrs. C. E. Wilson and H. C. Dewey as field assistants, and proceeded to Burns, Oreg., the western limit of his explorations the previous year. From Burns the party proceeded westward to Hampton Butte, Pauline Mountain, Prineville, Sisters, Farewell Bend, and thence southward to Fort Klamath, disbanding at Medford, Oreg., on September 15.

Considerable information was obtained regarding recent volcanoes at the numerous craters near Christmas Lake, at Lava Butte, and in the summit portion of the much eroded Tertiary volcanic mountain in which Pauline and East lakes are situated. The vast lava plains of central Oregon were found to be essentially a continuation of the similar plains in Washington and Idaho, and much additional information was obtained regarding the Columbia River lava, of which they are composed. The results of this field work are embodied in a report on the "Geology and Water Resources of Central Oregon," which will soon be published as a bulletin of the Survey.

During the spring Professor Russell made a study of the hard-rock geology, clay beds, and marl deposits of the Ann Arbor (Michigan) quadrangle, and collaborated with Mr. Frank Leverett and Prof. C. A. Davis in the completion of the Ann Arbor folio.

Salisbury party.—During the summer of 1903 Prof. R. D. Salisbury spent a short time in the Bighorn Mountains, Wyoming, making a general study of the glaciation of that range and directing the work of the party of volunteer assistants, consisting of Messrs. E. S. Bastin, leader; E. D. K. Leffingwell, S. R. Capps, A. E. Taylor, W. McGee, and A. D. Hole, to whom the detailed study was assigned. This party remained in the field from July 1 until the middle of September, when field work was stopped by severe snowstorms. The work on the surface geology and the tracing of the limits of former glaciation were completed. Considerable time was also devoted to the study of certain local lacustrine and fluviatile deposits in the mountains and to the stream terraces near the foot of the range.

After leaving the Bighorn region Professor Salisbury spent a week in the Bear River Range of Idaho, in consultation with Mr. William Peterson, to whom has been intrusted the study of the glacial formations in that locality. He also gave supervision to the glacial investigations of Mr. W. W. Atwood in the Uinta Mountains, Utah, and during the winter completed the maps and folio text covering the Pleistocene geology of the Passaic and Franklin (New Jersey) quadrangles.

George Otis Smith party.—Mr. George Otis Smith continued geologic work in Maine, in cooperation with the State, devoting considerable time to the mapping of the areal geology of the Penobscot Bay quadrangle and to several economic studies, including an investigation, in company with Mr. David White, of the possibilities of the occurrence of coal in the southeastern part of the State. Mr. Smith also visited other areas in Maine where coal has been reported to occur, as well as two localities where prospecting for gold is being conducted. In October he made a critical study of certain localities in the Taconic Range of western New England, in connection with the survey of that area for folio publication, and also made a brief examination of a number of gold prospects in southern Vermont, with a view to determining their economic importance.

In the office Mr. Smith devoted considerable time to the compilation of his field notes on the Penobscot Bay quadrangle, and, with the assistance of Mr. F. C. Calkins, to the preparation of the maps and text of the Snoqualmie (Washington) folio, the survey for which was completed the preceding year. Much of his time was also occupied in the review of referred manuscripts relating to New England geology, and in the preparation, in collaboration with Mr. David White as joint author, of a professional paper entitled "The Geology of the Perry Basin in Southeastern Maine," which has been completed and submitted for publication. A brief paper entitled "Quartz Veins in Maine and Vermont" was also prepared and published in the annual economic bulletin (No. 225). During the latter half of the year Mr. Smith served as a member of the committee on geologic names.

Early in June he accompanied Mr. Whitman Cross in a brief critical examination of certain localities in Rhode Island, and later in the month resumed areal mapping in Maine, assisted by Messrs. E. S. Bastin and C. W. Brown.

James Perrin Smith party.—Prof. James Perrin Smith devoted his time to paleontologic work in connection with various stratigraphic problems in the West, and to the collection of material needed for the preparation of his monograph on the marine Triassic faunas of America.

Professor Smith spent a short time in the Aspen Mountains, Idaho, and in the Wasatch Range, Utah, making collections of fossils from lower Triassic rocks. In this work he was assisted by Mr. David Tarpey, who not only made the journey at his own expense, but also provided the wagon and team used by the party. The specimens obtained have greatly enlarged the Survey collections of lower Triassic fossils, especially cephalopods, and added much to the knowledge of Triassic stratigraphy.

A brief period was also spent in Shasta County, Cal., where, with the assistance of Mr. Wheeler North, collections were made from some newly discovered exposures of the upper Triassic, which have added numerous species to the existing collections and served to clear many doubtful points in the stratigraphy of the region.

Two weeks were devoted to a journey through central Nevada and eastern California, in which extensive collections (including some new species) were made from the middle Triassic.

It is designed to obtain as complete a collection of marine Triassic fossils as possible for use in the preparation of the monograph on that subject, and although large and valuable collections of the representative faunas were procured, an endeavor will be made to add to them during the present field season.

In the office Professor Smith was engaged until the middle of February, when illness prevented a continuance of his labors, in the classification of the fossils gathered during the summer, in the revision of a manuscript on the Triassic cephalopod genera of America, and in the preparation of the manuscript for the monograph on the marine Triassic faunas of America.

W. S. Tangier Smith party.—Mr. W. S. Tangier Smith devoted July to office work in Washington in connection with the preparation of reports on the lead and zinc districts of Joplin, Mo., and of western Kentucky. August and September were spent in the Black Hills investigating the igneous rocks of the Sundance (Wyoming-South Dakota) and adjoining quadrangles. The remainder of the year was given to office work, which included the completion of a report on the lead, zinc, and fluorspar deposits of western Kentucky, in collaboration with Mr. E. O. Ulrich, and one on the igneous rocks of the Sundance and adjoining quadrangles. Good progress was also made on the report on the Joplin district, which will be completed during the early part of the next fiscal year. For about two months Mr. Smith was assisted in the office by Mr. C. E. Siebenthal.

Spurr party.—Mr. J. E. Spurr spent three months in field work in the Tonopah, Nev., mining district, continuing the detailed study of the surface and underground geology which was begun the preceding season, a new topographic base map of the principal mining localities having been prepared in the meantime. A month was then devoted to study of the economic geology of the Silver Peak quadrangle, about 60 miles west of Tonopah, for the geologic folio of that area, the areal survey for which was made some time ago by Mr. H. W. Turner. In the course of this field work (in all of which Mr. Spurr was assisted by Mr. L. Dominian), short side trips were made to several other mining districts in the region, notably the Grandpa (now called Goldfields), the Southern Klondike, and the Gold Mountain districts.

During the office season Mr. Spurr prepared a brief report (published as Bulletin No. 219) on the Tonopah mining district, giving the essential results of his investigation, and practically completed the detailed report, which deals with many problems in ore deposition, rock alteration, vulcanology, petrology, and faulting. Before submitting the latter report, however, he will spend a short time in the district for revisionary work and study of new developments. In addition, nine short papers on economic subjects were prepared for the annual economic bulletin, three referred manuscripts were reviewed, and considerable progress was made in the preparation of the report on the economic geology of the Silver Peak area.

Stose party.—Mr. George W. Stose was occupied throughout the year chiefly with duties pertaining to the editing of geologic maps. August and September, however, he spent in field work in Pennsylvania, completing the survey of the Mercersburg quadrangle and making a reconnaissance of the northern end of South Mountain, in the Carlisle quadrangle. During the winter progress was made in the preparation of the Mercersburg-Chambersburg folio. A short paper, entitled

"Barite in Southern Pennsylvania and Pure Limestone in Berkeley County, W. Va.," was prepared for the annual economic bulletin, and considerable time was devoted to the work of the committee on geologic names, of which Mr. Stose is secretary.

Taff party.—For the first three months of the fiscal year Mr. J. A. Taff was detailed to the Interior Department and was engaged in the preparation of reports on the segregated coal and asphalt lands of the Choctaw and Chickasaw nations in Indian Territory. These lands were divided into ten districts, and a separate report on each, with map, was prepared and submitted to the Secretary of the Interior on October 17.

During the winter the report on the geology of the Arbuckle and Wichita mountains, in Indian Territory and Oklahoma, was completed and published as a professional paper (No. 31), and afterwards the maps and text for the Tahlequah and Muscogee (Indian Territory) folios were finished.

Early in May Mr. Taff was again detailed to prepare circulars of information on the unleased segregated coal and asphalt lands in the Choctaw and Chickasaw nations, to be used in connection with the sale of these tracts. For this purpose the lands were divided into six districts, and a descriptive report on each, with map, was prepared and submitted to the Secretary of the Interior before the close of the fiscal year.

Incidental office work included the proof reading of the Arbuckle and Wichita mountains report and the preparation of geologic maps and sections for a model of the segregated coal lands in the Choctaw Nation.

Tarr party.—During the year Prof. R. S. Tarr was engaged in completing the mapping of the Pleistocene deposits and in studying the physiography of the quadrangles embraced in the Watkins Glen (New York) folio, which is now in an advanced state and will be completed and submitted for publication early in the next fiscal year. Throughout the field season he was assisted by Messrs. Lawrence Martin and B. S. Butler, and for a shorter period by Mr. G. D. Hubbard.

Across the area included in this folio extends the massive moraine mapped by Professor Chamberlin and described in the Second Annual Report of the Survey. Professor Tarr's detailed study has resulted in differentiating the parts of this moraine and in tracing the location of the ice fronts of the Cayuga and Seneca Valley lobes at different stages of the recession. Many interesting problems in the Pleistocene glaciation and physiography of the region, however, can not be determined until the mapping of the entire Finger Lakes area has been completed.

Taylor party.—Mr. F. B. Taylor, owing to illness, was prevented from continuing field work last summer, but during the winter he prepared a report on the water resources of the Taconic quadrangle, in Massachusetts, New York, and Vermont, and spent considerable time, under the direction of Professor Chamberlin, in the preparation of his portion of the forthcoming monograph descriptive of the glacial geology and associated lake history of the lower peninsula of Michigan and the northern part of Indiana, of which he is joint author with Mr. Frank Leverett.

About June 1, 1904 Mr. Taylor resumed field work in Michigan, continuing his studies—begun in the summer of 1902—of the old lake features of the State.

Ulrich party.—Mr. E. O. Ulrich spent the greater part of July in southern Illinois, where he was associated with Mr. H. F. Bain in a study of structural and stratigraphic problems bearing upon the distribution of the deposits of fluorite and its associated minerals in the Kentucky-Illinois fluorite district.

Two months were then devoted to a rapid survey of the Ordovician rocks in the Mississippi Valley above the mouth of the Ohio and in northeastern Illinois and eastern Wisconsin. The object of this survey was to obtain stratigraphic and paleontologic data which might serve as a basis for detailed correlations. Perhaps the most noteworthy result of this reconnaissance was the acquirement of proof that the western part of the Ohio province is divisible into three subbasins, each characterized by peculiarities in the faunas and lithologic characters of their respective formations.

About five weeks were spent with Mr George I. Adams in paleontologic and stratigraphic investigations in the Permo-

Carboniferous area of north-central Texas. Large collections of fossils, made with the view of showing their horizontal and vertical ranges in the area, were obtained; also important stratigraphic data, which indicate a gradual change of the beds toward the north.

Part of the month of November was devoted to mapping the geologic formations on the south side of the Ohio, in the East Cincinnati and the West Cincinnati quadrangles, with reference to the preparation of a geologic folio of the area.

In the office Mr. Ulrich was occupied in the revision of the report, by himself and Mr. W. S. Tangier Smith, on the lead, zinc, and fluorite deposits of western Kentucky; in the completion of two papers, with Mr. R. S. Bassler as joint author, on Paleozoic bryozoa; in the preparation of reports on the Paleozoic formations of the Mississippi Valley and on the correlation of geologic formations in northern Arkansas, the latter published as part of a professional paper on the lead and zinc deposits of northern Arkansas, by Mr. George I. Adams; in the identification of collections of Ordovician and Silurian fossils for various members of the Survey; and in the critical reading of referred manuscripts.

Vaughan party.—Mr. T. Wayland Vaughan continued work on the preparation of his monograph on the later Tertiary corals of North America, and also spent considerable time in arranging, labeling, and cataloguing collections of both recent and fossil corals in the United States National Museum and in identifying and preparing reports on collections of fossils submitted to him, especially collections of Tertiary corals sent in by Mr. S. W. McCallie, assistant State geologist of Georgia, who is cooperating with the Survey in a study of the underground water supply of that State.

Nearly all of the earlier work on the American Recent and fossil corals having been done by European scientists, the type specimens are located in European museums. In order to complete his monograph on North American Tertiary corals, Mr Vaughan found it necessary to study these original specimens He accordingly spent the time between August 5 and November 11 in Europe (the expenses of the trip being borne by himself) studying types of American corals in the museums of Berlin, Upsala, Paris, London, and Glasgow, and examining collections of other corals at Vienna and at Leipzig. Additional descriptions and numerous photographs of many of the type specimens were obtained, and through the generosity of the University of Upsala Mr. Vaughan was permitted to bring to Washington a collection belonging to that institution, in order that he might have opportunity to study it more thoroughly. In connection with this trip Mr. Vaughan attended, as one of the delegates of the Survey, the Ninth International Geological Congress at Vienna.

During the winter Mr. Vaughan's attention was directed to the existence of extensive fossil coral reefs in southern California. At his request Mr. Walter C. Mendenhall, who was engaged in hydrologic investigations in southern California, and Dr. Stephen Bowers visited the region during January and February. Mr. Mendenhall gave his attention to a study of the general geology of the region, while Doctor Bowers made extensive collections of fossils. This locality has proved to be of great geologic importance, showing the close relations between the mid-Tertiary faunas of the two coasts of America, thereby throwing more light on the geologic history of the southern portion of the continent.

Mr. Vaughan also prepared, at the request of the United States Fish Commission, a report on the corals collected by that bureau around the Hawaiian Islands in 1902.

Ward party.—Mr. Lester F. Ward spent the first three and one-half months of the fiscal year in Europe, engaged in paleobotanic and bibliographic researches in the museums and libraries of Paris, Vienna, Dresden, Berlin, Leipzig, Frankfort on the Main, Brussels, and Louvain. He also attended the Ninth International Geological Congress at Vienna, and made a few geologic excursions to points of special interest in connection with his work. Many type specimens of important species of fossil plants were studied, and Mr. Ward obtained, from rare paleobotanic works not accessible in America, a large amount of valuable data pertaining to his special branch of science. In addition, visits were made to a large number of antiquarian book stores, and as a result about 150 rare memoirs were obtained for the library of the Survey.

The remainder of the year was devoted to the compilation of the results of the summer's work, to the supervision of the preparation of the bibliography of fossil plants, which is under the immediate charge of Miss Charlotte H. Schmidt and on which satisfactory progress has been made, and to the collection of data for the preparation of the third paper of the series on the Mesozoic floras of the United States. This paper will deal with the flora of the "Middle Cretaceous," or the plant-bearing beds next above those treated in the second paper, which was completed and submitted for publication last year. These beds embrace the Raritan formation and the strata of similar age in all parts of the country where fossil plants occur. In this work Dr. Arthur Hollick, of the New York Botanical Garden, will assist, making a study of the collections from Gay Head and the adjacent region.

Weed party.—Mr. Walter H. Weed devoted the greater part of the year to the completion of his report on the Butte mining district, in Montana, which is now nearly finished. In connection with this work a topographic survey of the mountainous area lying immediately east of Butte was made by Mr. R. H. Chapman. This area, which embraces an extension of the Butte copper district, is cut by many veins carrying high values in copper and silver, and is one of the regions upon which the future of the district will depend. Its survey will therefore add materially to the value of the Butte report.

The Helena special folio, part of the field work for which was done by Mr. L. S. Griswold several years ago and subsequently completed by Mr. Weed, was finally revised and submitted for publication. This area embraces the Prickly Pear Valley and the country tributary to Helena, Mont.; the Last Chance Gulch, where gold was discovered soon after the State was settled; and the important mining district south of the city. It presents a wide range of sedimentary and igneous rocks, whose relations are of great theoretic as well as practical interest.

The maps and text for the geologic folio of the Boulder (Montana) quadrangle were also completed and transmitted. This area embraces the important mining districts in Jefferson County, which have been productive since the first discovery of gold in the State.

Under Mr. Weed's supervision, Dr. Joseph Barrell continued office work upon material collected in the Marysville and Elkhorn regions, Montana, and prepared a report on the batholiths of Marysville and Boulder and their influence upon the adjacent sedimentary rocks.

The investigation of the copper deposits of the Appalachian region was continued, though a relatively small amount of time was devoted to it during the year. Mr. Weed, however, visited the copper mines at Ely and Copper Hill, also those at Griggstown, N. J. The results of his observations were published in the annual economic bulletin, as were the results of an investigation made by Mr. Thomas L. Watson, under Mr. Weed's supervision, of the copper mines of Lincoln County, Ga. Other copper localities in New Jersey and Maryland were revisited by Mr. Weed, and considerable progress was made by Mr. Watson in a petrographic study of the rocks of Lincoln County, Ga.

Mr. Weed devoted the last two months of the year to the preparation, under the direction of Mr. Arnold Hague, of the geologic maps of the Yellowstone Park geyser basins and hot-spring areas for the atlas to accompany Part I of the monograph on the Yellowstone National Park. This work has involved a careful review of observations extending over many years, and the solution of numerous intricate problems.

White party.—Mr. David White spent two months of the field season in a study of the subdivisions of the Coal Measures in the southern Appalachian region, for the purpose of making more exact correlations with the subdivisions established in Pennsylvania and West Virginia. Examination of the geologic sections and of collections of fossils from the Estillville and Bristol quadrangles in southwestern Virginia, the Harlan and Middlesboro districts of Kentucky, and the Briceville quadrangle in Tennessee failed to reveal clear evidence of the presence of Coal Measures as young as the Allegheny formation of the northern Appalachian region. A preliminary statement of the results of this investigation, so far as they are concerned with the conditions of sedimentation in the Appalachian trough during Pottsville time, has been published in the Bulletin of the Geological Society of America.

In accordance with cooperative plans entered into with the State of Maine, Mr. White spent three weeks with Mr. George Otis Smith in a stratigraphic reconnaissance of the Perry basin and a paleontologic study of the Perry formation in particular, with special reference to the prospects of developing coal in Washington County. This examination failed to disclose the slightest evidence of the occurrence of coal, and a thorough study of the paleobotanic material collected by Mr. White leaves no room for further controversy as to the pre-Carboniferous age of the Perry formation. The results of this investigation are given in the joint report of Messrs. Smith and White, which is to be published as a professional paper of the Survey.

The task of obtaining sufficient paleontologic evidence from the Dunkard and Monongahela formations to determine the Permo-Pennsylvanian boundary in the Appalachian trough, which was undertaken by Mr. White in 1902, was continued during the last fiscal year. Large collections of fossils bearing on this problem were made by Mr. T. E. Williard in Ohio, Pennsylvania, and West Virginia, and the study of these has thrown considerable light on the otherwise little-known flora of the Monongahela.

Aside from the investigations mentioned above, so much of Mr. White's time in the office was given to the study of and reports on collections submitted by various geologists of the Survey, in connection with their work, and by State geologists, that he was able to make little progress with his monograph on the fossil floras of the Pottsville formation in the Appalachian trough. The material therefor was, however, greatly increased by the collections made during the field season.

Williams party.—Prof. H. S. Williams spent about two months in the field studying the areal geology of the Watkins Glen (New York) quadrangle. In this work he was assisted by

Messrs. E. M. Kindle and V. H. Barnett, who remained in the field until near the end of October. During the office season, with Mr. Kindle's assistance, the maps and text for the Watkins Glen folio were practically completed. One of the most important scientific results of the work in this area was the establishment of connection between the Chemung faunas and the fauna of a recently discovered zone in which the species are almost entirely of forms regarded as characteristic of the Hamilton formation, but which have been found in abundance 2,000 feet above the top of that formation. Two well-defined horizons of this fauna were found in the Watkins quadrangle, thus establishing the recurrence of the dominant elements of a fossil fauna after its complete departure and replacement by a distinct fauna, and after an interval representing at least 2,000 feet of strata.

In addition the manuscript for a bulletin entitled "Contributions to Devonian Paleontology, 1903," under the joint authorship of Professor Williams and Mr. Kindle, was thoroughly revised to conform to evidence obtained during the field season, and submitted for publication. This paper contains a discussion of the faunal succession and geographic distribution of the faunas between the top of the Silurian and the Carboniferous in the States of Kentucky, West Virginia, and Virginia, as well as detailed reports on the succession of faunas for the same geologic interval for the Catawissa, Leroy, and other selected long sections in northern Pennsylvania.

A report was also prepared on the faunas discovered by Prof. N. S. Shaler in the Cobscook Bay region of Maine, to accompany the report of Messrs. George Otis Smith and David White on the Perry basin, and progress was made on the report on the Chapman fauna of Maine.

Wolff party.—During the year Prof. J. E. Wolff completed and submitted for publication the maps and texts for the following folios or parts of folios on which he has been engaged: Taconic (Massachusetts-Vermont-New York), Mettawee (Vermont-New York), Passaic (New Jersey).

Under Professor Wolff's supervision field work in the Wilmington (Vermont) quadrangle was also continued, about 50 square miles of the areal geology being mapped by Messrs. C. W. Brown and H. O. Wood, who during the winter platted their observations and worked up the field notes acquired.

Professor Wolff, assisted by Mr. H. O. Wood and Dr. J. M. Bell, also devoted some time to a study of the hornblendes and pyroxenes of the New Jersey gneisses, for the purpose of ascertaining the origin of those rocks.

Division of Alaskan Mineral Resources.

ORGANIZATION OF DIVISION.

It was early recognized that the peculiar conditions under which Alaskan investigations were carried on demanded an administration that was more or less distinct from that covering the work in the States, and this demand was met by putting its control in the hands of a committee in which both the geologic and the topographic branches were represented. With the rapid expansion of the Alaskan surveys the administration by a committee proved impracticable and it became necessary to vest the entire responsibility for both the geologic and the topographic work in one person, who should, as far as possible, keep in close touch with the entire field. This seemed all the more desirable because the geologic and topographic surveys are often carried on by combined parties, and hence could not well be separately controlled. Moreover, since the appropriation is made in a lump sum, for the investigation of Alaska's mineral resources, the allotment for the distinct classes of work must be determined from year to year by the demands of the mining interests.

At the close of the last fiscal year, therefore, in accordance with a recommendation made to the Secretary of the Interior, the Alaskan geologic and topographic surveys were combined as the division of Alaskan mineral resources, and Mr. Alfred H. Brooks was made geologist in charge.

On the creation of a distinct Alaskan division there were assigned to it all the men who were engaged in Alaskan surveys: Messrs. Arthur C. Spencer, A. J. Collier, F. H. Moffit, Sidney Paige, and F. C. Schrader, from the division of geology, and Mr. T. G. Gerdine from the division of topography.

Mr. D. C. Witherspoon was appointed topographer and assigned to the division on November 12, after certification by the Civil Service Commission. Messrs. Arthur Hollick and Cleveland Abbe, jr., of the per diem force, were also assigned to temporary duty with the division. Messrs. L. M. Prindle, G. C. Martin, F. L. Hess, C. W. Wright, R. B. Oliver, and E. J. Hill were employed under temporary appointments during the summer months, and the first four during a part of the winter months.

On April 1 Mr. E. G. Hamilton, assistant topographer, was transferred to the division from the topographic branch, and Mr. R. W. Stone, assistant geologist, from the division of geology, on May 1. Messrs. Prindle, F. E. Wright, C. W. Wright, G. C. Martin, and F. L. Hess, having been certified by the Civil Service Commission, were appointed to the geologic corps of the division at the opening of the present field season. Miss Marion Thorwarth was continued in her position as stenographic clerk, and Miss Elise Durer was appointed stenographer in the division on March 3. Messrs. Schrader and Spencer severed their connection with the Alaskan work at the beginning of the new fiscal year.

The net result of these transfers and appointments leaves the division with nine geologists besides the geologist in charge, three topographers, and two stenographers. The field force includes three topographic and three geologic assistants.

WORK IN 1903.

Under authority of an act of Congress making appropriation of $60,000 for continuation of the investigation of the mineral resources of Alaska, seven parties were engaged in geologic and topographic surveys during the last season. (For allotments, see page 25.)

Of these parties one was employed in an investigation of the geology and mineral resources of the Juneau gold belt; one in a study of the Controller Bay and Cook Inlet oil fields; another in a supplementary investigation of the tin deposits and gold placers of the Seward Peninsula; a fourth was organized to make joint geologic and topographic surveys of the northeastern part of the Seward Peninsula; the Fortymile, Birch Creek, and Fairbanks placers were investigated by a fifth geologic party, while a sixth made topographic surveys in the same region; the study of Mesozoic and Tertiary stratigraphy along the Yukon, with special attention to coal-bearing horizons, was the work of yet another party.

At the close of the field season all the plans had been successfully executed and the members of the division returned to Washington, devoting the winter to the preparation of maps and the writing of reports.

SOUTHEASTERN ALASKA.

Mr. Arthur C. Spencer, geologist, assisted by Mr. C. W. Wright, made a detailed study of the geology and mineral resources of the Juneau special district, including the Alaska-Treadwell and other mines near Juneau. A reconnaissance was also made of all the mining camps of the mainland portion of southeastern Alaska, from Windham Bay northward to and including the Porcupine placer district. Mr. Wright devoted three weeks of the early summer to a study of the mining conditions and general geology of the Porcupine placer district, and spent the remainder of the season with Mr. Spencer in the Juneau region. The observations of the Spencer party cover a mainland strip approximately 200 miles in length, and were pursued in sufficient detail to determine the main geologic and important economic features.

Mr. Spencer made a special study of the mines in the Juneau district, including the Alaska-Treadwell Group, the Ebner, the Silver Queen, and the Alaska-Juneau, and made a more hasty examination of those farther north and south, including the mines of the Seward and Benners Bay regions, of Sumdum Bay, and many other localities. The total output ot this group for 1903 is estimated at $2,400,000.

The general geologic results are briefly summarized as follows: The Juneau gold belt resembles the gold belt of California in several respects. Not only are the various rocks which occur in this part of southeastern Alaska similar in character and partly equivalent in age to those forming the country rock of the Mother Lode district, but there is also a definite linear distribution of some of the gold-bearing veins parallel with the general strike of the bed-rock formations, though, as in the neighborhood of the noted systems of veins in the California gold belt, there are many independent deposits lying outside the main complex of lodes.

In the mainland belt north of Windham Bay the sedimentary formations all strike in a general northwest-southeast direction, dipping invariably to the east, and these structures are closely followed by the igneous rocks, with which the sedimentary rocks form bands running in general parallel with the trend of the coast. In order of their occurrence from southwest to northeast, the rocks may be grouped into three series: (1) Black slates and black limestones alternating with greenstones and more or less metamorphosed; (2) highly metamorphic schists; (3) intrusive dioritic rocks, forming the main mass of the Coast Range. The average width of the sedimentary belt upon the mainland is about 6 miles, while the diorite zone is from 50 to 60 miles across, extending into British territory. Limestones are interbedded with the slates and carry Paleozoic fossils. The greenstones interbedded with the slates are mostly volcanic rocks that flowed out upon the surface of the sedimentary strata at different periods. East of the slate-greenstone series, and sharply defined from it, is a series of highly metamorphic schists, characterized by hornblende, mica, and garnet, and intercalated with a few bands of quartzite and limestones.

The third series of rocks named above, the Coast Range intrusives, generally known as the Coast Range granites, in this district consist of dioritic and not granitic rocks. They vary in character from normal hornblende-diorites or quartz-diorites to granodiorites, while an extreme type is found in the albite-syenite occurring at the Treadwell mines. The diorites generally follow the lines of stratification of the older rocks, though locally there is considerable crosscutting. The main mineralization of the Juneau belt occurred subsequent to the intrusion of the diorite, in which respect the deposits correspond in general with those of the gold belt of California.

A preliminary statement of Mr. Spencer's results has been published in a paper entitled "The Juneau Gold Belt, Alaska," in Bulletin 225, and the final report is in preparation.

The gold production of the placers of the Porcupine district since 1896 has been approximately \$460,000. Mr. Wright's investigations show that the Porcupine district contains both sedimentary and igneous rocks, the former considerably metamorphosed. The area lies a few miles southwest of the Coast Range intrusive belt, composed chiefly of dioritic rocks, adjacent to which on the south is a zone of metamorphic black slates, phyllites, and limestones, probably of Carboniferous age, 8 miles in width, with structures parallel to the general northwest-southeast trend of the diorite contact. This sedimentary series is limited on the south by an outlying band of diorite from 2 to 4 miles in width, also striking northwest and southeast.

The Porcupine and other gold-bearing creeks of this region lie mainly in the sedimentary rocks, but the upper portions cut into the southern diorite. Mr. Wright finds the source of the gold in this sedimentary series, which is generally mineralized. Quartz veins are not very abundant, they are usually small, and are often merely stringers parallel with the structure of the slates, but occasionally they crosscut the slates and persist for considerable distances. Calcite veins are more numerous and in some instances have been reported to carry gold. The gold deposits consist principally of a general impregnation of iron sulphides, forming an interrupted zone of mineralization in the southern part of the area. Assays of two samples from this zone, one an average taken across several feet and the other from a rich seam, gave respectively \$0.41 and \$2.48 per ton.

There are three types of gravel deposit in the Porcupine district—creek gravels, side benches, and high benches. The creek gravels fill the present channels to various depths, and can not be definitely separated from the side benches or gravel banks, which rise in places 20 and 30 feet above the stream. The high gravels occupy portions of former channels which have been locally preserved, but elsewhere are dissected by stream erosion.

Mr. Wright's results are summarized in a preliminary statement entitled "The Porcupine Placer Mining District," already published in Bulletin 225, and his final report is in press as Bulletin 236.

SOUTHERN AND SOUTHWESTERN ALASKA.

Indications of petroleum have been known at Cape Yaktag, Controller Bay, on the west shore of Cook Inlet, and at many points on the Alaskan Peninsula for a number of years, and a high-grade coal was known to occur on Bering River. The developments in these fields led to a demand for their investigations, but unfortunately the limits of the appropriation permitted only a preliminary survey.

The preliminary study of this field was assigned to Mr. George C. Martin, who spent about a month in the petroleum and coal fields near Controller Bay and Bering River, and about the same length of time in the petroleum fields of Cook Inlet and Cold Bay.

These fields, though widely separated, are all on the southern coast of Alaska, and, except the Bering River coal, are on tide water. The Controller Bay fields are near the Copper River; the Cape Yaktag fields lie 75 miles farther east. The Cook Inlet region is about 320 miles west of Controller Bay, while the Cold Bay field is about 160 miles farther southwest, on the southern shore of Alaska Peninsula The Bering River coal fields are from 20 to 40 miles from the coast, in the valley of Bering River, which flows into Controller Bay.

Petroleum seepages are very abundant in the Controller Bay region, and the largest are situated about 4 miles east of Katalla, where the oil has collected in pools. There are also seepages at the head of Burls Creek, between Bering Lake and Controller Bay, and near the Nitchawak River. Flows of gas occur along the lower course of the Natalla River, but the composition of the gas is unknown.

The first well in the Controller Bay region was drilled in the summer of 1901, but owing to loss of tools work was stopped. Since then a number of drill holes have been put down, but up to the time of Mr. Martin's visit only one had struck oil. The oil was found at a depth of 360 feet, when the well was immediately capped, but was afterwards drilled deeper, and in September, 1903, had reached a depth between 400 and 500 feet.

The size and distribution of the seepages point to the conclusion that a vast amount of organic matter which was subsequently converted into petroleum was incorporated with the sediments now constituting the oil-bearing shales of the Controller Bay region. The appearance of the rocks shows that there the series comprises many beds that are sufficiently porous to afford reservoirs for the accumulation of oil, and the successful well shows that the conditions are favorable for at least one productive pool.

By analysis the oil proves to be a refining oil of the same general nature as Pennsylvania petroleum.

The rocks include a complex semimetamorphosed series, a series of oil-bearing shales (Tertiary?), a series of coal measures, and a few igneous rocks.

The metamorphosed series include sandstones, limestones, and shales, varying in color from dark gray to dull tones of red and green and frequently having a mottled appearance. These are probably overlain by the oil-bearing shales, which are dark argillaceous and carbonaceous shales, with occasional bands of sandstone, limestone, conglomerate, and glauconitic rock. The few fossils that have been obtained indicate that the shales are of Tertiary age. The next higher horizon is believed to be represented by the coal measures, consisting of many hundreds of feet of sandstones and shales, apparently overlying the oil-bearing shales, a fact which indicates their later origin. Besides these sediments there are several masses of igneous rocks in the region.

The structure of the field is very complex, for there appears to be a major folding modified by a minor folding that often reveals itself merely as a crumpling in the softer shales. The larger folds strike east and west and the lesser folds southwest and northeast.

The Cape Yaktag oil field extends eastward for about 25 miles from the mouth of Yaktag River along an anticlinal axis parallel to and very near the shore line. The rocks consist of shales with interbedded sandstone and limestone, resembling very closely those of the Controller Bay region.

The Bering River coal field is situated from 12 to 25 miles inland from Controller Bay, and as at present recognized includes about 85 square miles. In the opinion of Mr. Martin the field holds several distinct commercial coals, and seams of others may be found.

In physical properties the coal is very much alike in all parts of this field and resembles the harder bituminous coals of the Eastern States. These coals are shown by analysis to be of the highest grade yet found on the west coast of America. The seams in places reach a thickness of 20 or 30 feet and give every promise of commercial importance.

Mr. Martin also visited another locality of petroleum seepages, which lies on the western shore of Cook Inlet between Chinitna Bay and Enochkin and Iliamna bays, where he spent a month mapping the shore line and formational boundaries on a traverse plane table, and measuring detailed stratigraphic sections.

The rocks in this area include a massive crystalline series, exposed in the Chigmit Mountains, and a sedimentary formation of Jurassic age in a belt east of them, succeeded farther east by a series of overlying agglomerates, shales, and volcanic flows. These beds lie in belts that are parallel to the coast. The relation of the sedimentaries to the crystallines is complex and obscure, but the remainder of the series is conformable and is gently and simply folded. The dominant structural feature is a low, broad, somewhat undulated anticline parallel to the shore, followed on the west by a narrow syncline, beyond which is a second very closely folded and probably faulted anticline.

The surface indications of petroleum are seepages and so-called gas springs. The first sample of oil from this field was obtained in 1882, and claims were staked in 1892. Interest was again awakened in 1896 at Oil Bay; later a well is reported to have struck a flow at a depth of about 500 feet. The well is, however, 1,000 feet deep and affords a continuous flow of gas, water having shut off the oil below 500 feet. A well was drilled at Dry Bay 320 feet without striking oil.

Cold Bay, on the south shore of Alaska Peninsula, one of the best harbors of the peninsula, is also the scene of prospecting for petroleum. The bed rocks of the district are dark shales with some limestone beds which carry Jurassic fossils, and are of the same horizon as the oil-bearing rock of Cook Inlet. At one locality some Triassic forms have been reported. The strata dip very gently though irregularly. If petroleum be stored within the series of rocks about Cold Bay, other things being equal, the very gentle folding that the strata have undergone should be favorable to the formation of large pools. In the summer of 1903 two wells were begun about 5 miles from the west shore of Cold Bay at an elevation of about 750 feet.

On some of the hillsides several miles inland from Cold Bay are seepages of petroleum that are in some cases continuous, in others intermittent. The petroleum runs down the hillsides in the watercourses, and in several places collects at the bottom of the hills in peat bogs. Here it loses enough of its volatile constituents by evaporation to render it immobile, and remains impregnating the peat and forming over its surface a thin coating of black paraffin wax. The peat so impregnated is a fuel of great value, replacing even the coal imported from Puget Sound, which is brought in large amounts for use in drilling operations. Analysis shows that this material compares favorably with most of the coals sold on the Pacific coast and, indeed, is superior as regards calorific power, quantity of ash, and sulphur.

COPPER RIVER REGION.

The economic results of the surveys of the Copper River region have been published under the title "The Mineral Resources of the Mount Wrangell District" (Professional Paper No. 15), and it is expected that the final reports will soon be submitted. The delay is in part due to the fact that Mr. Mendenhall, one of the geologists who worked in this field, was transferred to the division of hydrology on

July 2 and has been able to give but very little attention to the Alaskan work. Mr. Schrader has been continuously employed in the office during the past year to work up the results of his previous two seasons' field work. A part of his time was given to a thorough revision of his manuscript, entitled "A Reconnaissance in Northern Alaska," which was published as Professional Paper No. 20, and the remainder to his report on the upper Copper River basin.

YUKON-TANANA REGION.

In consequence of new discoveries and recent developments in the Yukon-Tanana region a demand was made for a survey of this field. Two parties were therefore dispatched to this region, one to make a topographic map of the country from Eagle to the Tanana and from Tanana to Circle, the other to study the placer districts of the territory. The combined topographic and geologic parties, in charge of Mr. T. G. Gerdine, topographer, reached Eagle June 16, when Mr. Gerdine, with Mr. R. B. Oliver, topographic assistant, and 6 men, commenced the topographic work, while Mr. L. M. Prindle, special assistant, with 2 men, entered upon the geologic work.

Mr. Prindle spent eighty-eight days in field work from the time of landing at Eagle to the close of the season at Fairbanks, on September 12. During the latter part of June and July he examined the Fortymile placers and those in the vicinity of Eagle and spent the month of August in traveling from Eagle to Birch Creek and in studying the placers of the Birch Creek region. In the time that remained he made a trip across the country to the Tanana and spent four days in the Fairbanks placer district. In all of these regions work was concentrated on gold-producing creeks and localities where prospecting was in progress, with the aim of learning as much as possible of present developments and future possibilities

In the Fortymile country the party visited Wade Creek, Walker Fork, Franklin Creek, Chicken Creek, the North Fork of Fortymile, and several outlying localities where some work is being done; in the vicinity of Eagle, American Creek, Discovery Fork, and localities on Seventymile Creek were examined; in the Birch Creek region, Deadwood, Mammoth, Mastodon, Miller, and Eagle creeks were visited; and in the Fairbanks region a trip was made to Pedro, Cleary, and Fairbanks creeks.

There are three important rock types of the Fortymile district, viz, an old and closely folded metamorphic schist, a series of greenstone effusives, and an intrusive granite. The metamorphic schists occupy by far the greater area of this section and have a general northwest-southeast strike, though locally considerable variation was observed, suggesting a structure more complex than the broad observations would indicate. The greenstones form a younger series not so highly altered, though they are of earlier origin than the granites which cut the two formations noted.

In the Birch Creek region a quartzite-schist is the rock of greatest prominence and extends from this section through to the Fairbanks district. Though in places it appears as a quartzite with little alteration, the greater mass is highly contorted and schistose. Quartz stringers are abundant in all of the metamorphic rocks, and these, with the zones of mineralization, are the source of the placer gold.

Mr. Prindle has published a preliminary paper entitled "Gold Placers of the Fairbanks District" in Bulletin No. 225, and has prepared a report entitled "The Gold Placers of the Fortymile, Birch Creek, and Fairbanks Regions," which is now in press.

Mr. Gerdine, with the assistance of Mr. R. B. Oliver, mapped a belt of country adjoining the Fortymile quadrangle. A system of control triangulation was extended with the reconnaissance surveys of Tanana River to the Fairbanks mining district on the Tanana, covering a distance of 150 miles and controlling an area 20 miles in width. A topographic survey was also carried from Fairbanks, including in all an area of nearly 6,000 square miles. The mapping was all done for publication on scale of $\frac{1}{250,000}$, and the final maps have been drawn and submitted as illustrations for Mr. Prindle's report.

YUKON RIVER.

In 1902 Mr. Arthur J. Collier made a reconnaissance down the Yukon River, giving special attention to localities where coal had been prospected or successfully mined. The results of this work were of such interest that it was deemed advisable to make further investigations in this region, chiefly to collect paleontologic data, more especially from coal-bearing horizons, and to determine the stratigraphic succession along the river. To carry out this plan Mr. Arthur Hollick, assistant geologist, and Sidney Paige, field assistant, left Seattle, Wash., the first week in June, for Fortymile, on the Yukon, where the work was to begin. The party was equipped with one Peterboro canoe and two light tents, and at Eagle a cook was engaged, and the party of three proceeded together from this point down the Yukon.

Between Eagle and Circle several important fossil-bearing areas were visited, among them Calico Bluff, Nation River, Washington and Woodchopper Creek. From Circle the party took a steamer to the Drew coal mine, 25 miles above Rampart, and after making large collections, proceeded down stream by canoe, making many halts for collection and stratigraphic studies between the Melozi River and the Anvik, where the season's work was completed. Mr. Hollick's studies will serve to clear up many doubtful points of the Tertiary and Mesozoic stratigraphy, and to determine more accurately the age of the coal-bearing beds. The season's collections, aggregating about a ton, are being worked up by the paleontologists of the Survey as fast as circumstances will permit.

SEWARD PENINSULA.

One geologic and one combined geologic and topographic party were engaged during the past season in Seward Peninsula, and completed the reconnaissance mapping of the entire district. Both parties sailed from Seattle on June 3 and landed at Nome June 16.

The geologic party, composed of Mr. Arthur J. Collier, assistant geologist, Mr. Frank L. Hess, field assistant, and two camp hands, was detailed to study the economic developments which had been made in the southern and western parts of the peninsula since 1900 and to supplement former investigations of the geology.

Mr. Collier's party, after spending a few days in the vicinity of Anvil Creek, moved northward along the divide between Snake and Nome rivers, making a critical examination of the geologic section. From Stewart River the party continued northward to the foothills of the Kigluaik Mountains and studied two geologic sections across the range. The placer deposits of the Bluestone region were next examined, after which the party proceeded to Teller.

Reports of new tin discoveries near York led Mr. Collier to visit that region. With Mr. Hess he proceeded by sail-boat, and at Lost River, about 25 miles west of Teller, they were successful in tracing float tin to its bed-rock source, a discovery which bids fair to be of commercial importance. York, at the mouth of the Anikovik River, was next visited, from which point Mr. Hess made a hasty trip northward to study the stream tin deposits on Buck Creek, while Mr. Collier made an equally hasty trip to Cape Mountain, about 12 miles west of York. The remainder of the season was spent in the study of placers and geology in the Kugruk and Council City mining districts, as well as the Solomon River region. After his return from the field Mr. Collier prepared a report entitled "The Tin Deposits of the York Region, Alaska," which was abstracted in Bulletin 225 and later published as Bulletin 229.

The combined geologic and topographic party was in charge of Mr. D. C. Witherspoon, who was accompanied by Mr. Fred H. Moffit, assistant geologist, Mr. C. E. Hill, topographic field assistant, and six camp hands. The two immediate objects which it was expected to accomplish were to complete the reconnaissance of the peninsula by mapping the northeastern part, which had not been reached by previous surveys, and to procure information concerning the placer gold deposits discovered in 1901 on Candle Creek and the tributaries of the Kiwalik and Inmachuk and Buckland rivers. The necessary equipment consisted of 13 pack horses and provisions for the party sufficient for three months' campaign.

After landing at Nome one section of the party went inland with the pack train, while another, with a part of the supplies, went by ocean and river steamer to Mary Iglo, on the Kuzitrin River, where both arrived early in July. During the remainder of the season topographic surveys were carried on by two parties, one under Mr. Hill and the other under Mr. Witherspoon, while Mr. Moffit carried on his geologic work for the most part with the cooperation of the latter party.

The topographic surveys were extended so as to include all of the unmapped area of the northeastern part of the peninsula, which included about 6,400 square miles.

The surveys were made with plane table on a scale of $\frac{1}{180,000}$ and control was maintained by latitude and azimuth observations, together with intersection on points of known position in the southern part of the peninsula. The topographic sketching was of a reconnaissance character, the relief being indicated by 200-foot contours, altitudes being checked by vertical angles.

Mr. Moffit's investigations covered the placers of the Candle Creek and Inmachuk, Kiwalik, and Buckland River valleys, in the Fairhaven precinct. They show that though this northeastern section of Seward Peninsula has not produced more than half a million, yet it will probably be among the large producers of the peninsula.

The rocks of the region are chiefly micaceous and graphitic schists of undetermined age and thickness, interstratified with occasional limestone beds and overlain in some sections by flows of recent cellular lava. Massive crystalline limestones or marbles occur as isolated areas within the schists, but have a much smaller distribution. The schists are believed to overlie the massive limestones and to pass into them by a gradual transition, so that the boundary between the two is not sharply drawn. Both are much folded, and the schists are further modified by the development within them of a complicated series of quartz veins and lenses, which are the source of the gold, and fragments of which form a considerable part of the stream gravels. These changes are probably brought about in part by the intrusion into the sedimentary beds of the light-colored granular eruptives which are found at a number of localities within the region.

At a much later period in geologic time there was deposited upon the older sediments a series of coal-bearing beds which are folded but not altered, as are the rocks on which they lie. These were found in the valleys of the Koyuk and Kiwalik rivers and their coals have been developed, some for local use.

WORK IN 1904.

Under the $20,000 increase of appropriation for the Alaskan work, which made it $80,000, eight parties have been dispatched to this field. Topographic surveys will be made by two parties and geologic surveys by five parties, while one is to undertake an investigation of methods of placer mining. Even with this increased force there are many urgent demands on the part of the public which can not be complied with.

GEOLOGY OF SOUTHEASTERN ALASKA.

The geologic work of the last season in southeastern Alaska will be continued by Messrs. C. W. and F. W. Wright. As this is the most noteworthy lode mining district of Alaska, and as its rich deposits of gold, silver, and copper are only partially developed, a study of its resources is likely to be of great interest to the prospector and investor. The work will begin with a reconnaissance across the islands from Taku Inlet to Sitka. An examination of the mining district about Sitka will follow, together with a study of the coal deposits of Admiralty Island. With Wrangell as a base, Mr. F. W. Wright will then study the local geology and mineral deposits, while Mr. C. W. Wright connects the geology of the Juneau district, the work of Mr. A. C. Spencer in 1903, with that of the Ketchikan district, the work of Mr. Alfred H. Brooks in 1901. If time permits, some of the copper and gold mines of Prince of Wales Island will be visited.

PLACER DISTRICTS AT COOK INLET.

Mr. F. H. Moffit, assistant geologist, has been dispatched with a party of seven men to carry a reconnaissance survey from Resurrection Bay to Turnagain Arm, to include the Sunrise placer district. To Mr. E. G. Hamilton has been intrusted the topographic surveys of this party.

OIL AND COAL FIELDS OF SOUTHWESTERN ALASKA.

The continued development of the oil fields of southwestern Alaska, and the presence there of important deposits of coal, make advisable additional reconnaissance surveys in that region. Messrs. G. C. Martin and R. W. Stone will survey this area, and, if time allows, will extend their reconnaissance over the entire peninsula. A traverse will be made from Cold Bay to Igagik, via Becharof Lake and Ugaguk River; also from Cold Bay to Ugashik, via Ugashik Lakes. A reconnaissance survey of Kachemak Bay will also be made in order to determine more definitely the limits of the coal field and its commercial value, while stratigraphic studies will be made at Snug Harbor, in the hope that they may throw some light on the existence of petroleum in this district. Mr. T. W. Stanton, paleontologist in charge of section of paleontology, accompanied this party and expects to make an extensive collection of fossils. The regions about Dry Bay, Cold Bay, Enochkin Bay, Cape Douglas, Amalik Harbor, and Herendeen Bay will be studied with a special view of the possibilities of new discoveries of coal and petroleum. Mr. Martin and his associates took the field on June 1.

DETAILED TOPOGRAPHIC SURVEY OF SEWARD PENINSULA.

Seward Peninsula has been mapped on a scale of $\frac{1}{250,000}$, and a general geologic reconnaissance has been made of this region, but it is thought expedient now to make more detailed topographic surveys of that rich gold-bearing zone known as the Nome district. Mr. T. G. Gerdine, topographer, with two assistants, has been directed to map about 600 square miles in the vicinity of Nome on a scale of $\frac{1}{45,000}$. Mr. Gerdine will direct two subparties. One of these, under Mr. R. B.

Oliver, will spend the season in plane-table mapping; the other, under Mr. W. R. Hill, will devote its energies to leveling. These parties sailed from Seattle on June 5.

COAL DEPOSITS OF CAPE LISBURNE.

Mr. A. J. Collier has been directed to undertake a careful study of the important coal deposits in the vicinity of Cape Lisburne, which is approximately 200 miles north of Seward Peninsula. This coal has been mined at intervals during the last twenty years and is known to be of excellent quality, but no material progress has been made in its development. Mr. Collier will also make a detailed study of a geologic section along the coast from Cape Beaufort to Cape Thomson. He will make extensive collections of fossils. The tin deposits of the York region, which Mr. Collier was instrumental in finding in 1903, will also be visited and reexamined, as a year's development of the deposits may add much to our knowledge of the occurrence and origin of the tin. Mr. Collier sailed from Seattle on June 24.

PLACER DISTRICTS OF CENTRAL ALASKA.

Mr. L. M. Prindle, assisted by Mr. Frank L. Hess, will continue his work of last season in the placer district between the Yukon and Tanana rivers and along Fortymile and Birch creeks. Messrs. Prindle and Hess started from Eagle on June 15, moving southwest toward Fairbanks, where the important discoveries of the last two years will warrant careful studies. From there they will go north toward Rampart, finishing the season's work in an investigation of the mining district about Baker and Minook creeks.

TOPOGRAPHIC SURVEY FROM EAGLE TO RAMPART.

During the summer of 1903 Mr. T. G. Gerdine, topographer, mapped an area extending from Eagle to Fairbanks and a strip from Eagle down the Goodpaster River. Mr. D. C. Witherspoon has been detailed to continue this work, mapping another section between Eagle and Fairbanks. He will be assisted by Mr. Thomas G. Ford, who will work independently at times, as the character of the work may demand. Mr. Witherspoon began his surveys on June 20.

PLACER MINING METHODS.

The many calls for information regarding methods and costs of placer mining in this northern region have led to an investigation of these. Mr. C. W. Purington, special assistant, has been detailed for this purpose, and will be aided by Mr. Sidney Paige. It is proposed that they visit all of the larger placer districts of Alaska and make some comparative studies in the adjacent Canadian territory. Mr. Purington reached Juneau early in June and thence made his way to the Klondike district after having visited the Atlin region.

ADMINISTRATION.

The ever-increasing amount of administrative work of the division prevented Mr. Brooks from undertaking any field studies. The larger part of his time has been given to the organization of the division, the review of manuscript submitted for publication, and the formulation of plans for continuing surveys and investigations.

Mr. Brooks left Washington on August 5, and, going straight to Juneau, spent a few days with Messrs. Spencer and Wright. Continuing his journey he went inland by the White Pass Railway and down the Yukon. A short stop was made at Circle, where communication was established with Mr. Prindle. The remainder of the season was spent in the Nome district, Seward Peninsula, in visiting with Mr. Collier some of the important placers of the region. A short trip was made to the Topkok, where three days were spent in studying local geology, whence a visit was made to Solomon for the same purpose.

A paper submitted by Mr. Brooks on "The Geography of Alaska" at the close of the last fiscal year was withdrawn, both because it seemed desirable to enlarge its scope and also in order to include the results of last season's surveys.. He has been able to give in all about two months to scientific work in the office, and this has been devoted largely to a

MAP OF ALASKA, SHOWING PROGRESS OF TOPOGRAPHIC AND GEOLOGIC SURVEYS

Scale
100 0 100 200 300 400 miles

revision and extension of this paper. As it was deemed desirable to include a consideration of the geology as well as the geography of Alaska, a comprehensive examination of the entire literature has been necessary. A preliminary geologic map of the Territory was compiled and much attention was given to questions of correlation. Mr. Brooks expects to submit the results of these investigations in a report entitled "The Geography and Geology of Alaska."

As it seemed likely that an investigation of the water resources of Alaska might soon be undertaken, Mr. Cleveland Abbe, jr., was employed for three months in compiling all the existing data in regard to rainfall. A part of these results will be made public in the report on the geography of Alaska.

Mr. Brooks also prepared a paper entitled "Placer Mining in Alaska, in 1903," published in Bulletin 225. He called the attention of the public to the work of the Survey in Alaska by an article, entitled "The Investigation of Alaska's Mineral Wealth," published in the Transactions of the American Institute of Mining Engineers, while a summary of the Survey's operations in Alaska was prepared by Mr. Prindle for inclusion in Bulletin 227.

The progress of topographic and geologic surveys in Alaska is shown on the map, Pl. I.

During the office season Mr. Sidney Paige has acted as assistant to Mr. Brooks in the administrative work of the division, and has also given aid to some of the geologists in the compilation of their field notes.

Division of Mining and Mineral Resources.

The principal work of this division is the preparation of the annual report on the mineral resources of the United States, although considerable time is devoted to answering technical inquiries. During the year the report on the mineral resources for 1902, statistics for which were collected in conjunction with the Twelfth Census, was issued, and considerable progress was made on the report for 1903.

In addition to the regular agents and field assistants who aided in the work, Mr. David T. Day, geologist in charge, was assisted by Mr. Edward W. Parker and Mr. Jefferson Middleton, statisticians; Mr. William Taylor Thom, editorial clerk; Miss Josephine B. Claggett, Miss Katrine W. Cottrell, Miss Helen M. Hough, Mrs. Lotta L. Kimball, Miss Lida Mann, and Mrs. Mary M. Raborg, clerks; Miss Belle W. Bagley, Miss Altha T. Coons, and Miss Julia M. Corse, statistical experts; and Miss Elizabeth A. Balloch, Miss Martha B. Clark, Miss Eva E. Evans, Miss E. L. D. Patterson, and Miss Helen L. Stoddard, stenographers.

In 1903, for the fourth time, the total value of our mineral production exceeded the enormous sum of $1,000,000,000.

The exact figures for 1903 were $1,418,387,863 as compared with $1,260,509,543 in 1902, with $1,086,552,274 in 1901, with $1,063,678,053 in 1900, and with $972,208,008 in 1899, a gain of 1903 over 1902 of $157,878,320, or 12.52 per cent; a gain of 1903 over 1901 of $331,835,589, or 30.54 per cent; a gain of 1903 over 1900 of $354,709,810, or 33.35 per cent, and a gain of 1903 over 1899 of $446,179,855, or 45.89 per cent.

As heretofore, iron and coal are the most important of our mineral products. The value of the iron in 1903 was $344,-350,000; the value of coal, $503,130,657. The fuels increased from $469,078,647 in 1902 to $633,640,067 in 1903, a gain of $164,561,420, or 35 per cent. Every variety of fuel increased in value. Anthracite coal showed an increase in value from $76,173,586 in 1902 to $152,036,448 in 1903. The average price of anthracite coal per long ton at the mine was $2.50, as against $2.35 in 1902—the highest figure obtained up to that time since 1888—as compared with $2.05 in 1901, with $1.85 in 1900, and with $1.80 in 1899; and the average price per short ton for bituminous coal at the mine was $1.24, as compared with $1.12 in 1902. The increase in value of the bituminous coal output over 1902 was $60,235,726, a combined increase in value of coal of $136,098,588 over 1902.

The gain of $157,878,320 in the total value of our mineral production is due to the large increase in nonmetallic products, the metallic products showing a decrease from $642,258,584 in 1902 to $624,546,008 in 1903, a loss of $17,712,576, and the nonmetallic products showing an increase from $617,250,959 in 1902 to $792,841,853 in 1903, a gain of $175,590,896. To these products should be added estimated unspecified products, including building, molding, and other sands reported to this office, the rare mineral molybdenum, and other mineral products, valued at $1,000,000, making the total mineral production for 1903, $1,418,387,863

The manufacture of arsenious oxide, noted for the first time in the United States in the report for 1901, was continued, but in decreased proportions as compared with 1902.

Tin has been found in commercial quantities in South Carolina, and the mines were actively exploited during the year 1903.

METALS.

Iron and steel.—Twenty-two States produced pig iron in 1903, as against 22 in 1902, 20 in 1901, and 21 in 1900 and 1899. The total production of pig iron in 1903 was 18,009,252 long tons, against 17,821,307 tons in 1902, 15,878,354 tons in 1901, 13,789,242 tons in 1900, 13,620,703 tons in 1899, 11,773,934 tons in 1898, and 9,652,680 tons in 1897. The production of 1903 shows an increase of 187,945 long tons, or about 1.05 per cent, in quantity over the production of 1902, and a decrease in value from $372,775,000 to $344,350,000, amounting to $28,425,000, or 7.6 per cent. The average price per long ton of pig iron decreased from $20.90 in 1902 to $19.07 in 1903. The average prices per long ton in recent years have been as follows: 1901, $15.25; 1900, $18.85; 1899, $18; 1897, $9.85; 1896, $10.47; 1895, $11.14; 1894, $9.76.

Iron ores.—The production of iron ores in 1903 amounted to 35,019,308 long tons, as compared with 35,554,135 long tons in 1902, a loss of 534,827 long tons. The value at the mines of the ore mined in 1903 was $66,328,415. As in the five preceding years, the production of iron ores in 1903 has never been equaled by any other country.

Copper.—The production of domestic copper increased from

659,508,644 pounds in 1902 to 698,044,517 pounds in 1903, an increase of 38,535,873 pounds, or about 6 per cent in quantity, and increased in value from $76,568,954 in 1902 to $91,506,006 in 1903, an increase of $14,937,052, or about 20 per cent.

Lead.—The production of lead increased to 280,000 short tons after having been almost exactly the same for three years, viz, 270,000 short tons in 1902, 270,700 short tons in 1901, and 270,824 short tons in 1900. The value of the production in 1903 was $23,520,000, as compared with $22,140,000 in 1902, with $23,280,200 in 1901, and with $23,564,688 in 1900.

Zinc.—The production of zinc in 1903 showed an increase in quantity as compared with 1902 and 1901, the production being 159,219 short tons, as compared with 156,927 short tons in 1902, with 140,822 short tons in 1901, and with 123,886 short tons in 1900. The value of the zinc production in 1903 was $16,717,995, as compared with $14,625,596 in 1902, with $11,265,760 in 1901, and with $10,654,196 in 1900.

Gold.—The production of gold in 1903 amounted to 3,560,000 fine ounces, as compared with 3,870,000 fine ounces in 1902, with 3,805,500 fine ounces in 1901, and with 3,829,897 fine ounces in 1900. The value was $73,591,700, as compared with $80,000,000 in 1902, with $78,666,700 in 1901, with $79,171,000 in 1900, and with $71,053,400 in 1899.

Silver.—The coining value of the silver produced in 1903 was $70,206,060, as compared with $71,757,575 in 1902, with $71,387,800 in 1901, and with $74,533,495 in 1900. The production in 1903 was 54,300,000 fine ounces, as compared with 55,500,000 fine ounces in 1902, with 55,214,000 fine ounces in 1901, and with 57,647,000 fine ounces in 1900 The commercial value of the production in 1903 was $29,322,000, as compared with $29,415,000 in 1902, with $33,128,400 in 1901, and with $35,741,140 in 1900.

Quicksilver.—The production of quicksilver during 1903 amounted to 35,620 flasks of 76½ pounds net, as compared with 34,291 flasks in 1902, with 29,727 flasks in 1901, and with 28,317 flasks in 1900. The value of the quicksilver produced in 1903 was $1,544,934, as compared with $1,467,848 in 1902, with $1,382,305 in 1901, and with $1,302,586 in 1900. California, including Nevada, reported 30,591 flasks, as compared with 28,972 flasks in 1902, and with 26,720 flasks in 1901; and Texas reported 5,029 flasks, as against 5,319 flasks in 1902, and 2,932 flasks in 1901.

Aluminum.—The production of aluminum during 1903 was 7,500,000 pounds, valued at $2,284,900, as compared with 7,300,000 pounds, valued at $2,284,590, in 1902, with 7,150,000 pounds, valued at $2,238,000, in 1901, and with 7,150,000 pounds, valued at $1,920,000, in 1900.

Antimony.—No antimony was obtained from domestic ores during 1903. The antimony obtained from the smelting of foreign imported ores amounted to 570 short tons, valued at $103,341, and the antimony obtained from hard lead produced from foreign and domestic lead ores was 2,558 short tons, valued at $445,092, a total production for 1903 of 3,128 short tons, valued at $548,433, as compared with 3,561 short tons, valued at $634,506, in 1902, and with 2,639 short tons, valued at $539,902, in 1901. The estimated total amount of antimony available for consumption in 1903 was 5,475 short tons, including 2,347 short tons of imported antimony regulus, as compared with 6,255 short tons, including 2,694 short tons of imported antimony regulus, in 1902, with 4,475 short tons, including 1,837 short tons of imported antimony regulus, in 1901, and with 6,053 short tons, including 1,827 short tons of imported antimony regulus, in 1900.

Nickel.—The commercial production of metallic nickel in 1903 was 1,322,000 pounds, as compared with 5,748 pounds in 1902, with 6,700 pounds in 1901, with 9,715 pounds in 1900, and with 22,541 pounds in 1899. The value was $273,900, as compared with $2,701 in 1902, with $3,551 in 1901, with $3,886 in 1900, and with $8,566 in 1899. The imports of nickel in 1903 were valued at $1,493,889, as compared with $1,437,649 in 1902, with $1,849,620 in 1901, and with $1,183,884 in 1900.

Platinum.—The production of platinum from domestic ores in 1903 was 110 ounces, valued at $2,080 (not including $6,000 worth of platinum reported as contained in slimes obtained from the treatment of copper ores from the Rambler mine, Wyoming), as compared with 94 ounces, valued at $1,814, in 1902, with 1,408 ounces, valued at $27,526, in 1901, with 400 ounces, valued at $2,500, in 1900, and with 300 ounces, valued at $1,800, in 1899.

Bismuth.—No bismuth ores were produced in the United States during 1903 nor in 1902. The marketed output in 1901 was 318.6 short tons. The ore contained gold and silver, for which the producers were paid. As nearly as can be ascertained, the value of the output in 1901 was $80 per ton, not including charges for transportation or treatment.

Manganese ores.—The production of manganese ores decreased from 11,995 long tons, valued at $116,722, in 1901, to 7,477 long tons, valued at $60,911, in 1902, and to 2,825 long tons, valued at $25,335, in 1903, a decrease in quantity from 1902 of 4,652 tons and in value of $35,586. The average price per ton in 1903 was $8.97, as compared with $7.74 in 1902, with $9.73 in 1901, and with $8.52 in 1900.

Tin.—There was no production of metallic tin in 1903, but 20 short tons of high concentrates were shipped from South Carolina to England; value not given.

FUELS.

Coal.—For the second time in the history of the United States the production of coal in 1903 reached a total of over 300,000,000 short tons, showing an actual output of 357,290,117 tons of 2,000 pounds, valued at $503,130,657. Of this total the output of anthracite coal amounted to 66,351,713 long tons (equivalent to 74,313,919 short tons), which, as compared with the production of 36,940,710 long tons in 1902, was an increase of 29,411,003 long tons, or almost 80 per cent. This abnormal increase was due to the suspension of operations by the strike in the anthracite region from May 10 to October 23, 1902, a little over five months. The value of anthracite coal at the mines in 1903 was $152,036,448, as against $76,173,586 in 1902, and against $112,504,020 in 1901. The average value of the marketed coal sold during the year at the mines was $2.50 per long ton, the value in 1902 having been $2.35, and $2.05 in 1901.

The output of bituminous coal (which includes semi-anthracite and all semibituminous and lignite coals) amounted in 1903 to 282,976,198 short tons, valued at $351,094,209, as against 260,216,844 short tons, valued at $290,858,483 in 1902, and against 225,828,149 short tons, valued at $236,422,049, in 1901. The increase in the production of bituminous coal in 1903 over 1902 was, therefore, 22,759,354 tons in quantity and $60,235,726 in value. The average price per ton at the mines during 1903 was $1.24, the highest price recorded by the Survey, as against $1.12 per ton in 1902.

Coke.—The coke production of the United States in 1903 exceeded that of any year in our history, with the exception of 1902. The production, which includes the output from 1,956 retort or by-product ovens, amounted to 25,262,360 short tons, as compared with 25,401,730 short tons in 1902, with 21,795,883 short tons in 1901, and with 20,533,348 short tons in 1900. The decrease in quantity in 1903 from 1902 was only 139,370 short tons, or about 0.55 of 1 per cent. The increase in the value of coke was even more noteworthy than in 1902. The average price per ton at the ovens was the highest recorded in a period of twenty-four years, and the total value, in spite of the loss in quantity, reached the high figure of $66,459,623, an increase over 1902 of $3,120,456, or about 5 per cent, and over 1901 of $22,013,700, or 49.5 per cent.

Gas, coke, tar, and ammonia.—The aggregate value of all the products obtained from the distillation of coal in gas works and retort ovens in 1903 was $47,819,555, as compared with $43,869,440 in 1902.

Petroleum.—The total production of crude petroleum in the United States in 1903 was 100,461,337 barrels, as against 88,766,916 barrels in 1902, and 69,389,194 barrels in 1901, an increase of 11,694,421 barrels, or 13.17 per cent over the production of 1902 and of 44.78 per cent over that of 1901. The greatest portion of the increase in 1903 came from California and Indiana, the gain over 1902 being 10,398,204 barrels, or 74.36 per cent, for California and 1,705,515 barrels, or 22.80 per cent, for Indiana. Louisiana produced for the second time in 1903, the production being 917,771 barrels, as against 548,617 barrels in 1902. The increase over 1902 in the production of Kansas was 600,465 barrels, or about 190 per cent. Kentucky and Tennessee increased their production in 1903 by 368,955 barrels, or nearly 200 per cent. Indian Territory increased 101,811 barrels, or 274 per cent, as compared with 1902. The largest decrease in production in 1903, as compared with 1902, was in Pennsylvania, where it amounted to 708,724 barrels, or about 5.88 per cent, and Ohio showed a decrease of 533,945 barrels, or about 2.55 per cent. The decrease in West Virginia was 613,950 barrels, or about 4.50 per cent. The percentages of production for fields show a remarkable change from 1900 to 1903. In 1900 the percentages were: Appalachian field, 57; Lima-Indiana field, 34; all other fields, nearly 9. In 1903 the respective percentages were: Appalachian field, 31.41; Lima-Indiana field, 23.97; all other fields, about 44.62. The value of crude petroleum produced during 1903 was $94,694,050, or 94.26 cents per barrel, as compared with $71,178,910, or 80.19 cents per barrel in 1902.

Natural gas.—The value of the natural gas produced in 1903 was $35,815,360, as compared with $30,867,668 in 1902, with $27,067,500 in 1901, with $23,698,674 in 1900, and with $20,074,873 in 1899—a gain of 16 per cent in 1903 over 1902.

STRUCTURAL MATERIALS.

Stone.—The value of all kinds of building stone produced in the United States during 1903 amounted to $67,960,468, as compared with $64,5[illegible]9,099 in 1902, with $55,615,926 in 1901, with $44,321,345 in 1900, and with $44,090,670 in 1899.

Clay products.—The activity in all branches of the clay-working industries noted in the reports as true of 1899, 1900, 1901, and 1902 continued during 1903. The value of all clay products, as reported to this office in 1903, was $130,962,648, as compared with $122,169,531 in 1902, with $110,211,587 in 1901, and with $96,212,345 in 1900. The brick and tile products in 1903 were valued at $105,526,596, as compared with $98,042,078 in 1902, with $87,747,727 in 1901, and with

$76,413,775 in 1900; the pottery products were valued in 1903 at $25,436,052, as compared with $24,127,453 in 1902, with $22,463,860 in 1901, and with $19,798,570 in 1900.

The commercial production of clay mined and sold by those not manufacturing the product themselves in 1903 was valued at $2,649,042, as compared with $2,061,072 in 1902, with $2,576,932 in 1901, and with $1,840,377 in 1900.

Cement.—The total production of hydraulic cement in the United States in 1903 was 29,899,140 barrels, valued at $31,931,341, as compared with 25,753,504 barrels, valued at $25,366,380, in 1902, with 20,068,737 barrels, valued at $15,786,789, in 1901, and with 17,231,150 barrels, valued at $13,283,581, in 1900. The Portland cement production in 1903 was 22,342,973 barrels, valued at $27,713,319, as compared with 17,230,644 barrels, valued at $20,864,078, in 1902, with 12,711,225 barrels, valued at $12,532,360, in 1901, and with 8,482,020 barrels, valued at $9,280,525, in 1900—an increase, as compared with 1900, in quantity of about 163 per cent and in value of over 199 per cent. The production of natural-rock cement in 1903 was 7,030,271 barrels, valued at $3,675,520, as compared with 8,044,305 barrels, valued at $4,076,630, in 1902, with 7,084,823 barrels, valued at $3,056,278, in 1901, and with 8,383,519 barrels, valued at $3,728,848, in 1900. The production of slag cement amounted, in 1903, to 525,896 barrels, valued at $542,502, as compared with 478,555 barrels, valued at $425,672, in 1902, with 272,689 barrels, valued at $198,151, in 1901, and with 365,611 barrels, valued at $274,208, in 1900.

ABRASIVE MATERIALS.

Carborundum.—The production of carborundum in 1903 was 4,759,890 pounds, as compared with 3,741,500 pounds produced in 1902, and with 3,838,175 pounds in 1901. The value of the carborundum varies from 8 to 10 cents per pound.

Corundum and emery.—The combined production of corundum and emery in 1903 amounted to 2,542 short tons, valued at $64,102, as compared with 4,251 short tons, valued at $104,605, in 1902, and with 4,305 short tons, valued at $146,040, in 1901.

Crushed steel.—The production of crushed steel in 1903 was 755,000 pounds, as compared with 735,000 pounds in 1902, and with 690,000 pounds in 1901; and the product is quoted at 5½ cents per pound free on board at Pittsburg.

Crystalline quartz.—In 1903 the production of crystalline quartz included under Abrasives amounted to 8,938 short tons, valued at $76,908, as against 15,104 short tons, valued at $84,335, in 1902, and with 14,050 short tons, valued at $41,500, in 1901.

Garnet.—The production of abrasive garnet in the United States during 1903 amounted to 3,950 short tons, valued at $132,500, as against 3,926 short tons, valued at $132,820, in 1902, with 4,444 short tons, valued at $158,100, in 1901, and with 3,185 short tons, valued at $123,475, in 1900. As reported to the Survey the prices varied from $20 to $60 a ton, the highest price being obtained for the North Carolina garnet.

Grindstones.—The total value of all kinds of grindstones produced during 1903 was $721,446, as compared with $667,431 in 1902, and with $580,703 in 1901. The production of 1900, valued at $710,026, was until 1903 the largest on record for any year. It should be remembered, however, that the price has decreased from $15 per ton to from $8 to $10 per ton, and that therefore the tonnage of grindstones used has correspondingly increased within the last few years. The imports for 1903 amounted in value to $85,705, as compared with $76,906 in 1902, with $88,871 in 1901, and with $92,581 in 1900.

Infusorial earth and tripoli.—In 1903 the production of infusorial earth and tripoli amounted to 9,219 short tons, valued at $76,273, as compared with 5,665 short tons, valued at $53,244, in 1902, and with the production of 4,020 tons, valued at $52,950, in 1901.

Millstones and buhrstones.—The value of the production of millstones and buhrstones in 1903 was $52,552, as against $59,808 in 1902, and against $57,179 in 1901. From 1886 to 1894 there was a very large decrease—from $140,000 to $13,887—in the production of buhrstones. Since 1894 there has been a gradual increase in the production.

Oilstones and whetstones.—There was a decided increase in the commercial domestic production of oilstones and whetstones during 1903, the value of which amounted to $366,857, as compared with $221,762 in 1902, and with $158,300 in 1901.

CHEMICAL MATERIALS.

Arsenious oxide.—The domestic production of arsenious oxide (white arsenic) in 1903 was 611 short tons, valued at $36,696, as compared with 1,353 short tons, valued at $81,180, in 1902, and with 300 short tons, valued at $18,000, in 1901. The entire product was made by the Puget Sound Production Company at Everett, Wash., which began the manufacture of this important substance in 1901.

Borax.—The reported returns for 1903 gave an aggregate production of crude borax of 34,430 short tons, valued at $661,400, as compared with 17,404 short tons of refined and 2,600 tons of crude, valued at $2,538,614, in 1902. The production during 1901 was 17,887 short tons of crude borax and 5,344 short tons of refined borax, with a total value of $1,012,118.

Bromine.—The production of bromine in 1903, including the amount of bromine contained in potassium bromide, amounted to 598,500 pounds, valued at $167,580, as compared with 513,890 pounds, valued at $128,472 in 1902, and with 522,043 pounds, valued at $154,572, in 1901. The price per pound during 1903 averaged 28 cents, as compared with 25 cents in 1902, with 28 cents in 1901, and with 29 cents in 1900.

Fluorspar.—The total commercial production of fluorspar in 1903 was 42,523 short tons, valued at $213,617, as compared with 48,018 short tons, valued at $271,832 in 1902, and with 19,586 tons, valued at $113,803, in 1901. This increase in production was not due to any one State, but there was a large increase in production in Kentucky, and a decrease in Illinois and Arizona The average price of crude fluorspar in 1903 was reported as $4.28 per ton, as compared with $5.19 in 1902, and with $5 in 1901, and the average price of ground fluorspar in 1903 was $9.99 per ton, as compared with $9.98 in 1902, and with $9.22 in 1901.

Gypsum.—The production of gypsum, particularly for the manufacture of calcined plaster, continues to show a remarkable gain. The output of crude gypsum in 1903 was 1,041,704 short tons, valued in its first marketable condition at $3,792,943, as compared with 816,478 short tons, valued in its first marketable condition at $2,089,341, in 1902, with 633,791 short tons, valued at $1,506,641, in 1901, and with 594,462 short tons, valued at $1,627,203, in 1900. The production in 1899 was 486,235 short tons, and in 1898 it was 291,638 short tons. The greatly increased production of the last five years is attributable to the largely increased use of plaster of Paris in large modern buildings and in the manufacture of staff for temporary buildings.

Marls—The production of marls in the United States in 1903 was 34,211 short tons, valued at $22,521, in 1902 it was 12,439 short tons, valued at $12,741.

Phosphate rock.—The total commercial production of phosphate rock reported to the Survey in 1903 amounted to 1,581,576 long tons, valued at $5,319,294, as compared with 1,490,314 long tons, valued at $4,693,444, in 1902, and with 1,483,723 long tons, valued at $5,316,403, in 1901, an increase in quantity of 1903 over 1902 of 91,262 tons and in value of $625,850. The total quantity of phosphate rock reported as mined during 1903 was 1,618,799 long tons, as compared with 1,499,617 long tons in 1902, and with 1,440,408 long tons in 1901.

Salt.—The salt product includes salt in the form of brine used in large quantities for the manufacture of soda ash, sodium bicarbonate, caustic soda, and other sodium salts. The domestic production of salt in 1903 amounted to 18,968,089 barrels of 280 pounds, valued at $5,286,988, as compared with 23,849,231 barrels, valued at $5,668,636, in 1902, with 20,556,661 barrels, valued at $6,617,449, in 1901, and with 20,869,342 barrels, valued at $6,944,603, in 1900.

Sulphur and pyrite.—The domestic production of sulphur and of pyrite in 1903 for the manufacture of sulphuric acid amounted to 233,127 long tons, valued at $1,109,818, as compared with 207,874 long tons, valued at $947,089, in 1902, and with a combined production of 241,691 long tons, valued at $1,257,879, in 1901. The greater part of the output of pyrite was derived from Virginia, Georgia, North Carolina, Colorado, and Massachusetts, named in the order of production.

PIGMENTS.

Barytes.—The production of crude barytes in 1903 was 50,397 short tons, valued at $152,150, as compared with 61,668 short tons, valued at $203,154, in 1902, and with 49,070 short tons, valued at $157,844, in 1901.

Cobalt oxide.—The domestic production of cobalt oxide in 1903 was valued at $228,000, not including the value of 60 short tons of cobalt ore, as compared with 3,730 pounds, valued at $6,714, in 1902, and with 13,360 pounds, valued at $24,048, in 1901. All the cobalt oxide was obtained as a by-product in smelting lead ores at Mine Lamotte, Missouri.

Mineral paints.—The commercial production of mineral paints in 1903 amounted to 62,122 short tons, valued at $646,222, as compared with 73,049 short tons, valued at $944,332, in 1902, and with 61,460 short tons, valued at $789,962, in 1901.

Zinc white.—The production of zinc white in 1902 amounted to 62,962 short tons, valued at $4,801,718, as compared with 52,645 short tons, valued at $4,016,499, in 1902, and with 46,500 short tons, valued at $3,720,000, in 1901.

MISCELLANEOUS.

Asbestos.—The asbestos commercially produced in the United States in 1903 was obtained chiefly from the mines at Sall Mountain, White County, Ga., with smaller quantities from near Dalton, Berkshire County, Mass., New Hartford, Conn., and Grand Canyon, Arizona. The total commercial production was 887 short tons, valued at $16,760, as compared with 1,005 short tons, valued at $16,200, in 1902, and with 747 short tons, valued at $13,498, in 1901.

Asphaltum.—Under this title are included the various bitumens or hydrocarbons not discussed under the heading "Petroleum" in the volume on mineral resources. The commercial production in 1903 was 101,255 short tons, valued at $1,005,446, as compared with 105,458 short tons, valued at $765,048, in 1902, and with 63,134 short tons, valued at $555,335, in 1901.

Bauxite.—In 1903 the production of bauxite was 48,087 long tons, valued at $171,306, as compared with 29,222 long tons, valued at $128,206, in 1902, and with 18,905 long tons, valued at $79,914, in 1901. Georgia yielded the greater bulk of the product, the remainder being supplied by Alabama and Arkansas.

Chromic iron ore.—California was the only State producing chromite during 1903, the quantity being 150 long tons, valued at $2,250 as compared with 315 long tons, valued at $4,567, in 1902, and with 368 long tons, valued at $5,790, in 1901.

Feldspar.—The production of feldspar in 1903 was 41,891 short tons, valued at $256,733, as against 45,287 short tons, valued at $250,424, in 1902, and against 34,741 short tons, valued at $220,422, in 1901.

Fibrous talc.—This variety of talc or soapstone occurs in but one locality in the United States—Gouverneur, St. Lawrence County, N. Y. It is used principally as makeweight in the manufacture of paper. In 1903 the production was 60,230 short tons, valued at $421,600, as compared with 71,100 short tons, valued at $615,350, in 1902, and with 69,200 short tons, valued at $483,600, in 1901.

Flint.—The production of flint in 1903 was 55,233 short tons, valued at $156,947, as against 36,365 short tons, valued at $144,209, in 1902, and against 34,420 short tons, valued at $149,297, in 1901.

Fuller's earth.—As reported to the Survey, the production of fuller's earth in 1903 was 20,693 short tons, valued at $190,277, as compared with 11,492 short tons, valued at $98,144, in 1902, and with 14,112 short tons, valued at $96,835, in 1901. The largest production of fuller's earth hitherto obtained was in 1897, the output being 17,113 short tons.

Graphite.—The commercial production of crystalline graphite during 1903 amounted to 4,538,155 pounds, valued at $154,170, as compared with 3,936,824 pounds, valued at $126,144, in 1902, with 3,967,612 pounds, valued at $135,914, in 1901, and with 5,507,855 pounds, valued at $178,761, in 1900. The production of amorphous graphite in 1903 was 16,591 short tons, valued at $71,384, as compared with 4,739 short tons, valued at $55,964, in 1902, and with 809 short tons, valued at $31,800, in 1901. The production of artificial graphite was 2,620,000 pounds, valued $178,670, the average price being 6.82 cents per pound, as compared with 2,358,828 pounds, valued at $110,700, in 1902, the average price being 4.69 cents per pound, and with 2,500,000 pounds, valued at $119,000, in 1901, the average price being 4.75 cents per pound.

Limestone for iron flux.—The quantity of limestone used for fluxing in blast furnaces in 1903 was 12,029,719 long tons, valued at $5,423,732, as compared with 12,139,248 long tons, valued at $5,271,252, in 1902, with 8,540,168 long tons, valued at $4,659,836, in 1901, and with 7,495,435 long tons, valued at $3,687,394, in 1900.

Lithium.—The production of lithium minerals in 1903 was 1,155 short tons, valued at $23,425 at the railroad, as against 1,245 short tons, valued at $25,750, in 1902. There is an increase in the demand for these minerals from foreign chemical manufacturers.

Magnesite.—The production of magnesite in the United States continues to be limited to California, and during the year 1903 the commercial production reported was 3,744 short tons, valued at $10,595, as compared with 2,830 short tons, valued at $8,490, in 1902.

Mica.—The total production of mica in 1903 was valued at $59,118, as compared with a total value of $118,849 for the production of 1902.

Mineral waters.—The total production of mineral waters in 1903 was 51,186,746 gallons, valued at $8,073,096, as compared with 64,859,451 gallons, valued at $8,793,761, in 1902, and with 55,771,181 gallons, valued at $7,586,962, in 1901.

Molybdenum.—The commercial production of molybdenum in 1903 was 791 short tons, valued at $61,915. The value of these molybdenum ores fluctuates very greatly, the highest price quoted being $1,500 per ton and the lowest $100.

Monazite.—The production of monazite is confined exclusively to North Carolina and South Carolina, by far the larger quantity being obtained from the former State, and in 1903 this amounted to 862,000 pounds, valued at $64,630, and 3,000 pounds of zircon, valued at $570, as compared with 802,000 pounds of monazite, valued at $64,160, in 1902, and with 748,736 pounds, valued at $59,262, in 1901. The price per pound of the monazite produced in 1903 received by the miners varied from 2½ to 6 cents, according to the percentage of thoria.

Precious stones.—The value of the gems and precious stones found in the United States in 1902 was $321,400, as compared with $328,450 in 1902, and with $289,050 in 1901, with $233,170 in 1900, and with $185,770 in 1899. There has been a great advance in the lapidary industry in the United States since 1894. The fact that larger establishments have been formed, which are able to purchase the rough diamonds in greater quantities, has placed our American diamond cutters in a position equal to that held by the cutters of Amsterdam, Antwerp, and Paris. The cutting of our native gems has also grown to the proportions of an industry, notably in the case of the beryls and the amethysts found in North Carolina and Connecticut; the turquoises from New Mexico, Arizona, Nevada, and California; the fine colored and deep-blue sapphires found in Montana; the colored tourmalines of San Joaquin County, Cal.; the chrysoprases from Visalia, Tulare County, Cal.; the garnets of Arizona and New Mexico, and the pale-purple garnets of North Carolina.

Pumice stone.—The production of pumice amounted in 1903 to 885 short tons, valued at $2,665, as against 700 short tons, valued at $2,750 in 1902.

Rutile.—The production of rutile in 1903 was about the same as in 1902.

Soapstone.—Exclusive of the production of fibrous talc from Gouverneur, N. Y., the production of talc and soapstone in 1903 amounted to 26,671 short tons, valued at $418,460, as compared with 26,854 short tons, valued at $525,157 in

1902, and with 28,643 tons, valued at $424,888 in 1901. The output for 1900 was 27,943 short tons, valued at $383,541, and for 1899 it was 24,765 short tons, valued at $330,805.

Tungsten.—The commercial production of crude tungsten ores during 1903 amounted to 292 short tons, valued at $32,439, as against 184 short tons in 1902, of which not more than a few tons were sold. In 1901 the production amounted to 179 tons of concentrated ore, valued at $27,720. The larger part of the production of 1902 was from Colorado.

Uranium and vanadium.—The production of uranium and vanadium minerals in 1903, as reported to the Survey, amounted to 19 short tons, valued at $5,625, as compared with 3,810 short tons, valued at $48,125 in 1902. This, of course, represents the crude ore.

Glass sand.—The production of glass sand in 1903 was 823,044 short tons, valued at $855,828, as compared with 943,135 short tons, valued at $807,797 in 1902.

Division of Chemical and Physical Research.

During the year 1903–4 several changes took place in the personnel of the chemical laboratory. On June 30, 1903, Mr. H. N. Stokes left the Survey and Mr. E. T. Allen was promoted to the vacant position. On October 1, Mr. E. C. Sullivan was appointed research assistant, and Mr. W. T. Schaller, general assistant with special reference to work in mineralogy and crystallography.

The routine work in the laboratory was essentially the same as in former years. In all, 323 analyses were reported and 290 qualitative determinations of minerals were made. Among the more important series of analyses were 34 rocks from Nevada, 4 from the Hawaiian Islands, 5 from Connecticut, 4 from Alaska, 6 from Cripple Creek, 8 from Montana, 4 from Washington, and 33 coals from Pennsylvania. Apart from this routine work, the chemists conducted various researches and did individual work as follows:

Mr. F. W. Clarke, chief chemist, prepared two bulletins—"Mineral Analyses from the Laboratories of the United States

Geological Survey" (No. 220) and a third edition of the similar publication upon rock analyses (No. 228), both of which were published. After January 1, he was engaged on a monographic treatise on the data of chemical geology, which will probably occupy a large part of his time for the next two years.

Mr. W. F. Hillebrand studied the chemical composition of lawsonite and of tetradymite from a new locality in Colorado. He and Mr. E. T. Allen are now engaged in an investigation of the accuracy of the fire assay for tellurides.

Mr. E. C. Sullivan took up the investigation of secondary enrichment in ore bodies, and made some progress in studying the absorption of copper salts by clays.

Mr. George Steiger continued his researches upon the replacement of bases in silicates, and succeeded in preparing zeolites, especially analcite, containing thallium in place of sodium. This part of the general investigation is nearly completed. Mr. Steiger also analyzed an interesting vesuvianite, the so-called "californite," and a remarkable white garnet which occurs with or near it.

Mr. W. T. Schaller entered upon the study of the lithia minerals found in southern California. After May 5 he was in the field collecting material and noting the modes of occurrence of the several species. In this work he is aided by the division of mineral resources, for which he is to prepare a report on lithia production in the United States. He has already made analyses of lepidolite, amblygonite, muscovite, and halloysite from the lithia locality at Pala. He has also analyzed boothite, prehnite, and a zeolite from California, dumortierite from California and Washington, cobaltite from Oregon, and bournonite from Arizona.

In the physical laboratory Messrs. A. L. Day and E. T. Allen completed the study of the thermal properties of the plagioclase feldspars at ordinary pressures, and a paper on the subject is now ready for publication. The microscopic examinations of the artificial feldspars were made by Prof. J. P. Iddings. This investigation settles the question of the isomorphism of this series of minerals and gives for the first time an accurate series of melting points. Messrs. A. L. Day and C. E. Van Orstrand also wrote an important paper on "black bodies." This subject leads to approximate values of the sun's temperature, but geologically it is mainly important because efforts are now being successfully made in Europe to found upon the properties of black bodies, or bodies which reflect no heat, a method of determining temperature at a distance—for example, in the crater of a volcano. The authors' treatment included an able application of the theory of functions by which the possible equations expressing thermal emanations are limited to a small number between which experiments must decide.

Mr. Van Orstrand spent a large part of the year in discussing experiments on elasticity numerically and by the theory of functions.

During the first quarter of the fiscal year Mr. G. F. Becker took leave of absence to represent the Survey at the International Geological Congress at Vienna and to examine into laboratory construction for the Carnegie Institution. During the winter he made a series of experiments on schistosity and slaty cleavage. The results will soon be published as Bulletin No. 241. Time not thus occupied was given to division work and to the subject of elasticity.

The Carnegie Institution made a grant of money to Messrs. Becker and Day for researches respectively in elasticity and high temperature work, laboratory space to be furnished by the Survey. The additional rooms required will be ready for occupation on July 1, and the experiments will be carried on in conjunction with those of the Survey.

TOPOGRAPHIC BRANCH.

Organization.

Until the close of the last fiscal year the topographic branch had for a number of years been organized into two divisions, topography and geography, and the former into five sections. At the beginning of the fiscal year 1903–4 the topographic division of this branch was tentatively reorganized by subdividing it into four sections. The old Atlantic and Central sections were consolidated into the Eastern section, in charge of Mr. H. M. Wilson, geographer; the Rocky Mountain and Pacific sections were consolidated into the Western section, in charge of Mr. E. M. Douglas, geographer; the triangulation and computing section remained in charge of Mr. S. S. Gannett, geographer; and the newly organized section of inspection of topographic surveying and mapping was placed in charge of Mr. John H. Renshawe.

The above organization having worked satisfactorily throughout the year, it was made permanent, with slight changes, on April 27, 1904. As now organized the topographic branch consists of three divisions:

Division of eastern topography, H. M. Wilson in charge.
Division of western topography, E. M. Douglas in charge.
Division of geography and forestry, Henry Gannett in charge.

The two divisions of topography include jointly three sections, the chiefs of which report to the topographic committee, viz:

Section of triangulation and computing, S. S. Gannett, geographer in charge.

Section of inspection of topographic surveying and mapping, J. H. Renshawe, geographer in charge.

Section of instruments and topographic records, S. A. Aplin, topographer in charge.

In addition to the above, the eastern and western divisions of topography are each subdivided into several sections in charge of topographers acting as section chiefs. These sections cover one or more States, the grouping of which may be changed from time to time to conform to the field work in progress.

The topographic committee consists of the Director (chairman) and the chiefs of the two topographic divisions.

The committee on instruments is continued as heretofore, viz: Mr. E. M. Douglas, chairman, and Messrs. S. S. Gannett and S. A. Aplin.

Mr. A. H. Thompson, geographer, acted through a portion of the year as assistant in charge of office to the two divisions of topography. He was also detailed to assist in the preparation and installation of the Geological Survey exhibit at the

Louisiana Purchase Exposition, and on May 1, 1904, proceeded to St. Louis to assume charge of that exhibit. His duties as assistant in charge of office were then temporarily assumed by Mr. S. S. Gannett, geographer.

Changes in the topographic corps were the appointments of Messrs. D. C. Witherspoon, topographer; G. D. Dais, assistant topographer; J. R. Ellis, J. G. Hefty, A. T. Fowler, H. L. McDonald, C. L. Nelson, S. N. Stoner, and Fred McLaughlin, topographic aids; and Miss Arline G. Weeks, clerk; the reinstatement, after prolonged leave without pay on account of sickness, of Messrs. W. M. Beaman and D. C. Harrison, topographers, and of Mr. W. N. Brown, topographer, from private surveys in Alaska; the resignations of Messrs. Nat. Tyler, jr., T. G. Basinger, and G. H. Guerdrum, topographers; the transfers of Messrs. E. C. Bebb, topographer, and W. W. Schlecht and E. S. Ela, assistant topographers, to the hydrographic branch; the granting of one year's leave of absence without pay to Mr. R. H. Sargent, topographer, for work for the Carnegie Institution in China, and the granting of two years' leave without pay to Mr. C. W. Sutton, assistant topographer, for work for the Government of Peru. Mr. E. C. Barnard, topographer, was detailed to the Department of State as chief topographer of the United States and Canada Boundary Survey, and Messrs. D. L. Reaburn and Sledge Tatum, topographers, and J. G. Hefty, topographic aid, were detailed as his assistants. Messrs. T. G. Gerdine and D. C. Witherspoon, topographers, were detailed for topographic work in the division of Alaskan mineral resources. Mr. W. J. Peters, topographer, continued on leave as a result of his absence with the Zeigler North Pole Expedition.

Cooperative arrangements for surveys were made with eleven States. The State engineer and surveyor of New York allotted \$19,000; the State survey commission of Pennsylvania, \$15,000; the State geologist of West Virginia, \$20,000; the governor of Ohio, \$28,800; the State of California, \$10,000; the curator of the State geological department of Kentucky, \$5,500; the State survey commission of Maine, \$2,500; the State geologist of Maryland, \$750; the State geologist of

Alabama, $1,000; the State geologist of Michigan, $1,700; the Louisiana experiment station, $1,500. Thus $105,750 was added by the States mentioned to the Federal appropriation for topographic work.

Summary of Results.

The following are the results obtained by all kinds of small-scale topographic surveys made, including the surveys of forest reserves, the reclamation surveys, and the surveys made by the division of Alaskan mineral resources.

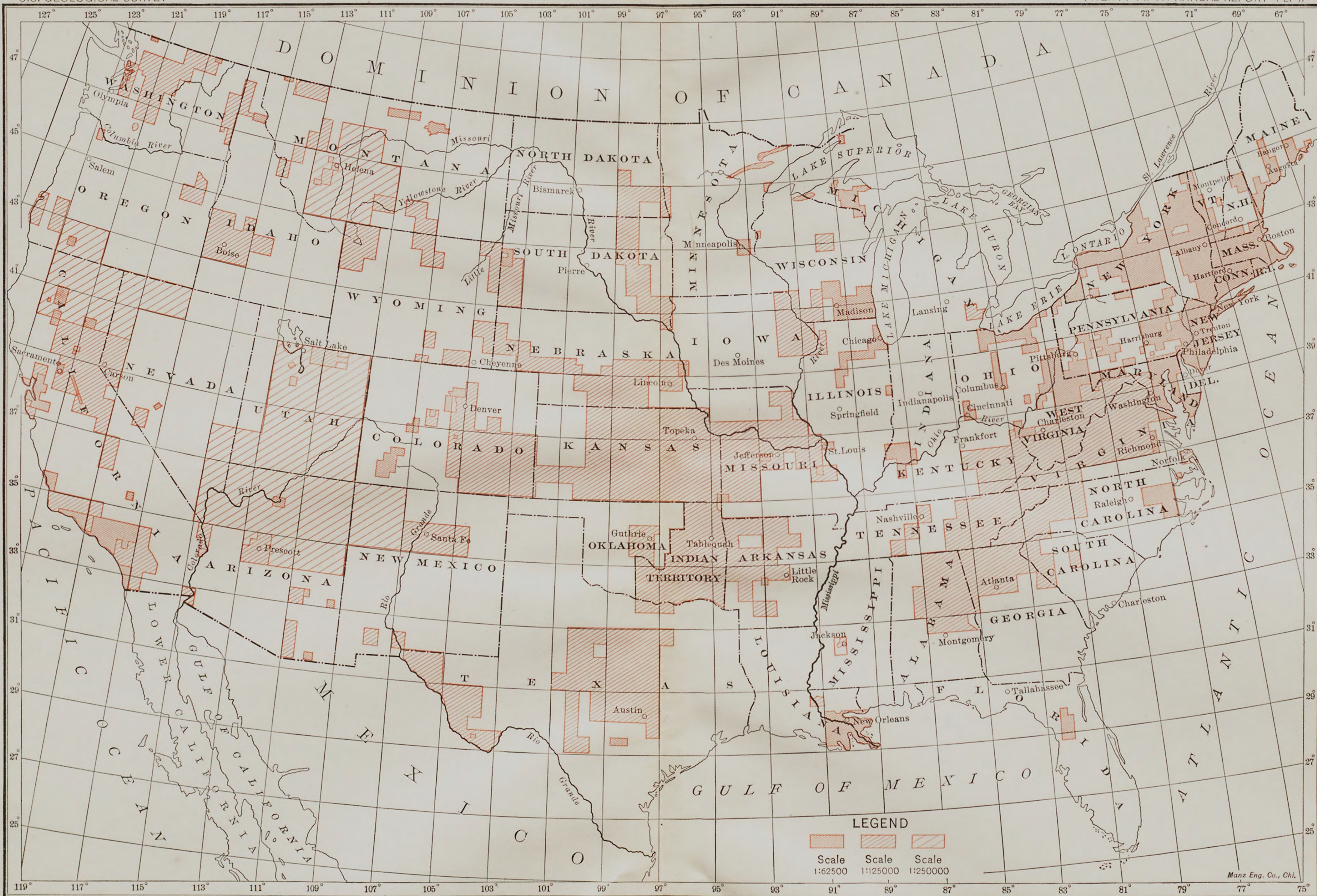
Primary azimuth observations were made at 2 triangulation stations; 403 triangulation stations were occupied or located; 2,283 miles of primary traverse were run.

The condition of topographic surveys to April 30, 1904, distinguished as to scale, etc., is shown on a general map of the United States, Pl. II, and the detailed distribution of this work in the various States and Territories is shown on the 23 accompanying maps, Pls. I and III to XXIV. On the latter are indicated by proper symbols the sheets published to June 30, 1904, the sheets in course of publication, and the areas surveyed during the field season of 1903 and drawn up in map form in the office season of 1903–4. By appropriate symbols these maps also show areas in which precise or primary spirit levels have been run and unmapped areas which are controlled by primary triangulation or traverse or by astronomic positions.

As shown in the following table giving the details relating to topographic mapping and spirit leveling for the fiscal year, the total area of new surveys was 26,699 square miles; the total area surveyed in the United States to date being 935,980 square miles, or about 31 per cent.

In addition, as shown in tables on pages 110 and 193, a large area of resurvey was completed by final topographic mapping over portions of the country into which preliminary reconnaissance surveying had been previously carried, thus making the total area of actual surveys for the season 34,140 square miles.

In connection with these topographic surveys there were run 28,083 linear miles of spirit levels, thus making the total



MAP OF UNITED STATES, SHOWING AREAS COVERED BY TOPOGRAPHIC SURVEYS

AND THE SCALE EMPLOYED FOR EACH AREA

Scale

100 0 100 200 300 miles

1904

mileage of spirit levels since the first authorization for this class of work by Congress, in 1896, amount to 130,884 miles.

The total area covered by topographic surveys made by members of the topographic branch in Alaska during the fiscal year 1903-4, as reported in detail on pages 77 and 80, was about 12,400 square miles.

Present condition of topographic surveys of the United States, showing new areas surveyed in 1903-4.

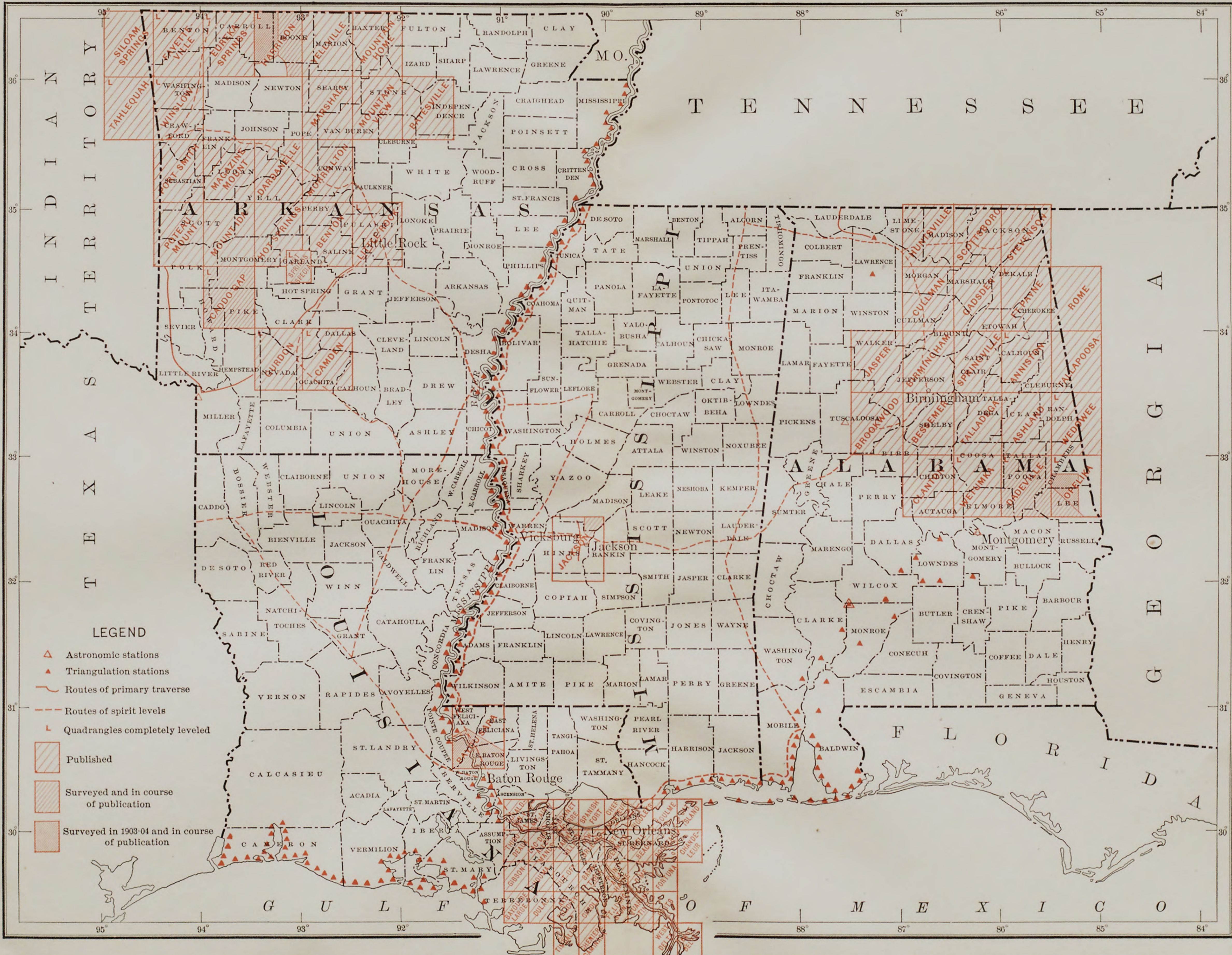
State or Territory.	Total area.	New area surveyed in 1903-4.	Total area surveyed to April 30, 1904.
	Sq. miles.	*Sq. miles.*	*Sq. miles.*
Alabama	52, 250	90	17, 534
Arizona	113, 020	2, 363	60, 813
Arkansas	53, 850	386	20, 315
California	158, 360	2, 532	67, 148
Colorado	103, 925	694	35, 101
Connecticut	* 5, 047	....	5, 047
Delaware	2, 050	....	818
District of Columbia	70	....	70
Florida	58, 680	....	1, 821
Georgia	59, 475	409	14, 952
Idaho	84, 800	....	14, 933
Illinois	56, 650	70	4, 915
Indian Territory	30, 962	....	30, 620
Indiana	36, 350	71	2, 311
Iowa	56, 025	287	9, 395
Kansas	82, 080	....	64, 159
Kentucky	40, 400	824	12, 727
Louisiana	48, 720	486	7, 003
Maine	33, 040	211	6, 122
Maryland	12, 210	53	9, 835
Massachusetts	* 8, 332	....	8, 332
Michigan	58, 915	550	3, 014
Minnesota	83, 365	....	2, 640
Mississippi	46, 810	....	249
Missouri	69, 415	3	32, 564
Montana	146, 080	1, 251	42, 628
Nebraska	77, 510	....	25, 774
Nevada	110, 700	....	28, 953
New Hampshire	9, 305	219	2, 604
New Jersey	* 7, 886	....	7, 756

Present condition of topographic surveys of the United States, showing new areas surveyed in 1903-4—Continued.

State or Territory.	Total area.	New area surveyed in 1903-4.	Total area surveyed to April 30, 1904.
	Sq. miles.	*Sq. miles.*	*Sq. miles.*
New Mexico	122,580	....	27,775
New York	49,170	2,747	33,871
North Carolina	52,250	....	15,872
North Dakota	70,795	....	7,010
Ohio	41,060	2,942	9,529
Oklahoma	39,030	....	4,154
Oregon	96,030	641	12,840
Pennsylvania	45,215	1,052	15,422
Rhode Island	* 1,131	....	1,131
South Carolina	30,570	16	5,016
South Dakota	77,650	328	17,103
Tennessee	42,050	807	19,849
Texas	265,780	1,529	63,188
Utah	84,970	14	62,628
Vermont	9,565	215	3,249
Virginia	42,450	....	29,063
Washington	69,180	2,891	15,859
West Virginia	24,780	1,394	20,945
Wisconsin	56,040	351	10,909
Wyoming	97,890	1,273	19,133
Total	[a] 3,024,880	26,699	934,694

[a] Total area of United States is from reports of Twelfth Census, and is not a summation of column.

The total areas of the States marked with an asterisk (*) and the areas given in the last column of the foregoing table include land areas only. They are the result of careful measurement on the topographic maps of the Geological Survey (see p. 136). They do not include large bodies of water bordering on the national boundary or the open ocean, but do include all rivers and the smaller lakes. The measurement closely follows the shore line, jumping from headland to headland only across necks or straits less than 1,000 feet in width. For example, the area of Long Island Sound is excluded, though the State boundary between Connecticut and New



MAP OF ALABAMA, MISSISSIPPI, ARKANSAS, AND LOUISIANA, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

York is near the middle of its channel, and legally the two States jointly control its waters.

Division of Topography.

EASTERN SECTION.

FIELD WORK.

SUMMARY.

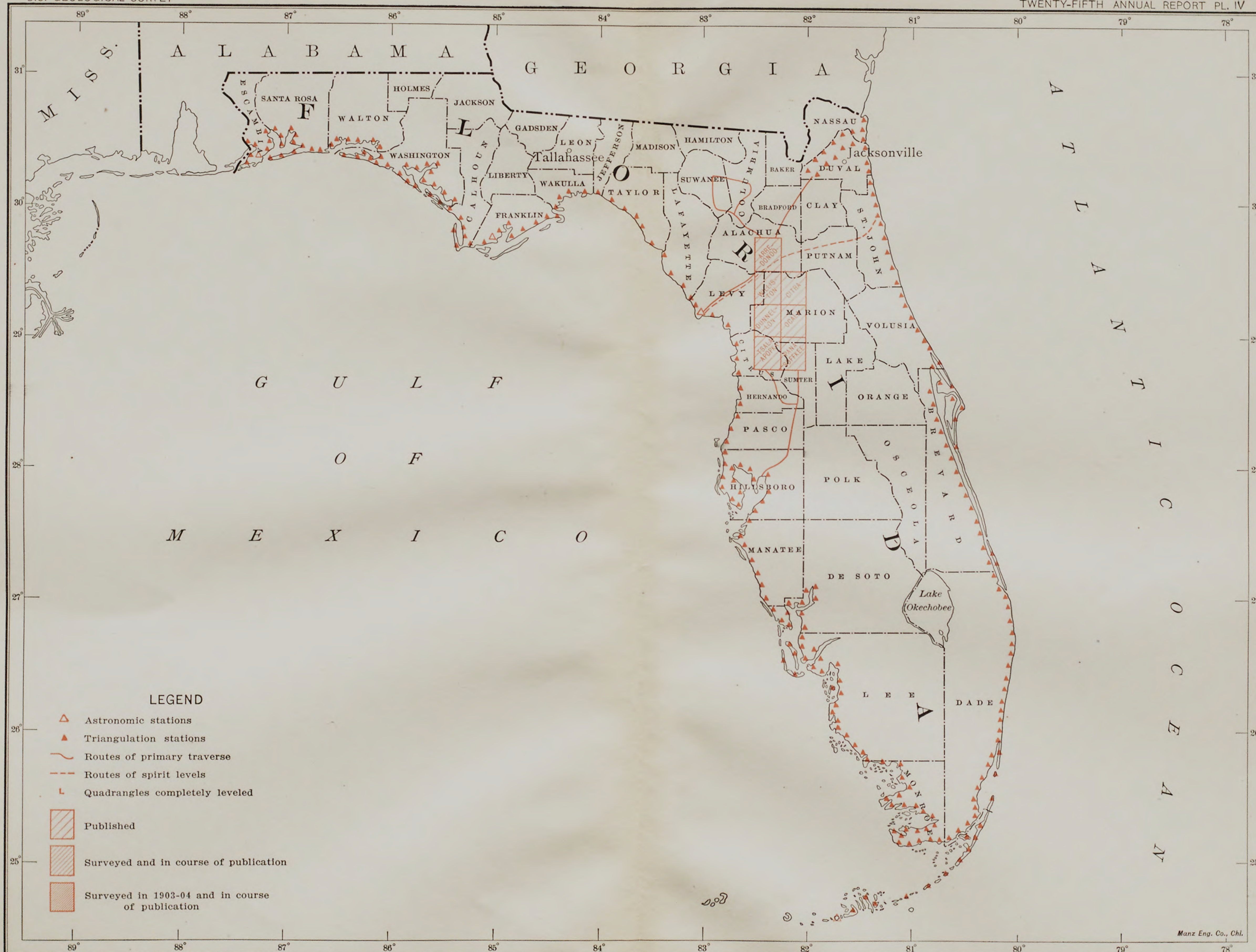
Upon its organization at the beginning of the field season, this section was placed in charge of Mr. H. M. Wilson, geographer. During the season topographic work was carried on by parties working in twenty-four States, namely: Alabama, Arkansas, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Michigan, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, West Virginia, and Wisconsin. The survey of fifty-five quadrangles was completed, and twenty-three were completely resurveyed or revised. In addition, fifty-seven quadrangles were partially surveyed. The total new area mapped was 13,183 square miles, of which 9,392 were for publication on the scale of 1:62,500, and 3,791 for publication on the scale of 1:125,000. There were resurveyed 5,166 square miles on the scale of 1:62,500, and 664 square miles on the scale of 1:125,000. In connection with this work 24,149 linear miles of levels were run and 662 permanent bench marks established. Primary control was carried on during the season by six parties working in portions of sixteen States. They controlled 11,760 square miles lying within forty-six separate quadrangles.

Topographic surveys in the eastern section from May 1, 1903, to April 30, 1904.

State or Territory.	Contour interval.	Scale of publication.				Total area surveyed.	Levels.	
		1:125,000.		1:62,500.				
		New.	Resurvey or revision.	New.	Resurvey or revision.		Distance run.	Bench marks.
	Feet.	*Sq. miles.*	*Sq. miles.*	*Sq. miles.*	*Sq. miles.*	*Sq. miles.*	*Miles.*	
Alabama	50	90				90	255	7
Arkansas	50	386				386	329	15
Georgia	20, 50	409			164	573	770	38
Illinois	10, 20			70	194	264	292	14
Indiana	20			71		71	72	2
Iowa	20	287				287	94	6
Kansas	20		950			950	1, 046	24
Kentucky	20	627		197	326	1, 150	1, 448	28
Louisiana	20	486				486	862	17
Maine	20			211		211	224	7
Maryland	20			53		53	28	
Michigan	20	329		221		550	720	24
Missouri	20, 50	3			510	513	1, 230	24
New Hampshire	20			219		219	310	17
New Jersey	20				1, 129	1, 129		
New York	20			2, 747		2, 747	2, 491	68
North Carolina	20, 100		664		540	1, 204	354	5
Ohio	10, 20			2, 942		2, 942	7, 311	209
Pennsylvania	20			1, 052		1, 052	2, 054	56
South Carolina	50, 100	16				16	40	3
Tennessee	20, 50	807			10	817	639	14
Vermont	20			215		215	207	5
West Virginia	20			1, 394	466	1, 860	2, 786	63
Wisconsin	20	351			877	1, 228	587	16
Total		3, 791	1, 614	9, 392	4, 216	19, 013	24, 149	662

DETAILS OF FIELD WORK, BY STATES.

Alabama.—The State geologist of Alabama allotted $1,000 for cooperative work in that State, which was supplemented by a like sum by the Federal Survey. The terms of the agreement of 1899 were continued to cover this cooperation. One party was engaged in mapping the Opelika (Alabama-Georgia) quadrangle, for publication on the scale of 1:125,000, with a contour interval of 50 feet, and partly completed its survey.



MAP OF FLORIDA, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Topographic surveys made in 1903-4, in cooperation with the State of Alabama.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels. Spirit levels.	Levels. Bench marks.	Levels. Elevations.	Traverse.
			Sq. mi.		*Miles.*			*Miles.*
Chambers, Lee	Opelika (unfinished).	W. L. Miller, in charge; C. D. S. Clarkson.	90	....	255	7	1,294	719

Arkansas.—One party was engaged in the topographic mapping of the Harrison (Arkansas-Missouri) quadrangle, for publication on the scale of 1:125,000, with a contour interval of 50 feet, and partly completed its survey.

Topographic surveys in Arkansas, 1903-4.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels. Spirit levels.	Levels. Bench marks.	Levels. Elevations.	Traverse.
			Sq. mi.		*Miles.*			*Miles.*
Carroll, Boone, Madison, Newton	Harrison (unfinished).	H. B. Blair	386	....	329	15	1,312	1,007

Georgia.—One party was engaged in topographic mapping in the Wilkes (Georgia-South Carolina) quadrangle for publication on the scale of 1:125,000, with a contour interval of 50 feet. The same party completed the resurvey of the Cartersville Special district, for publication on the scale of 1:62,500, with a contour interval of 20 feet. This work was under the general supervision of Mr. W. Carvel Hall.

Topographic surveys in Georgia, 1903-4.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels. Spirit levels.	Levels. Bench marks.	Levels. Elevations.	Traverse.
			Sq. m.		*Miles.*			*Miles.*
Bartow, Cherokee	Cartersville Special (resurvey completed).	G. H. Guerdrum, in charge; E. S. Ela.	164	62	189	5	705	841
Oglethorpe, Taliaferro, Warren, McDuffie, Wilkes, Lincoln, Elbert	Wilkes (unfinished).	G. H. Guerdrum	409	....	581	33	1,485	1,510

Illinois.—One party was engaged in the resurvey of the St. Louis (Missouri-Illinois) quadrangle, and in the mapping of the Peoria quadrangle, for publication on the scale of 1:62,500, with contour intervals of 20 and 10 feet, respectively, both of which were completely mapped. An area of about 15 square miles, including St. Louis, Mo., and neighboring cities, was mapped on the large scale of 2,000 feet to 1 inch, with contours of 20 feet. All this work was under the immediate charge of Mr. C. E. Cooke, topographer.

Topographic surveys in Illinois, 1903–4.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Madison St. Clair Monroe	East St. Louis (resurvey completed).	C. E. Cooke in charge; G. Young, W. O. Tufts.	194	....	221	5	485	531
Peoria Tazewell	Peoria (completed).	C. E. Cooke.	70	....	71	9	270	135

Indiana.—One party was engaged in mapping the Newburg (Indiana-Kentucky) quadrangle, for publication on the scale of 1:62,500, with a contour interval of 20 feet, and completed the same.

Topographic surveys in Indiana, 1903–4.

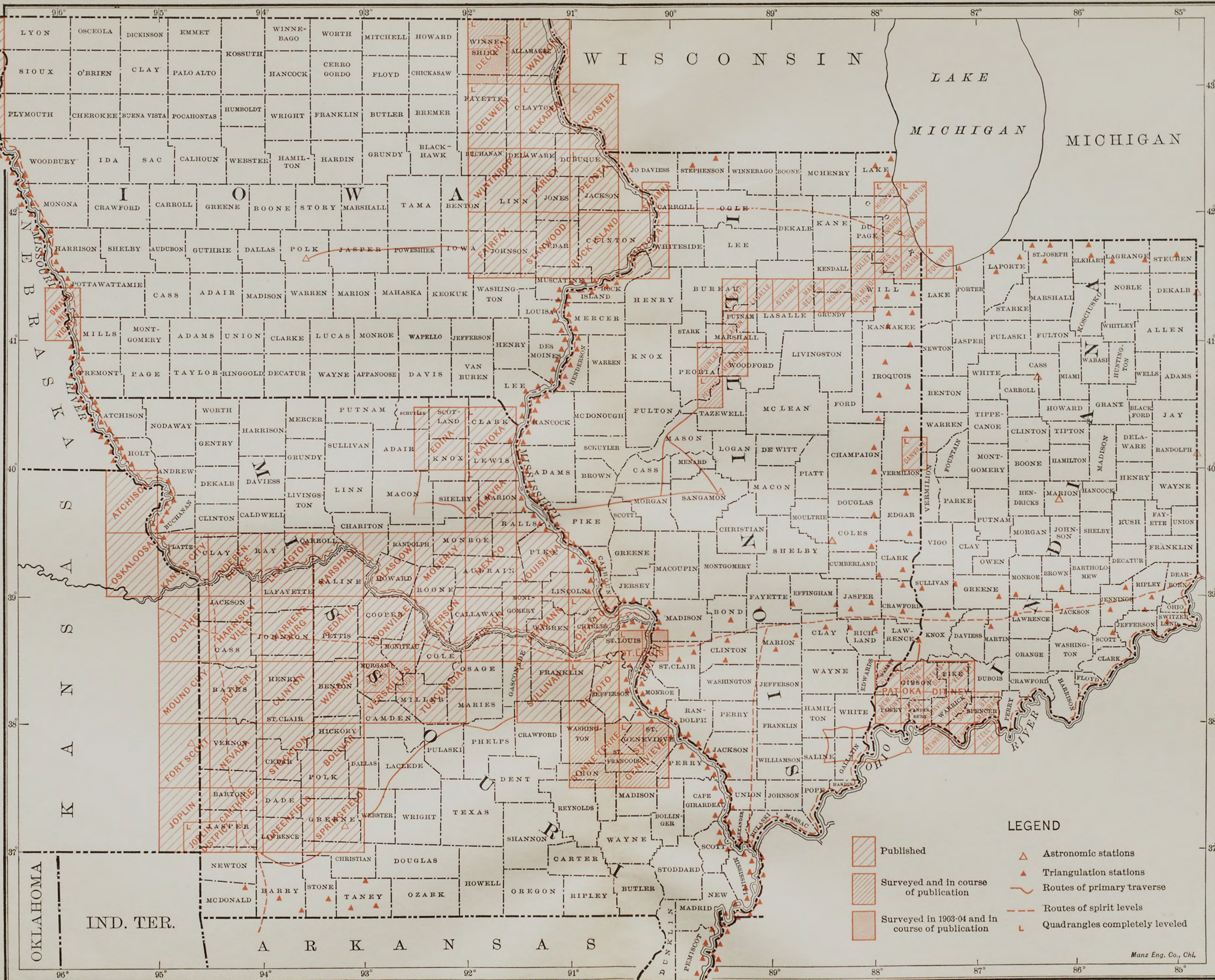
County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Warwick Vanderburg	Newburg (completed).	W. H. Lovell.	71	....	72	2	227	111

Iowa.—One party was engaged on the topographic mapping of the Decorah (Iowa) quadrangle, for publication on the scale of 1:125,000, with a contour interval of 20 feet, and completed the same.

Topographic surveys in Iowa, 1903–4.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles*
Fayette Winnesheik Allamakee	Decorah (completed).	R. C. McKinney.	287	....	94	6	288	478

Kansas.—One party was engaged on the resurvey of the Independence (Kansas) quadrangle, for publication, on the



MAP OF INDIANA, ILLINOIS, IOWA, AND MISSOURI, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL scale of 1:125,000, with a contour interval of 20 feet, completing the same.

Topographic surveys in Kansas, 1903-4.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Wilson; Montgomery; Neosho; Labette	Independence (resurvey completed).	Basil Duke, in charge; J. G. Staack.	950	....	1,046	24	1,800	....

Kentucky.—In November, 1902, an agreement was entered into between the curator of the State geological department of Kentucky and the Director of the United States Geological Survey, providing for the expenditure of an appropriation of $5,500, allotted by the State of Kentucky, and $5,500 allotted by the Federal Survey, for cooperative topographic survey in the State. One party was engaged in the resurvey of six quadrangles, lying partly within the States of Tennessee and Virginia, for publication on the scale of 1:62,500, with a contour interval of 20 feet. No sheet was completely mapped. Mr. Nat. Tyler, jr., was in charge of the party.

Topographic surveys made in 1903-4, in cooperation with the State of Kentucky.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Bell; Whitley; Knox	Log Mountain..	Nat. Tyler, jr., in charge.	31	16	54	....	91	52
Letcher; Harlan; Leslie	Black Mountain	Nat. Tyler, jr.; R. W. Berry.	43	13	61	....	269	77
Harlan; Leslie; Knox	Harlan	.....do............	133	49	138	4	510	388
Bell	Middlesboro....	Nat. Tyler, jr......	45	39	232	3	270	527
Leslie; Clay; Knox; Bell; Harlan	Pineville	Nat. Tyler, jr.; R. W. Berry.	19	10	40	2	126	44
Do.; Bell	Hagan..........	.....do............	55	38	47	....	233	164
Total[a]...	....	....	326	165	572	9	1,499	1,252

[a] Resurveys completed in field.

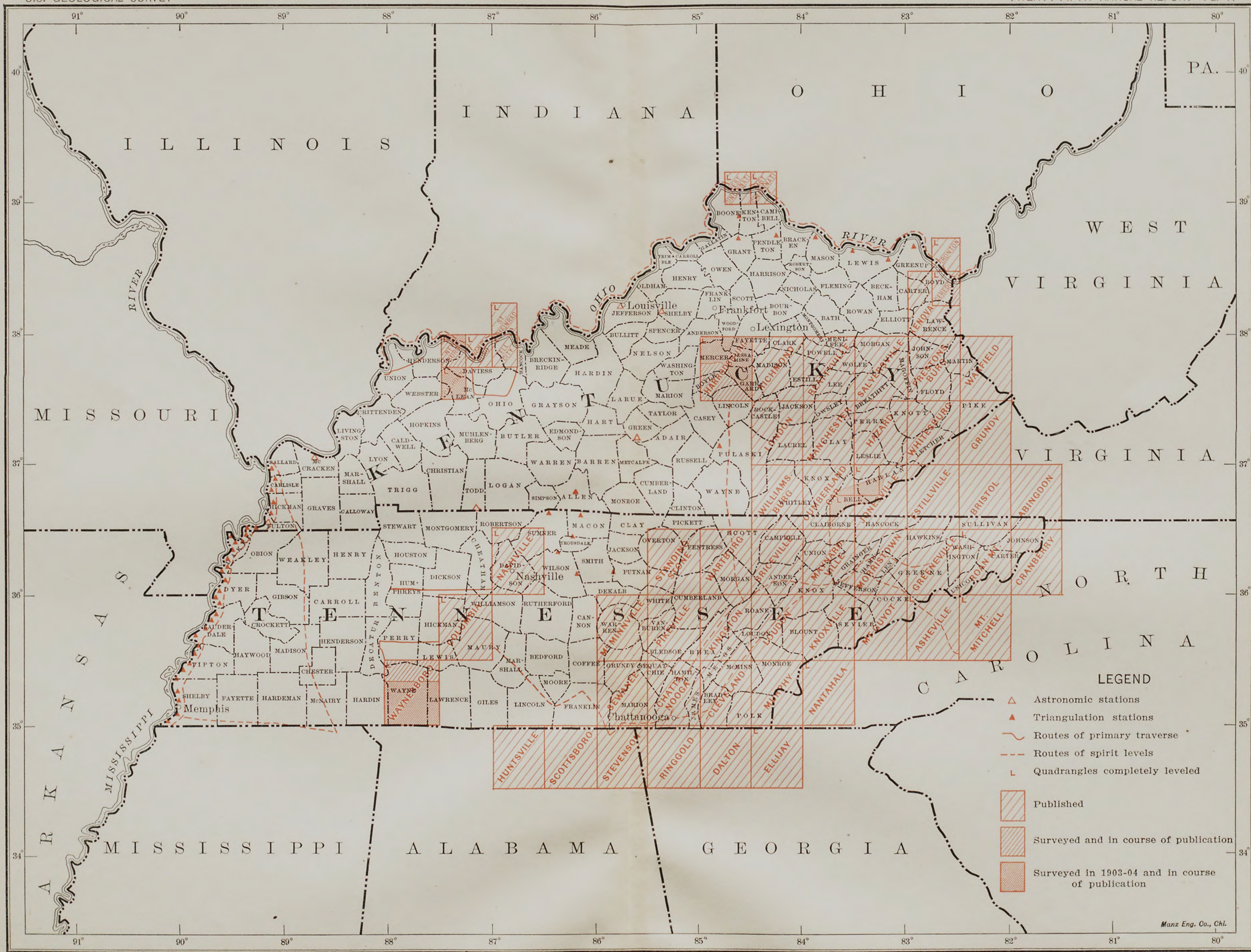
Outside of this cooperation two parties were engaged in the topographic mapping of four quadrangles, namely: Harrodsburg, for publication on the scale of 1:125,000, with a contour interval of 50 feet; and Calhoun, Sutherland, and Newburg, the latter lying partly in Indiana, all three for publication on the scale of 1:62,500, with a contour interval 20 feet.

Topographic surveys in Kentucky, 1903–4.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Mercer Anderson Boyle Garrard Lincoln Woodford Casey Jessamine Fayette	Harrodsburg	W. L. Miller	627	....	642	3	1,865	1,787
McLean Daviess Webster Henderson	Calhoun	W. H. Lovell	193	....	142	9	658	81
Henderson Daviess	Newburg	do	4	....	....	....	....	....
Total[a]			824	....	784	12	2,523	1,868
McLean Daviess Ohio	Sutherland (unfinished).	W. H. Lovell	....	....	92	7	345	198

[a] Completed in field.

Louisiana.—Under an agreement entered into between the director of the Louisiana experiment station and the Director of the United States Geological Survey in February, 1903, it was provided that not more than \$2,500 was to be expended by the State on cooperative topographic surveys. As stated in the Twenty-fourth Annual Report of the Director, field work was commenced in March, under the direction of Mr. J. H. Renshawe, geographer, on the Bayou Sara quadrangle and continued through May. Field work was resumed in September, 1903, under the general direction of Mr. H. M. Wilson, geographer, under whose supervision the field work of the central section had in the meantime been placed. This



MAP OF KENTUCKY AND TENNESSEE, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL work extended into the Baton Rouge quadrangle. On account of the great detail in which it was found necessary to map the northern portion of the area the total funds were exhausted early in November, 1903. The Director of the United States Geological Survey therefore allotted an additional $2,500 from the funds of the Federal Survey, making a total on behalf of this Survey of $5,000. This work was mapped for publication on the scale of 1:125,000, with a contour interval of 20 feet. The work of the full season is reported below, neither sheet having been completed.

Topographic surveys made in 1903–4 in cooperation with the State of Louisiana.

Parish.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. miles.		*Miles.*			*Miles.*
Ascension Assumption Iberia Martin Iberville East Baton Rouge West Baton Rouge	Baton Rouge	Duncan Hannegan, in charge; E. G. Hamilton.	(HMW) 85	....	173	1	435	151
Pointe Coupee East Feliciana West Feliciana East Baton Rouge West Baton Rouge	Bayou Sara	.....do	(JHR) 110	....	369	8	759	2,153
			(HMW) 291	....	320	8	1,002	....
Total	....	....	486	....	862	17	2,196	2,304

Maine.—Under an agreement entered into between the State survey commissioners of Maine and the Director of the United States Geological Survey, signed April 14, 1903, it was planned that the State of Maine should expend not less than $2,500 on cooperative topographic surveys within the State and that at least an equal amount should be expended by the Director of this Survey. One party completed the topographic mapping of the Bingham quadrangle, and one the revision for culture of the Castine, Bluehill, Mount Desert, Vinalhaven, and Swans Island quadrangles. The publication scale of this work is 1:62,500, and the contour interval 20 feet. This work was under the general supervision of Mr. Hersey Munroe.

Topographic surveys made in 1903–4 in cooperation with the State of Maine.

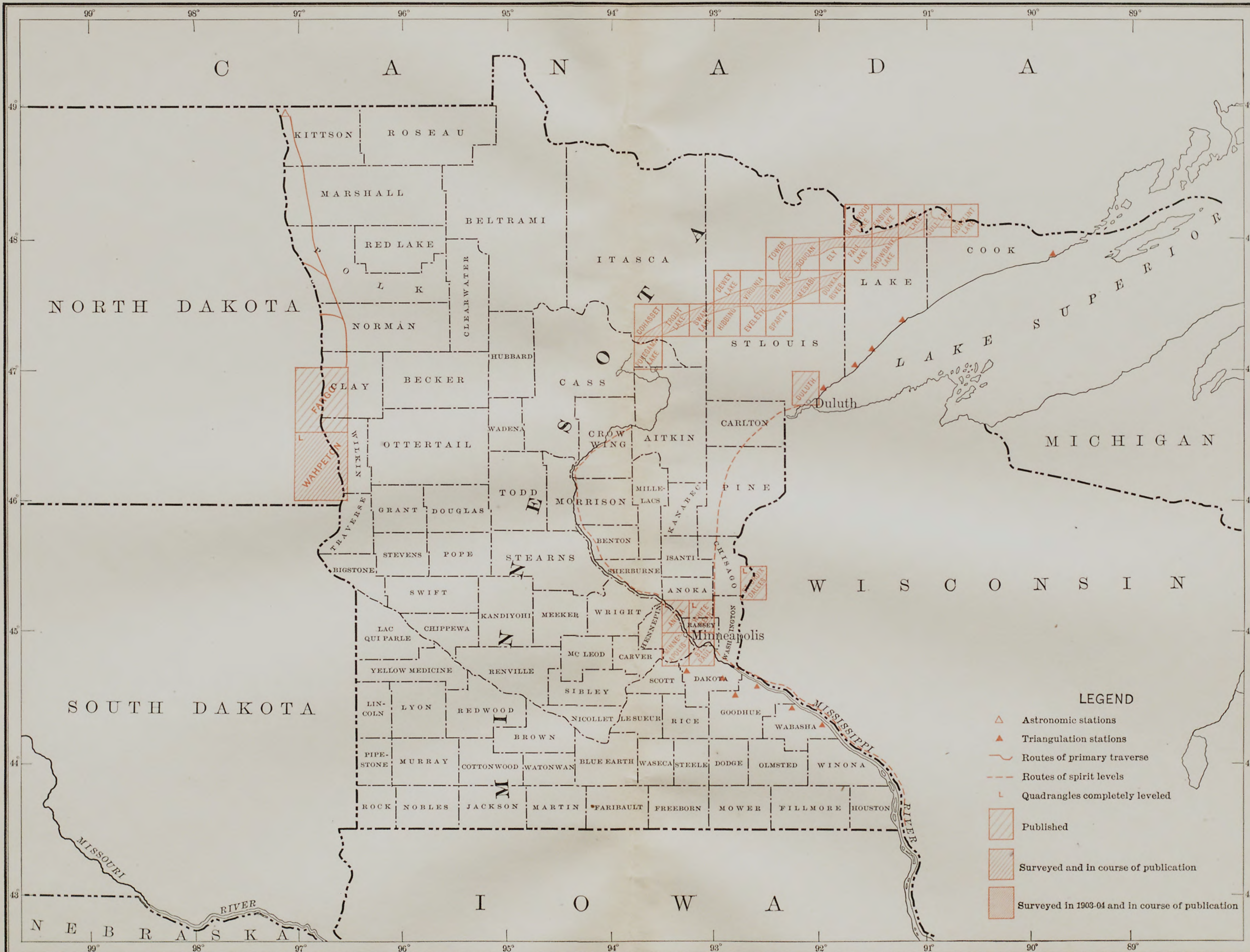
County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Somerset	Bingham (completed).	T. F. Slaughter, in charge; A. T. Fowler.	211	67	224	7	458	993
Waldo, Hancock, Knox	Bluehill, Castine, Mount Desert, Vinalhaven, and Swans Island.	Hersey Munroe, in charge; T. F. Slaughter.	.....	.....	.....	.....	.....	.....

Maryland.—In January, 1903, it was agreed that the State geologist of Maryland should allot $250 and that the Director of the United States Geological Survey should allot a like amount to cooperative topographic surveys in Maryland, to be prosecuted under the terms of the agreement signed on May 15, 1902. In September, 1903, the State geologist of Maryland allotted an additional sum of $500, and the Director of the United States Geological Survey did the same. During the season one party was engaged in completing the survey of the Westminster (Maryland-Pennsylvania) quadrangle, and in running road traverse over the Preston quadrangle. The additional funds were used in the extension of primary control which will hereafter be reported upon. The publication scale of this work is 1:62,500 and the contour interval 20 feet.

Topographic surveys made in 1903–4 in cooperation with the State of Maryland.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Carroll, Baltimore	Westminster (completed).	W. C. Hall, in charge; G. S. Smith.	53	.....	28	.....	.....	.....
Dorchester, Caroline, Talbot	Preston (unfinished).	W. C. Hall	.....	.....	.....	.....	.....	49

Michigan.—Under an agreement signed by the State geologist of Michigan and the Director of the United States Geological Survey on May 27, 1903, it was agreed that the State of Michigan should expend not less than $1,700 for the fiscal



MAP OF MINNESOTA, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL year ending June 30, 1904, and that the Federal Survey should expend at least an equal amount on cooperative topographic surveys in Michigan. One party was engaged in the topographic survey of the Detroit River (Michigan-Canada) quadrangle, for publication on the scale of 1:125,000, with a contour interval of 20 feet. The four 15-minute sheets covering this will be separately published on the scale of 1:62,500, the survey for one of which, the Northville, was finished during the season.

Topographic surveys made in 1903–4 in cooperation with the State of Michigan.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Wayne ...... Oakland.....	Northville (completed).	Robert Muldrow, in charge; J. T. McCoy.	221	....	180	6	460	392
Wayne ...... Oakland..... Macomb..... Monroe......	Detroit River (unfinished).	.....do..............	329	....	540	18	1,370	1,150

Missouri.—Four parties were engaged in topographic surveys in four quadrangles: The resurvey of the St. Louis (Missouri-Illinois) quadrangle, for publication on the scale of 1:62,500, with a contour interval of 20 feet; the survey of the Harrison (Arkansas-Missouri) quadrangle, on the publication scale of 1:125,000, with a contour interval of 50 feet; the resurvey of the Bonneterre and Farmington quadrangles for publication on the scale of 1:62,500, with a contour interval of 20 feet. An area of about 75 square miles, including St. Louis and neighboring cities, was mapped on the large scale of 2,000 feet to 1 inch, with contours of 20 feet.

Topographic surveys in Missouri, 1903–4.

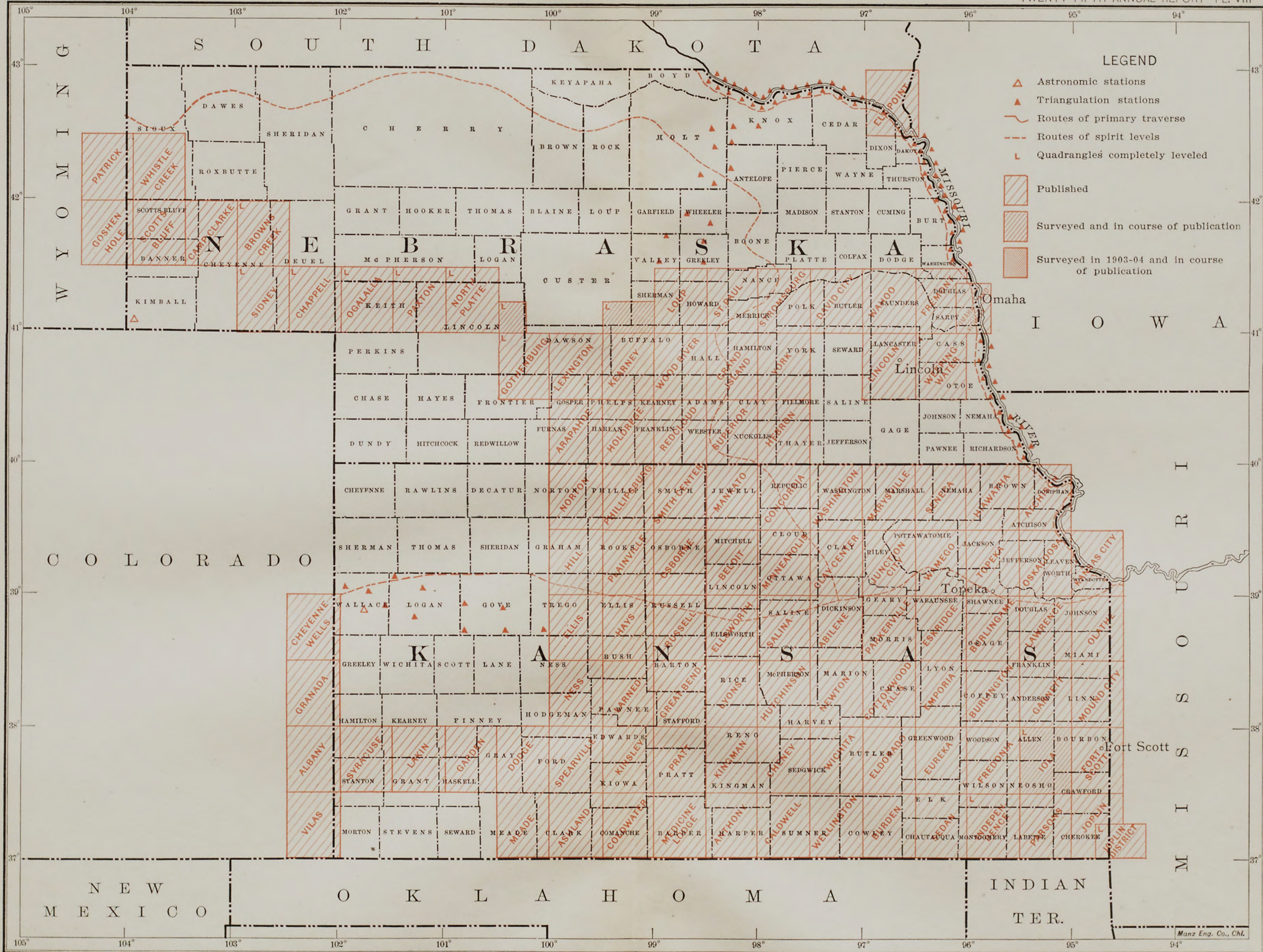
County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
St. Louis City	East St. Louis	C. E. Cooke, in charge; G. Young, W. O. Tufts.	41					
St. Louis City, St. Louis, Jefferson	West St. Louis	do	233		403	5	1,909	732
Reynolds, Iron, St. Francois, Madison, Washington	Bonneterre	W. J. Lloyd, in charge; D. F. Higgins, J. N. Williamson.	236		529	12	3,327	1,067
Total[a]			510		932	17	5,236	1,799
St. Francois, Ste. Genevieve	Farmington	W. J. Lloyd			298	7	2,176	
Stone, Taney	Harrison	H. B. Blair	3					
Total[b]			3		298	7	2,176	

[a] Resurvey completed in the field. [b] Unfinished in the field.

New Hampshire.—One party was engaged in the topographic mapping of two quadrangles, for publication on the scale of 1:62,500, with a contour interval of 20 feet.

Topographic surveys in New Hampshire, 1903–4.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Rockingham, Hillsboro	Manchester (completed).	Hersey Munroe, in charge; T. F. Slaughter, A. T. Fowler, B. B. Alexander.	219	85	281	15	825	962
Hillsboro	Milford (unfinished).	Hersey Munroe			29	2	39	



MAP OF NEBRASKA AND KANSAS, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

New Jersey.—Five parties were engaged in the revision of work on sheets covering five quadrangles, designed for publication on the scale of 1:62,500, with a contour interval of 20 feet, the work being under the general charge of Mr. Hersey Munroe. These sheets were completely revised for culture.

Topographic surveys in New Jersey, 1903–4.

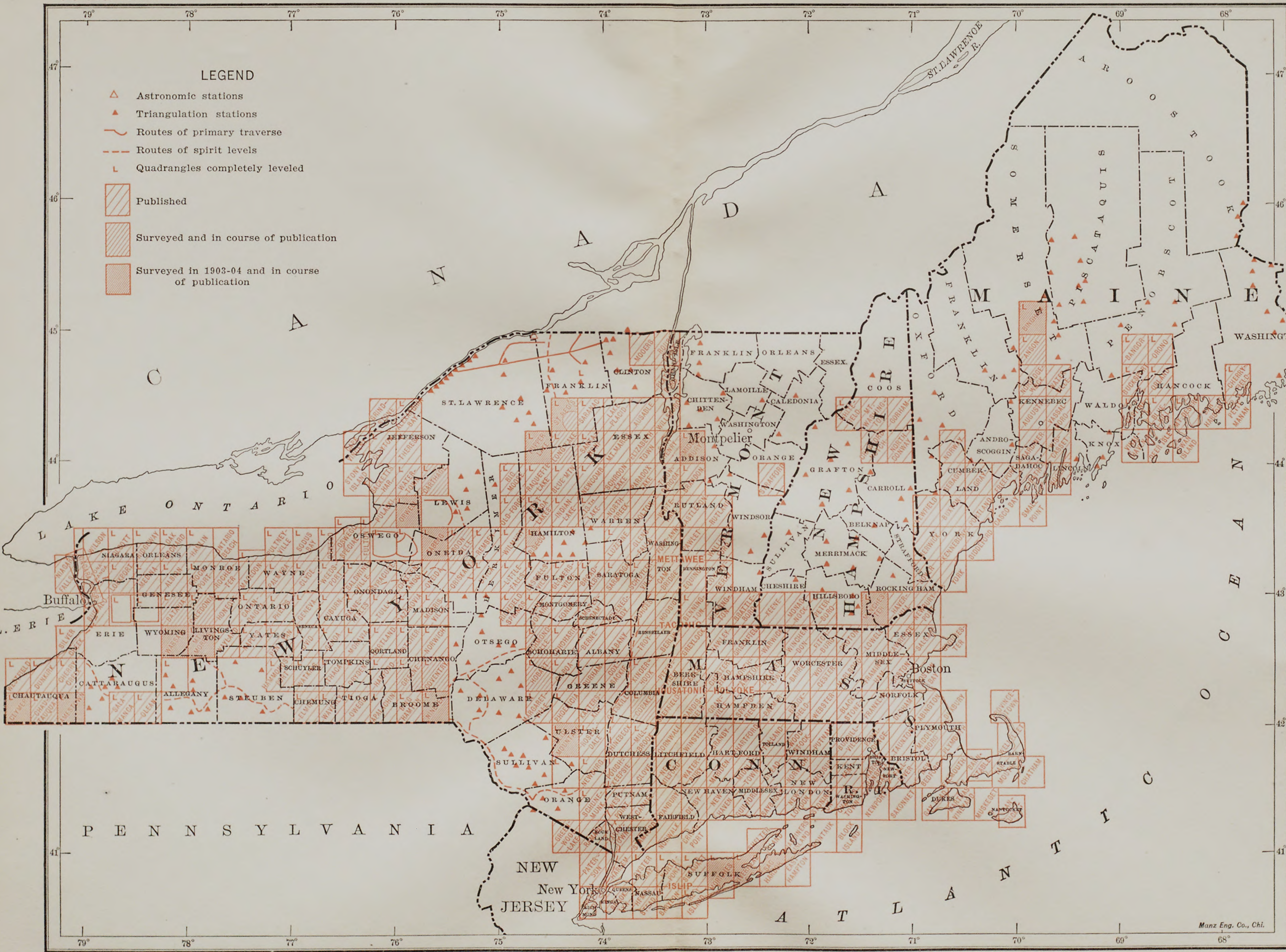
County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels. Spirit levels.	Levels. Bench marks.	Levels. Elevations.	Traverse.
			Sq. mi.		*Miles.*			*Miles.*
Morris, Somerset, Hunterdon, Middlesex	Somerville	Robert Coe, J. P. Gardner.	227	....	......	....	......	555
Morris, Sussex, Somerset	Lake Hopatcong.	Robert Coe, J. M. Whitman, J. I. Gayetty, I. A. Flocker.	223	....	......	....	......	8
Essex, Morris, Passaic	Morristown	J. M. Whitman, I. A. Flocker.	226	....	......	....	......	......
Sussex, Warren, Morris, Hunterdon	Hackettstown	Hersey Munroe, I. A. Flocker, J. M. Whitman, J. I. Gayetty.	226	....	......	....	......	161
Morris, Hunterdon, Warren, Somerset	High Bridge	A. T. Fowler, J. I. Gayetty.	227	....	......	....	......	82
Total	....	....	1,129	....	......	....	......	806

New York.—In Chapter 599 of the Laws of 1903 of the State of New York, an appropriation of $20,000 was made for the continuation of the cooperative topographic survey of the State of New York, in terms similar to those of Chapter 96 of the Laws of 1899. Of this sum $19,000 was allotted by the State and a like amount by the Director of the United States Geological Survey for the field and office work of the fiscal year 1903–4. Five parties were engaged in work in twenty-seven quadrangles, for publication on the scale of 1:62,500, with a contour interval of 20 feet. Of these, sixteen were completed and eleven were partly surveyed. The whole was under the general supervision of Mr. J. H. Jennings.

Topographic surveys made in 1903–4 in cooperation with the State of New York.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Chautauqua	Clymer	W. H. Lovell	222					
Suffolk	Easthampton	J. H. Jennings, in charge; A. P. Meade, jr.	28		20		61	139
Do	Gardiners Island.	do	43					
Chautauqua, Cattaraugus	Jamestown	W. H. Lovell, J. I. Gayetty.	222	242	128	2	232	426
Suffolk	Moriches	J. H. Jennings, in charge; J. M. Whitman, G. Young.	203		156	3	285	666
Do	Montauk	J. H. Jennings, in charge; W. H. S. Morey.	19					80
Wyoming, Livingston, Allegany	Mount Morris	J. H. Jennings	220	141	191	1	385	575
Broome, Chenango	Nineveh	C. C. Bassett	222	25	133		397	279
Oswego, Jefferson, Lewis	Orwell	J. H. Jennings, in charge; J. I. Gayetty.	216					390
Suffolk	Riverhead	J. H. Jennings, in charge; J. M. Whitman, A. P. Meade, jr.	147		133	2	421	609
Do	Sag Harbor	do	82		78		207	170
Do	Shelter Island	J. H. Jennings, in charge; A. P. Meade, jr.	62		27		68	43
Ulster, Sullivan	Slide Mountain	C. C. Bassett	222	271	124	6	352	595
Franklin	St. Regis	G. S. Smith, in charge; W. O. Tufts, A. P. Meade, jr., O. C. Merrill, I. A. Flocker, B. B. Alexander, Fred Graff, jr.	168	6	54	5	228	633
Oneida, Lewis	Taberg	J. H. Jennings, in charge; J. I. Gayetty.	217		115		292	139
Wyoming, Livingston, Allegany	Warsaw	J. H. Jennings, in charge; W. H. Lovell.	220	122	184	8	467	441
Total[a]			2,513	807	1,343	27	3,395	5,185
Wyoming, Genesee, Erie	Attica	J. H. Jennings, in charge; J. I. Gayetty.			244	7	539	42
Allegany	Belfast	J. H. Jennings, in charge; W. H. Lovell, C. Hartmann, jr.		229	121	7	289	175
Erie	Depew	J. H. Jennings, in charge; J. I. Gayetty.			169	7	630	40

[a] Completed in field.



MAP OF MAINE, NEW HAMPSHIRE, VERMONT, MASSACHUSETTS, RHODE ISLAND, CONNECTICUT, AND NEW YORK SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Topographic surveys made in 1903–4 in cooperation with the State of New York—Cont'd.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Ulster, Orange, Sullivan	Ellenville	C. C. Bassett		273	161	7	382	608
Lewis	Highmarket	J. H. Jennings, in charge; W. H. S. Morey.	6					
Oswego, Lewis, Oneida	Kasoag	J. H. Jennings						82
Franklin	Loon Lake	G. S. Smith			103	3	315	228
Oswego, Onondaga	Mexico	J. H. Jennings, in charge; J. I. Gayetty.			263	6	884	600
Hamilton, Fulton, Herkimer	Piseco Lake	J. M. Whitman, in charge; F. T. Fitch.	59					347
Hamilton	Lake Pleasant	J. M. Whitman		110			90	224
Franklin, Hamilton, St. Lawrence	Tupper Lake	G. S. Smith, in charge; W. O. Tufts, J. M. Whitman, A. P. Meade, jr., O. C. Merrill, I. A. Flocker, W. H. S. Morey, B. B. Alexander, Fred Graff, jr.	169		87	4	381	329
Total[a]			234	612	1,148	41	3,510	2,675

[a] Unfinished in field.

North Carolina.—No allotment was made for cooperative topographic surveying in North Carolina for the fiscal year 1903–4. There remained, however, from previous years an unexpended balance of State funds to the amount of \$914.64 and of United States Geological Survey funds of \$51.64, and as this balance was not sufficient to cover the necessary revision the Director of the Federal Survey added \$702.68. The total therefore available for the above work was \$1,668.96. One party was engaged on the revision of three atlas sheets for publication on the scale of 1:62,500, with a contour interval of 20 feet. Outside of any cooperative appropriation the resurvey of the Morganton quadrangle and of the Saluda (North Carolina-South Carolina) quadrangle was in progress for publication in sheets on the scale of 1:125,000, with a contour interval of 100 feet. The whole was under the general supervision of Mr. W. Carvel Hall.

Topographic surveys in North Carolina, 1903–4.

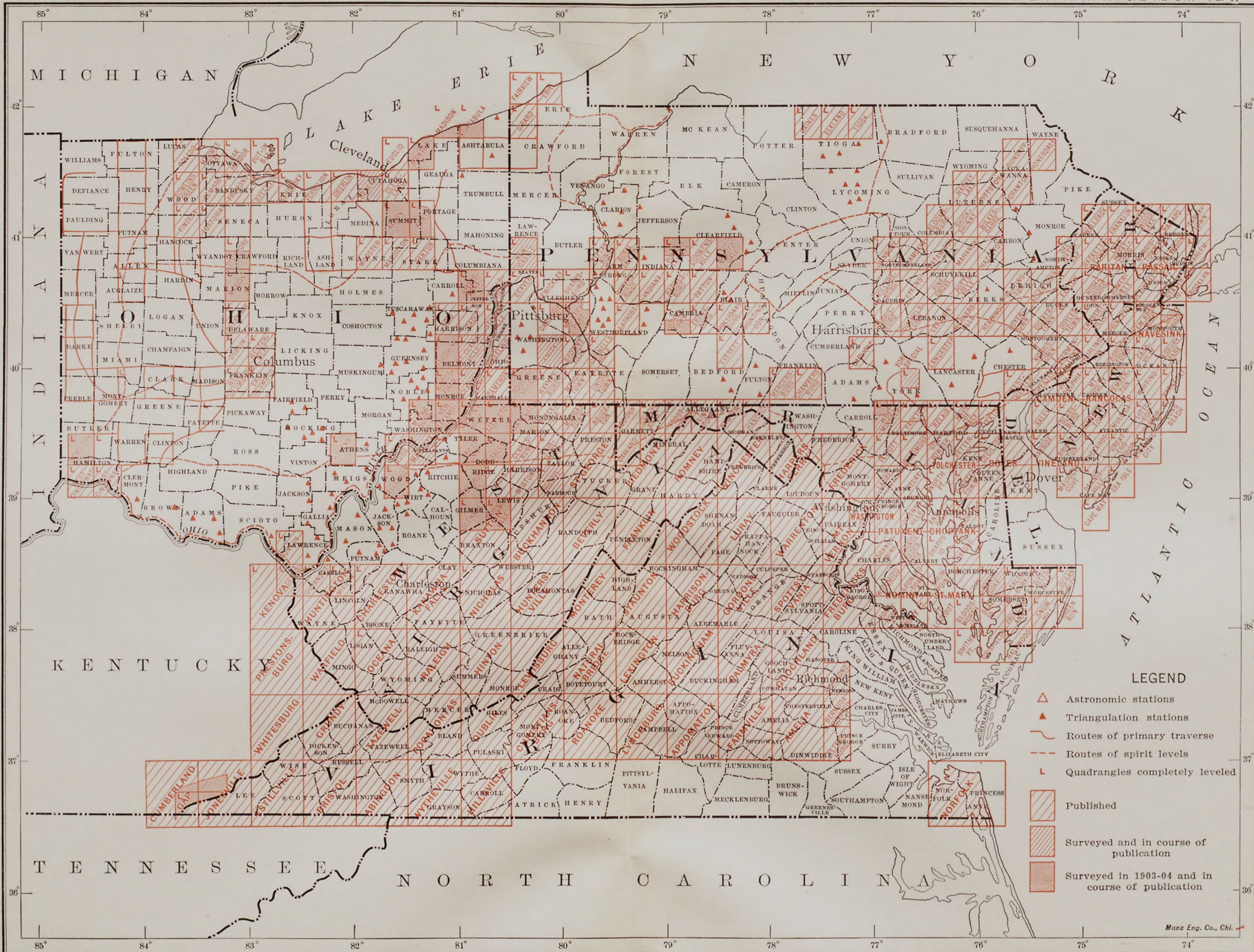
County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Caldwell, Mitchell, McDowell, Cleveland, Lincoln, Rutherford, Burke, Catawba	Morganton (resurvey completed).	W. C. Hall, in charge; L. S. Leopold.	664	151	326	....	934	2,492
Saluda, Henderson, Buncombe, Rutherford, Polk, McDowell	Saluda (resurvey unfinished).	....do	....	44	28	5	137	......

Topographic surveys made in 1903–4 in cooperation with the State of North Carolina.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Martin, Beaufort, Pitt	Chocowinity	Robert Coe	115	....	......	....	......	......
Pitt	Winterville	....do	240	....	......	....	......	52
Craven, Jones, Lenoir	Trent River	....do	185	....	......	....	......	......
Total[a]			540	....	......	....	......	52

[a] Revision completed in field.

Ohio.—Under an agreement signed by the governor of Ohio and the Director of the United States Geological Survey on May 22, 1903, it was arranged that \$30,000 should be expended by the State on cooperative topographic surveys, to be supplemented by a like amount from the Federal Survey, for the fiscal year ending June 30, 1904. From this sum the State withdrew \$1,200 to meet expenses of inspection and for clerk hire, and the Survey withdrew a like sum, and, in addition, \$1,200 to offset a similar withdrawal by the State at the close of the previous year. There thus remained available \$28,800 of State money and \$27,600 of Federal money, or a total of \$56,400 for field and office work for the season of 1903. The



MAP OF PENNSYLVANIA, NEW JERSEY, DELAWARE, MARYLAND, VIRGINIA, WEST VIRGINIA, AND OHIO SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

cooperative work of this season was begun about the middle of May under Mr. J. H. Renshawe, geographer, who continued in charge until June 4, 1903, when he was succeeded by Mr. H. M. Wilson, geographer, in charge of the eastern section of topography. Such work as was done on the same atlas sheet by both the above-named geographers is republished here, with corrections to the progress reported in the Twenty-fourth Annual Report of the Director. Nine parties were engaged in completing the topographic mapping of sixteen quadrangles, some of which cover portions of the areas of the State of West Virginia. Five parties were engaged in the partial mapping of eleven additional quadrangles. All of the above work was under the general supervision of Mr. W. T. Griswold for a portion of the season, and all is for publication on a scale of 1:62,500, with a contour interval of 10 or 20 feet.

Topographic surveys made in 1903–4 in cooperation with the State of Ohio.

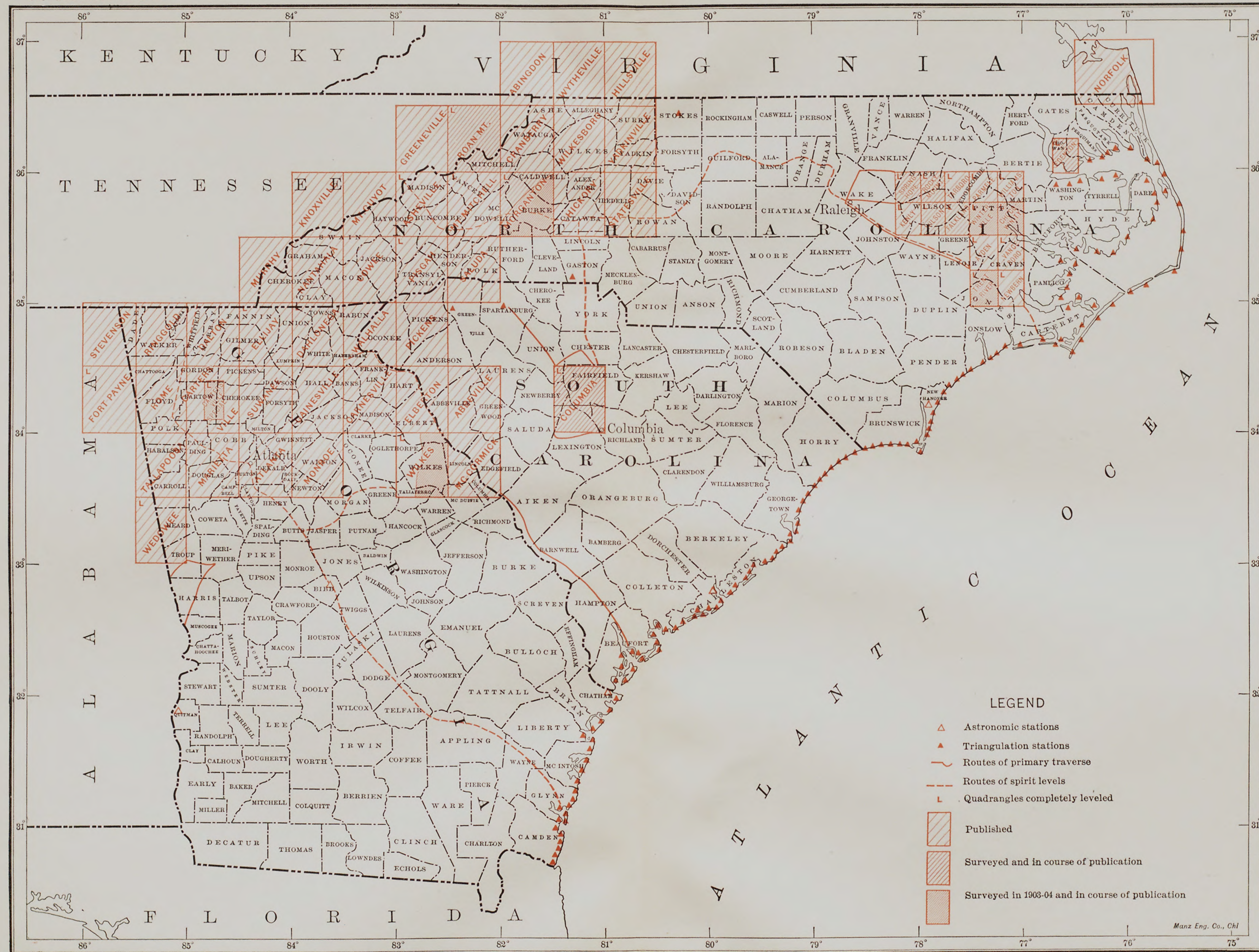
County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Summit, Medina	Akron	D. Hannegan, C. W. Goodlove.	225	....	351	14	1,702	494
Ashtabula	Ashtabula	R. D. Cummin, in charge; R. Coe.	117	....	211	8	364	348
Athens, Morgan, Hocking	Athens	V. H. Manning, in charge; H. L. Johnston, G. C. Anderson.	231	345	558	10	2,845	1,059
Meigs, Athens, Washington	Belleville	W. N. Morrill	10	6	14	....	58	33
Belmont, Monroe	Clarington	W. H. Griffin, in charge; E. C. Bebb, B. Duke, C. H. Birdseye.	(JHR) 62	....	....	....	....	....
			(HMW) 115	....	....	....	....	....
Belmont, Guernsey, Harrison	Flushing	W. T. Griswold, in charge; M. J. Munn, R. Coe.	228	40	337	....	2,017	44
Butler, Hamilton	Hamilton	W. H. Griffin, in charge; C. L. Sadler.	231	....	591	8	430	885
Washington, Monroe, Noble	Macksburg	C. W. Goodlove, M. Hackett.	(JHR) 10	267	326	....	2,446	574
			(HMW) 220	....	294	20	2,279	409
Marion, Wyandot, Crawford	Marion	M. Hackett, in charge; C. H. Birdseye.	227	....	596	13	2,093	630
Lake, Geauga, Cuyahoga	Mentor	R. D. Cummin, in charge; C. W. Goodlove, R. Coe.	184	....	290	11	763	684
Monroe	New Martinsville.	W. N. Morrill, in charge; J. R. McMillan.	80	77	146	1	464	348

Topographic surveys made in 1903–4 in cooperation with the State of Ohio—Continued.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Monroe Washington	New Matamoras	V. H. Manning, in charge; W. J. Lloyd, C. L. Sadler.	(JHR) 67	415	410	3	1,612	655
			(HMW) 116	127	102	3	522	50
Lake	Perry	R. D. Cummin	53	....	169	4	656	368
Columbiana Jefferson Carroll	Salineville	V. H. Manning, in charge; H. L. Johnston, J. T. McCoy.	(JHR) 165	....	....	....	....	14
			(HMW) 35	....	....	....	....	6
Belmont Harrison Jefferson	St. Clairsville	W. T. Griswold, in charge; M. J. Munn.	72	....	14	7	90	10
Guernsey Noble Belmont Monroe	Woodsfield	W. H. Griffin, in charge; D. Hannegan, J. T. McCoy, C. L. Sadler, C. H. Birdseye.	(JHR)	53	330	....	231	488
			(HMW) 229	51	154	9	183	....
Total[a]			2,677	1,381	4,893	111	18,755	7,099
Athens Washington Morgan	Cutler	V. H. Manning	....	292	245	4	1,355	648
Montgomery Greene Miami Clark	Dayton	do	....	....	61	13	544	685
Summit Portage	Kent	D. Hannegan, C. W. Goodlove.	150	....	378	11	2,669	1,230
Allen Logan Auglaize	Lima	V. H. Manning	....	....	85	13	529	656
Butler Warren Hamilton	Mason	W. H. Griffin	....	....	444	8	331	722
Fayette Madison Ross Pickaway	Mount Sterling	V. H. Manning	....	....	96	15	391	487
Vinton Hocking Athens	Orland	do	....	13	....	....	....	7
Clark Greene	Springfield	do	....	....	82	11	428	688
Washington	St. Marys	A. M. Walker, W. N. Morrill, J. R. Eakin.	....	59	101	6	448	52
Crawford Wyandot Senaca	Sycamore	V. H. Manning, M. Hackett, C. H. Birdseye.	115	....	550	9	3,308	688
Seneca	Tiffin	V. H. Manning	....	....	376	8	2,150	649
Total[b]			265	364	2,418	98	12,153	6,512

[a] Completed in field.

[b] Unfinished in field.



MAP OF NORTH CAROLINA, SOUTH CAROLINA, AND GEORGIA, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Pennsylvania.—In June, 1903, the chairman of the Pennsylvania survey commission and the Director of the United States Geological Survey arranged to extend the terms of the cooperative agreement made in 1901 to cover the work of 1903. It was decided to allot $15,000 each for cooperative topographic surveys. Six parties were engaged in the topographic mapping of sixteen quadrangles, two of which lie partly within West Virginia and one partly within Maryland. Of these, five were completed during the season. This work is designed for publication on the scale of 1:62,500, with a contour interval of 20 feet. An area of about 185 square miles, including Pittsburg and neighboring cities, was mapped, for publication on the large scale of 2,000 feet to 1 inch, with a contour interval of 20 feet. All work in this State was under the general supervision of Mr. Frank Sutton, who also had immediate charge of the Pittsburg work.

Topographic surveys made in 1903–4 in cooperation with the State of Pennsylvania.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		*Miles.*			*Miles.*
Clearfield Center	Houtzdale	A. C. Roberts	213		12			26
Greene	Littleton	A. M. Walker, in charge; E. I. Ireland, J. R. Eakin.	26	13	44	1	65	64
Greene	Mannington	E. I. Ireland	1					
Greene	Rogersville	R. D. Cummin, E. G. Hamilton.	230	29	64		187	
York Adams	Westminster	W. C. Hall, in charge; G. S. Smith.	19		21			
Total[a]			489	42	141	1	252	90
Allegheny Washington	Carnegie	Frank Sutton, in charge; R. Coe, E. B. Clark, J. S. B. Daingerfield, E. G. Hamilton, J. H. Wheat, A. C. Roberts.	117	240	344	10	1,122	973
Chester Lancaster	Coatesville	Frank Sutton			316	7	974	626
Armstrong Westmoreland Allegheny Indiana	Freeport	do			42	4	105	
Westmoreland Allegheny	Greensburg	Frank Sutton, in charge; E. G. Hamilton.		270	284	3	1,194	1,417

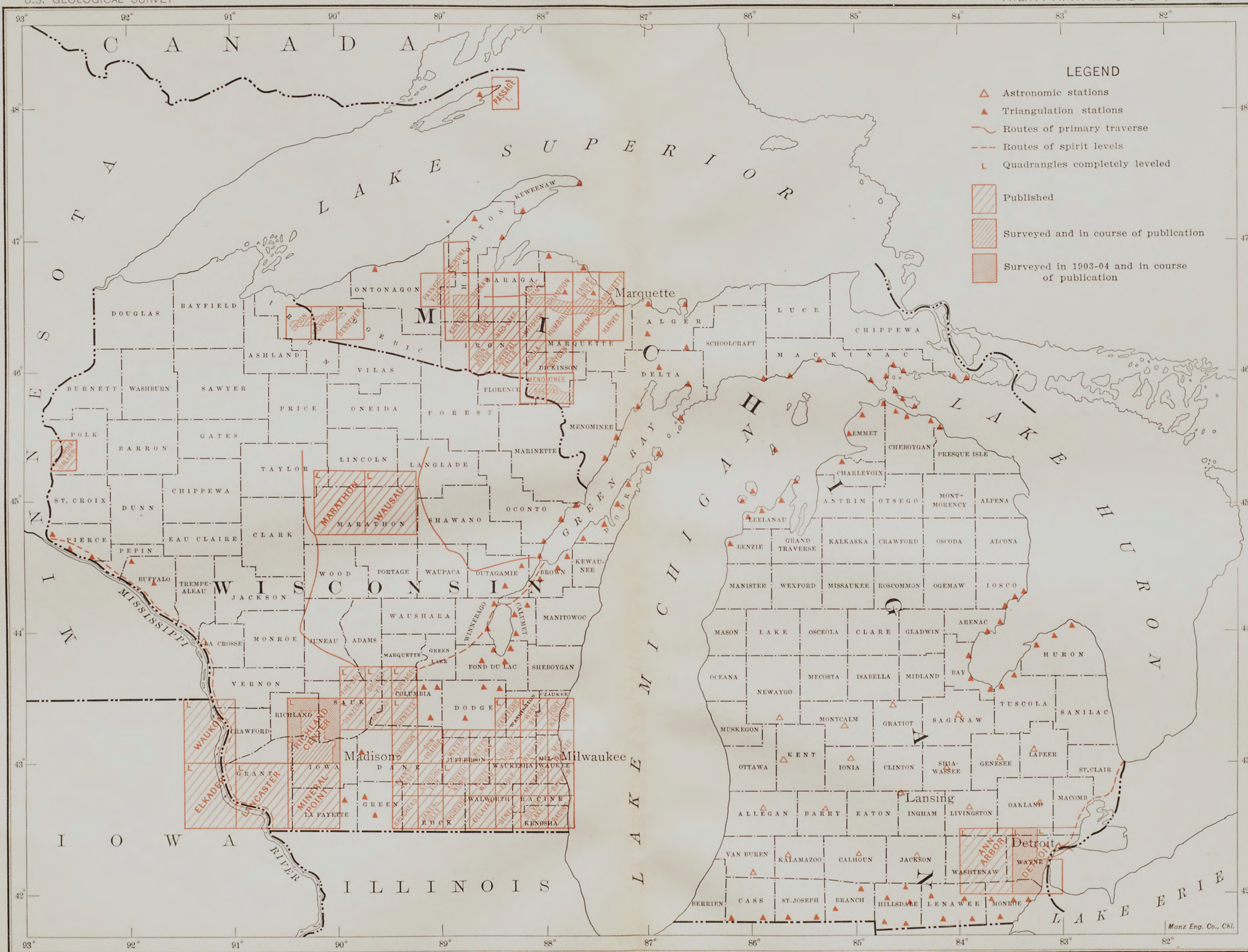
[a] Completed in field.

Topographic surveys made in 1903–4 in cooperation with the State of Pennsylvania—Continued.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels. Spirit levels.	Levels. Bench marks.	Levels. Elevations.	Traverse.
			Sq. mi.		*Miles.*			*Miles.*
Cambria; Somerset; Westmoreland; Indiana	Johnstown	R. D. Cummin, in charge; E. G. Hamilton.	126	....	187	....	609	847
Allegheny; Westmoreland; Washington	McKeesport	Frank Sutton, in charge; E. B. Clark, J. H. Wheat, E. I. Ireland, R. W. Berry, J. S. B. Daingerfield.	156	316	322	3	1,421	1,144
Montgomery; Berks; Chester	Phoenixville	Frank Sutton	....	....	30	8	88	....
Clearfield; Indiana; Jefferson	Punxsutawney	A. C. Roberts	113	....	....	....	....	18
Butler; Beaver; Allegheny	Sewickley	Frank Sutton, in charge; A. C. Roberts, J. H. Wheat, C. A. Clunet, E. G. Hamilton.	36	126	186	6	727	88
Butler; Allegheny; Westmoreland	Sharpsburg	Frank Sutton, in charge; E. B. Clark.	15	172	147	6	526	149
Lancaster; Berks; Chester	Suplee	Frank Sutton	....	....	55	8	160	....
Total [a]			563	1,124	1,913	55	6,926	5,262

[a] Unfinished in field.

South Carolina.—One party was engaged on the survey of the Wilkes (Georgia-South Carolina) quadrangle, for publication on the scale of 1:125,000, with a contour interval of 50 feet. One party was engaged on the resurvey of the Saluda (North Carolina-South Carolina) quadrangle, for publication on the scale of 1:125,000, with a contour interval of 100 feet. All this work was under the general supervision of Mr. W. Carvel Hall.



MAP OF MICHIGAN AND WISCONSIN, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Topographic surveys in South Carolina, 1903–4.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels. Spirit levels.	Levels. Bench marks.	Levels. Elevations.	Traverse.
			Sq. mi.		*Miles.*			*Miles.*
Abbeville	Wilkes (unfinished).	G. H. Guerdrum	16	....	24	......	62	73
Spartanburg, Greenville	Saluda (resurvey, unfinished).	W. C. Hall in charge; L. S. Leopold.	....	6	16	3	62	......

Tennessee.—One party was engaged on the survey of the Waynesboro (Tennessee-Alabama) quadrangle and the Linden quadrangle, for publication on the scale of 1:125,000, with a contour interval of 50 feet. One party was engaged on the resurvey of the Log Mountain (Kentucky-Tennessee) quadrangle, for publication on the scale of 1:62,500, with a contour interval of 20 feet.

Topographic surveys in Tennessee, 1903–4.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels. Spirit levels.	Levels. Bench marks.	Levels. Elevations.	Traverse.
			Sq. mi.		*Miles.*			*Miles.*
Lewis, Perry, Wayne, Lawrence	Waynesboro (completed).	Oscar Jones, in charge; G. T. Ford.	807	....	621	14	2,063	2,146
Perry, Lewis, Humphreys, Hickman, Dickson	Linden (unfinished).	Oscar Jones	....	....	......	......	......	242
Claiborne, Campbell	Log Mountain	Nat. Tyler, jr	10	....	18	......	......	18

Vermont.—One party was engaged in the topographic mapping of one quadrangle, for publication on the scale of 1:62,500, with a contour interval of 20 feet. This work was under the general supervision of Mr. Hersey Munroe.

Topographic surveys in Vermont, 1903–4.

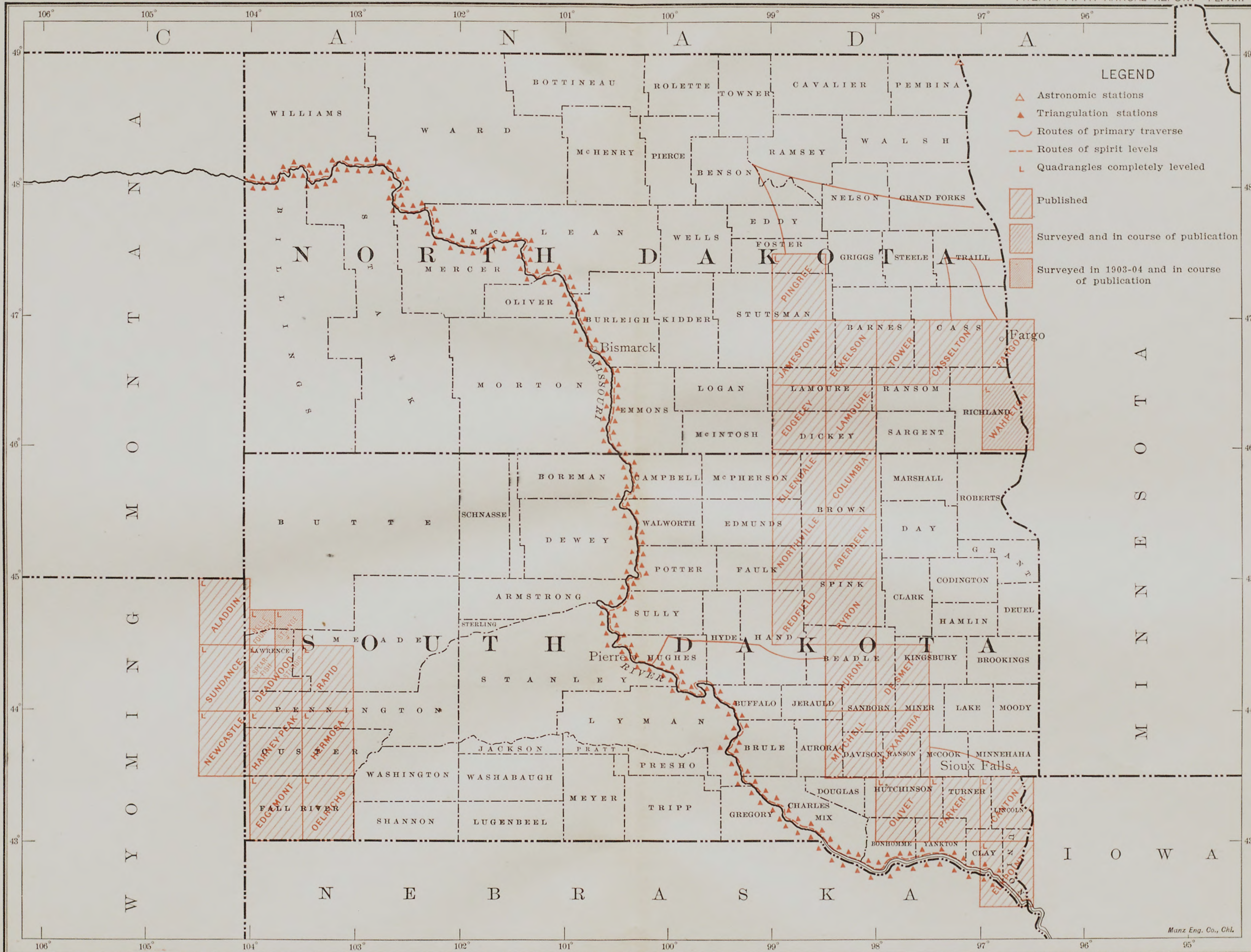
County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels. Spirit levels.	Levels. Bench marks.	Levels. Elevations.	Traverse.
			Sq. mi.		*Miles.*			*Miles.*
Addison	Middlebury (completed).	Gilbert Young	215	123	207	5	388	640

West Virginia.—In March, 1903, the State geologist of West Virginia and the Director of the United States Geological Survey agreed that $20,000 should be provided during the year 1903 by the State of West Virginia, out of the total allotment by the legislature of $30,000 for the two years 1903 and 1904, and that the Federal Survey should expend $15,000 during the same period of time on the topographic survey of the State to be prosecuted under an agreement signed by the State geologist of West Virginia on March 6, 1901, and by the Director of the United States Geological Survey on March 7, 1901. Seven parties were engaged in mapping fifteen quadrangles, portions of some of which lie in the adjoining States of Maryland, Pennsylvania, and Ohio, such areas being mapped in cooperation with those States. Ten of these surveys were completed during the season, of which two were resurveys of older small-scale maps on a larger scale. These are designed for publication on the scale of 1:62,500, with a contour interval of 20 feet. Mr. A. M. Walker was in general supervisory charge of all work wholly within the borders of this State.

Topographic surveys made in 1903–4 in cooperation with the State of West Virginia.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels. Spirit levels.	Levels. Bench marks.	Levels. Elevations.	Traverse.
			Sq. mi.		*Miles.*			*Miles.*
Wirt, Wood, Jackson	Belleville	W. N. Morrill	222	140	309	7	1,295	735
Marshall	Clarington[a]	W. H. Griffin in charge; C. H. Birdseye, B. Duke, E. C. Bebb, A. H. Bumstead.	...	...	...	...	...	...
Wetzel, Marshall, Tyler	New Martinsville.	W. N. Morrill in charge; J. R. McMillan.	152	148	282	4	900	676
Tyler	New Matamoras	V. H. Manning in charge; W. J. Lloyd, C. L. Sadler, C. G. Anderson.	12	23	18	1	72	38
Wetzel, Doddridge, Harrison, Tyler	Center Point	A. M. Walker	231	52	410	4	762	756
Tyler, Harrison, Ritchie	West Union	A. M. Walker in charge; W. N. Morrill, E. I. Ireland, C. A. Clunet, J. H. Sinclair.	231	71	381	7	1,592	931

[a] Completed under Ohio.



MAP OF NORTH DAKOTA AND SOUTH DAKOTA, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Topographic surveys made in 1903-4 in cooperation with the State of West Virginia—Continued.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels. Spirit levels.	Levels. Bench marks.	Levels. Elevations.	Traverse.
			Sq. mi.		*Miles.*			*Miles.*
Wetzel Tyler Marshall	Littleton	A. M. Walker in charge; E. I. Ireland, J. R. Eakin.	204	102	343	7	509	504
Monongalia Wetzel Monroe	Mannington	E. I. Ireland	229	91	101	....	185	382
Total[a]			1,281	627	1,844	30	5,315	4,022
Preston Barbour Taylor Marion Monongalia	Thornton	A. M. Walker, in charge; C. A. Clunet.	....	121	....	....	....	....
Doddridge Gilmer Ritchie	Holbrook	A. M. Walker, in charge; W. N. Morrill, E. I. Ireland, A. Pike, J. H. Sinclair.	113	50	314	11	926	910
Pleasants Ritchie Tyler	St. Marys	A. M. Walker, in charge; W. N. Morrill, J. R. Eakin.	....	59	101	6	448	52
Calhoun Wirt Roane	Arnoldsburg	A. Pike	....	....	16	3	70	....
Ritchie Calhoun Wirt	Harrisville	do	....	....	16	2	70	....
Total[b]			113	230	447	22	1,514	962
Gilmer Braxton	Glenville	A. Pike	233	37	351	11	367	1,584
Gilmer Braxton Lewis	Burnsville	do	233	7	144	....	20	840
Total[c]			466	44	495	11	387	2,424

[a] Completed in field. [b] Unfinished in field. [c] Resurvey completed in field.

Wisconsin.—Two parties were engaged on topographic surveys within this State, one on the survey of the Richland Center quadrangle, for publication on the scale of 1:125,000, with a contour interval of 20 feet; the other on the resurvey of the Koshkonong quadrangle and the revision of the Eagle, Whitewater, and Racine quadrangles, for publication on the scale of 1:62,500, with a contour interval of 20 feet.

Topographic surveys in Wisconsin, 1903–4.

County.	Sheet.	Topographer.	Area mapped.	Trigonometric locations.	Levels.			Traverse.
					Spirit levels.	Bench marks.	Elevations.	
			Sq. mi.		Miles.			
Richland, Iowa, Sauk, Grant	Richland Center (completed).	R. C. McKinney	351	2,302	120	6	1,886	488
Rock, Walworth, Jefferson	Koshkonong (resurvey completed).	R. Muldrow, in charge; J. T. McCoy.	219	29	467	10	2,038	524
Total [a]			570	2,331	587	16	3,924	1,012
Waukesha, Racine, Walworth	Eagle	R. Muldrow, in charge; H. L. McDonald.	219					377
Waukesha, Walworth, Jefferson	Whitewater	H. L. McDonald	219					426
Racine, Kenosha	Racine	R. Muldrow, in charge; H. L. McDonald.	220					324
Total [b]			658					1,127

[a] Completed in field. [b] Revision completed in field.

RIVER SURVEYS.

In March, 1903, arrangements were made, whereby surveys of certain rivers upon which hydrographic investigations were in progress were to be made under the direction of Mr. H. M. Wilson, geographer, in charge of the eastern section of topography. The arrangement was substantially as follows:

1. The topographic branch to have the entire charge of, to supervise, and to administer the surveys.
2. For areas not yet mapped by the topographic branch, the expenditure to be charged equally to the allotments for the two branches.
3. In areas for which topographic mapping has been completed all expenses to be charged to the appropriation for hydrographic work.
4. All expenses connected with the office drafting and writing of reports for publication to be charged to the appropriation for hydrographic work.

Two parties were organized for field work throughout the season, one for surveys of certain rivers in Georgia, the other for surveys of certain rivers in Georgia, North Carolina, and Tennessee.

To develop the methods of survey, Mr. W. O. Tufts, topographic aid, was designated to organize the first party and Mr. J. R. Eakin, topographic aid, the second. These men remained with the work but a few weeks, during which time they instructed (and recommended as competent to continue the work) Messrs. Fred A. Franck and Carroll Caldwell, field assistants, who remained in charge of the parties throughout the season. The field and office supervision of this work was assigned to Mr. W. Carvel Hall, topographer, who, aided by Mr. G. H. Guerdrum, topographer, visited the field parties from time to time throughout the season.

Later on, in connection with areas under topographic survey in various parts of the East, surveys were made on the Chippewa River, in Wisconsin, and the lower Chattahoochee River, in Georgia and Alabama, by Mr. F. T. Fitch, field assistant; on the Kennebec River, in Maine, by Messrs. A. T. Fowler, topographic aid, and F. J. McMaugh, field assistant; on the Buffalo River, in Tennessee, under the direction of Mr. Oscar Jones, topographer, and on the Catawba River, in North Carolina, under the direction of Mr. W. Carvel Hall, topographer.

The following is a list of the rivers surveyed during the season by drainage basins:

Upper eastern Mississippi basin:
- Chippewa River, Wisconsin, 42.5 miles, from Chippewa Falls to The Forks, near Flambeau.

Kennebec basin:
- Kennebec River, Maine, for 135 miles, from tidewater near Hallowell to Moosehead Lake, Maine.

Tennessee basin:
- Buffalo River, Tennessee, 47 miles, from near Flat Woods to near Buffalo.
- Notteley River, North Carolina-Georgia, 38 miles, from near Murphy, N. C., to to near Blairsville, Ga.
- Hiwassee River, North Carolina-Georgia, 63.3 miles, from Hiwassee to Tennessee State line, near Appalachia.
- Toccoa River, Georgia, 37.5 miles, from near Dial, Ga., to Tennessee State line, near McCays, Tenn.

Santee basin:
- Catawba River, North Carolina, 45 miles from near Marion to near Connelly Springs.

Savannah basin:
- Tallulah, Tugaloo, and Savannah rivers, Georgia-South Carolina, 95 miles from Tallulah Falls to mouth of Broad River, near Lisbon, Ga.
- Chattooga River, Georgia-South Carolina, 29.3 miles from its mouth near Tallulah Falls to near Russell, S. C.
- Tallulah River, Georgia, 29.3 miles from near Tallulah Falls to near Blalock, Ga.
- Broad River, Georgia, 66.5 miles from its mouth near Lisbon Point to near Carnesville, Ga.

Altamaha basin:

Alcovey River, Georgia, 18.3 miles from its mouth near Worthville to Dailey's bridge near Starsville.

South River, Georgia, 56.8 miles from Constitution to its junction with Yellow River near Worthville.

Ocmulgee River, Georgia, 49.5 miles from mouth of Yellow River, near Worthville, to Macon.

Yellow River, Georgia, from its mouth near Worthville to near Yellow River, 57.3 miles.

Towaliga River, Georgia, 21.7 miles from near Berner to High Falls.

Chattahoochee basin:

Soque River, Georgia, 8.8 miles from its mouth near View to Clarksville.

Chattahoochee River, Georgia, 64.7 miles from Chattahoochee to Franklin, and from near Chestatee to near Santee, 55 miles, and from near West Point to near Columbus, 35 miles.

Chestatee River, Georgia, 47.7 miles from Willow to its mouth near Chestatee.

At the close of the field season Messrs. Franck, Caldwell, and Fitch were retained in office in Washington for several months, inking up the maps, platting profiles, and writing reports. All of the office work was under the immediate direction of Mr. W. Carvel Hall, topographer, who, in consultation with Mr. John C. Hoyt, chief of the computing section of the hydrographic branch, developed the plan of drafting the maps and profiles and reporting the notes and results, and prepared the reports for publication.

The custody of the notes and maps resulting from the field surveys has been vested in the custodian of topographic instruments and records.

The results will be published in the annual reports of progress of stream measurements in the Water-Supply series in connection with the hydrographic data concerning such river system.

OFFICE WORK.

The work of surveying was discontinued by the various parties from time to time between November and December. Upon completion of field work the party chiefs reported for office work in Washington.

Mr. A. H. Thompson, geographer, was designated assistant in charge of office work to both the eastern and the western sections. In this capacity he aided Messrs. Wilson and Douglas during their absence on field inspection, by approving vouchers and looking after routine correspondence.

Office work of the eastern section was organized by Mr. Wilson into the following subsections:

Inspector of drafting and in charge of maps, J. H. Wheat.

New York, in charge of J. H. Jennings.

New England and New Jersey, in charge of Hersey Munroe.

Pennsylvania, in charge of Frank Sutton.

West Virginia, in charge of A. M. Walker.

Ohio, in charge of W. T. Griswold for a portion of the year, thereafter in charge of R. D. Cummin and Van H. Manning.

Southern States, in charge of W. Carvel Hall.

Wisconsin, Iowa, Michigan, and Louisiana, in charge of Robert Muldrow.

Missouri and Illinois, in charge of C. E. Cooke.

Arkansas, Kansas, and Kentucky, in charge of H. B. Blair.

The chiefs of these various subsections had entire supervision of all office drafting done in the various areas constituting the eastern section, including the examination of manuscript maps, as well as of printed proofs received from the division of engraving and printing.

Mr. Wilson was assisted in office management by Miss Helen Fields, who handled the correspondence and vouchers, and, with Miss Arline G. Weeks, was engaged in tabulating reports, cataloguing maps, and in performing other clerical duties connected with the recording of progress in the eastern section of topography.

During the office season the drafting of 78 sheets was completed. Photolithographic copies of all were made on the large scale of 1:48,000 (4,000 feet to 1 inch), or 1:96,000, for immediate distribution, and the originals were then transmitted for engraving. The following table, arranged alphabetically by States, enumerates these in detail:

Atlas sheets on which drafting was completed in office by eastern section of topography.

State.	Sheet.	Scale.	Contour interval.
Alabama	Dadeville	1:125, 000	50
Arkansas	Caddo Gap	1:125, 000	50
Georgia	Cartersville Special	1:62, 500	20
Illinois	Peoria	1:62, 500	10

Atlas sheets on which drafting was completed in office by eastern section of topography—Continued.

State.	Sheet.	Scale.	Contour interval.
Indiana	Newburg (Ind.-Ky.)	1:62,500	20
Iowa	Decorah	1:125,000	20
Kansas	Independence	1:125,000	20
Kentucky	Calhoun	1:62,500	20
	Harrodsburg	1:125,000	50
Maine	Bingham	1:62,500	20
	Bluehill	1:62,500	20
	Castine	1:62,500	20
	Mount Desert	1:62,500	20
	Swans Island	1:62,500	20
	Vinalhaven	1:62,500	20
Maryland	Westminster (Md.-Pa.)	1:62,500	20
Michigan	Northville	1:62,500	20
Missouri	Bonneterre	1:62,500	20
	St. Louis, East (Ill.-Mo.)	1:62,500	20
	St. Louis, West	1:62,500	20
New Hampshire	Manchester	1:62,500	20
New Jersey	Hackettstown	1:62,500	20
	High Bridge	1:62,500	20
	Lake Hopatcong	1:62,500	20
	Morristown	1:62,500	20
	Plainfield	1:62,500	20
	Somerville	1:62,500	20
New York	Clymer	1:62,500	20
	Easthampton	1:62,500	20
	Gardiners Island	1:62,500	20
	Jamestown	1:62,500	20
	Montauk	1:62,500	20
	Moriches	1:62,500	20
	Mount Morris	1:62,500	20
	Nineveh	1:62,500	20
	Orwell	1:62,500	20
	Riverhead	1:62,500	20
	Sag Harbor	1:62,500	20
	St. Regis	1:62,500	20
	Shelter Island	1:62,500	20
	Slide Mountain	1:62,500	20
	Taberg	1;62,500	20
	Warsaw	1:62,500	20

Atlas sheets on which drafting was completed in office by eastern section of topography—Continued.

State.	Sheet.	Scale.	Contour interval.
North Carolina	Chocowinity	1:62,500	10
	Morganton	1:125,000	100
	Trent River	1:62,500	20
	Winterville	1:62,500	10
Ohio	Akron	1:62,500	20
	Ashtabula	1:62,500	20
	Athens	1:62,500	20
	Clarington (W. Va.-Ohio)	1:62,500	20
	Flushing	1:62,500	20
	Hamilton	1:62,500	20
	Macksburg	1:62,500	20
	Marion	1:62,500	10
	Mentor	1:62,500	20
	New Matamoras (Ohio-W. Va.)	1:62,500	20
	Perry	1:62,500	20
	Salineville	1:62,500	20
	St. Clairsville	1:62,500	20
	Woodsfield	1:62,500	20
Pennsylvania	Houtzdale	1:62,500	20
	Rogersville	1:62,500	20
Tennessee	Waynesboro (Tenn.-Ala.)	1:125,000	50
Vermont	Middlebury	1:62,500	20
West Virginia	Belleville (W. Va.-Ohio)	1:62,500	20
	Burnsville	1:62,500	20
	Glenville	1:62,500	20
	Littleton (W. Va.-Pa.)	1:62,500	20
	Mannington (W. Va.-Pa.)	1:62,500	20
	New Martinsville (W. Va.-Ohio)	1:62,500	20
	Salem	1:62,500	20
	West Union	1:62,500	20
Wisconsin	Eagle	1:62,500	20
	Koshkonong	1:62,500	20
	Racine	1:62,500	20
	Richland Center	1:125,000	20
	Whitewater	1:62,500	20

QUADRANGLES MAPPED IN EASTERN SECTION SINCE 1879.

The following is a complete list of all quadrangles mapped by the Geological Survey in the eastern section from the date of the organization of the Survey, in 1879, to the close of the fiscal year 1904. It is arranged alphabetically by States, and under the States alphabetically by quadrangle or sheet names. This list shows the exact area mapped within each State in cases where a quadrangle is not entirely within a single State. The areas mapped to date within each State are summed up and these totals furnish the data used in compiling the table on page 107, in which total areas as heretofore reported have been corrected.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
ALABAMA:	Sq. miles.			Feet.	
Anniston	992.00	1886	1898	100, 50	1:125,000
Ashland	997.64	1889	......	100	1:125,000
Bessemer	997.64	1888	......	100	1:125,000
Birmingham	992.00	1887	......	100	1:125,000
Brookwood	997.64	1895	......	50	1:125,000
Clanton	1,003.20	1889	......	50	1:125,000
Cullman	986.29	1885	......	100	1:125,000
Dadeville	1,003.20	1902	......	50	1:125,000
Fort Payne (Ala.-Ga.)	982.96	1884	1898	100, 50	1:125,000
Gadsden	986.29	1885	......	100	1:125,000
Huntsville (Ala.-Tenn.)	955.22	1885	......	100	1:125,000
Jasper	992.00	1891	......	50	1:125,000
Rome (Ala.-Ga.)	81.80	1885	1896, 1898	100	1:125,000
Scottsboro (Ala.-Tenn.)	963.21	1885	......	100	1:125,000
Springville	992.00	1887	......	100	1:125,000
Stevenson (Ala.-Ga.-Tenn)	852.82	1884	1891	100	1:125,000
Talladega	997.64	1888	......	100	1:125,000
Tallapoosa (Ga.-Ala.)	176.55	1887	1895	100	1:125,000
Waynesboro (Ala.-Tenn.)	8.40	1903	......	50	1:125,000

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
ALABAMA—Continued.	*Sq. miles.*			*Feet.*	
Wedowee (Ala.-Ga.)	482.32	1899	......	50	1:125,000
Wetumka	1,003.20	1901	......	50	1:125,000
In process of mapping—					
Opelika (Ala.-Ga.)	90.00	......	......	50	1:125,000
Total, Alabama	17,534.02				
ARKANSAS:					
Batesville	968.70	1890	......	50	1:125,000
Benton [a]	980.50	1888	......	50	1:125,000
Caddo Gap	986.29	1901	......	50	1:125,000
Camden	992.00	1900	......	50	1:125,000
Dardanelle	974.64	1888	......	50	1:125,000
Eureka Springs (Mo.-Ark.)	957.67	1900	......	50	1:125,000
Fayetteville (Ark.-Mo.)	959.89	1899	......	50	1:125,000
Fort Smith (Ark.-Ind. T.)	855.42	1887	......	50	1:125,000
Gurdon	992.00	1900	......	50	1:125,000
Hot Springs [a]	980.50	1888	......	50	1:125,000
Hot Springs Special [a]	* *245.85*	1896	......	20	1:62,500
Little Rock	980.50	1891	......	50	1:125,000
Magazine Mountain	974.64	1887	......	50	1:125,000
Marshall	968.70	1889	......	50	1:125,000
Morrillton	974.64	1889	......	50	1:125,000
Mountain Home (Ark.-Mo.)	955.16	1890	......	50	1:125,000
Mountain View	968.70	1889	......	50	1:125,000
Mount Ida	980.50	1887	......	50	1:125,000
Poteau Mountain (Ark.-Ind. T.)	888.80	1887	......	50	1:125,000
Siloam Springs (Ind. T.-Ark.)	146.18	1899	......	50	1:125,000
Tahlequah (Ind. T.-Ark.)	12.69	1898	......	50	1:125,000
Winslow (Ark.-Ind. T.)	940.00	1898	......	50	1:125,000
Yellville (Ark.-Mo.)	957.40	1891	......	50	1:125,000
In process of mapping—					
Harrison (Ark.-Mo.)	804.00	......	......	50	1:125,000
Total, Arkansas	20,315.27				

[a] Hot Springs and Benton sheets, on scale of 1:125,000, include parts of Hot Springs Special.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
CONNECTICUT:	*Sq. miles.*			*Feet.*	
Bridgeport	75.15	1889	.....	20	1:62,500
Brookfield (Mass.-Conn.)	27.36	1887	.....	20	1:62,500
Carmel (N. Y.-Conn.)	36.32	1890	.....	20	1:62,500
Clove (N. Y.-Conn.)	19.89	1891	.....	20	1:62,500
Cornwall (Conn.-N. Y.)	220.68	1890	.....	20	1:62,500
Danbury	224.21	1889	.....	20	1:62,500
Derby	224.21	1889	.....	20	1:62,500
Gilead	223.36	1890	.....	20	1:62,500
Granby	222.50	1890	.....	20	1:62,500
Granville (Mass.-Conn.) [a]	26.22	1887	.....	20	1:62,500
Guilford	224.21	1890	.....	20	1:62,500
Hartford	222.50	1889	.....	20	1:62,500
Holyoke (Mass.-Conn.) [a]	**55.72*	1887	.....	40	1:125,000
Housatonic (Mass.-Conn.-N. Y.) [b]	*78.50*	1888	.....	40	1:125,000
Meriden	223.36	1890	.....	20	1:62,500
Middletown	223.36	1890	.....	20	1:62,500
Millbrook (N. Y.-Conn.)	3.00	1899	.....	20	1:62,500
Moosup (Conn.-R. I.)	185.36	1888	.....	20	1:62,500
New Haven	224.21	1890	.....	20	1:62,500
New London (Conn.-N. Y.)	178.04	1890	.....	20	1:62,000
New Milford	223.36	1889	.....	20	1:62,500
Norwalk (Conn.-N. Y.)	151.37	1890	.....	20	1:62,500
Norwich	223.36	1891	.....	20	1:62,500
Oyster Bay (N. Y.-Conn.)	3.32	1897	.....	20	1:62,500
Palmer (Mass.-Conn.)	44.20	1887	.....	20	1:62,500
Putnam (Conn.-R. I.)	181.00	1888	.....	20	1:62,500
Sandisfield (Mass.-Conn.) [b]	37.50	1886	.....	20	1:62,500
Saybrook	204.29	1890	.....	20	1:62,500
Sheffield (Mass.-Conn.-N. Y.) [b]	41.00	1885	.....	20	1:62,500
Springfield (Mass.-Conn.) [a]	29.50	1887	.....	20	1:62,500
Stamford (Conn.-N. Y.)	103.08	1890	.....	20	1:62,500

[a] Granville and Springfield sheets, on scale of 1:62,500, have been reduced and form parts of Holyoke sheet, on scale of 1:125,000.

[b] Sandisfield and Sheffield sheets, on scale of 1:62,500, have been reduced and form parts of Housatonic sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
CONNECTICUT—Continued.	*Sq. miles.*			*Feet.*	
Stonington (Conn.-R. I.-N. Y.)	112.46	1888	......	20	1:62,500
Tolland	222.50	1890	......	20	1:62,500
Waterbury	223.36	1890	......	20	1:62,500
Webster (Mass.-Conn.-R. I.)	18.00	1887	......	20	1:62,500
Winsted	222.50	1890	......	20	1:62,500
Woodstock	222.50	1890	......	20	1:62,500
Total, Connecticut	5,047.24				
DELAWARE:					
Bayside (N. J.-Del.) [a]	**23.10*	1889	......	10	1:62,500
Camden (N. J.-Pa.-Del.) [b]	*15.68*	1894	......	20	1:125,000
Cecilton (Md.-Del.) [d]	*14.26*	1899	......	20	1:62,500
Chester (Pa.-Del.-N. J.) [b] [c]	14.68	1894	......	20	1:62,500
Dover (Del.-Md.-N. J.) [d]	461.71	1896	......	20	1:125,000
Elkton (Md.-Pa.-Del.)	24.14	1896	......	20	1:62,500
Ocean City (Md.-Del.)	37.06	1900	......	10	1:62,500
Philadelphia and vicinity (Pa.-N. J.-Del.) [c]	*14.68*	1894	......	20	1:62,500
Pittsville (Md.-Del.)	42.95	1901	......	10	1:62,500
Salem (N. J.-Del.) [b]	1.00	1886	......	10	1:62,500
Salisbury (Md.-Del.)	30.72	1900	......	10	1:62,500
Vineland (N. J.-Del.) [a]	127.62	1896	......	20	1:125,000
West Chester (Pa.-Del.)	63.67	1901	......	20	1:62,500
Total, Delaware	817.81				

[a] Bayside sheet, on scale of 1:62,500, has been reduced and forms part of Vineland sheet, on scale of 1:125,000.

[b] Chester and Salem sheets, on scale of 1:62,500, have been reduced and forms part of Camden sheet, on scale of 1:125,000.

[c] Philadelphia and vicinity sheet includes Chester sheet.

[d] Cecilton sheet, on scale of 1:62,500, has been reduced and forms part of Dover sheet, on scale of 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
DISTRICT OF COLUMBIA:	*Sq. miles.*			*Feet.*	
East Washington (Md.-D. C.)[a]	23.02	1886	1897	20	1:62,500
Mt. Vernon (Va.-Md.-D. C.)[b]	**46.68*	1888	......	50	1:125,000
Patuxent (Md.-D. C.)[a]	*23.02*	1897	......	20	1:125,000
Washington (D. C.-Md.-Va)[abc]	*69.70*	......	......	20	....
West Washington (Md.-D. C.-Va.)[bc]	46.68	1886	1897	20	1:62,500
Total, District Columbia	69.70				
FLORIDA:					
Arredondo	259.05	1890	......	10	1:62,500
Citra	259.68	1893	......	10	1:62,500
Dunnellon	260.30	1891	1894	10	1:62,500
Ocala	260.30	1893	......	10	1:62,500
Panasoffkee	260.92	1893	......	10	1:62,500
Tsala Apopka	260.92	1893	......	10	1:62,500
Williston	259.68	1893	......	10	1:625,00
Total, Florida	1,820.85				
GEORGIA:					
Atlanta	992.00	1888	1895	50	1:125,000
Carnesville (Ga.-S. C.)	984.18	1889	......	50	1:125,000
Cartersville	986.29	1887	......	100	1:125,000
Cartersville Special[d]	*164.00*	......	1903	20	1:62,500
Dahlonega (Ga.-N. C.)	960.09	1885	1900	100	1:125,000
Dalton (Ga.-Tenn.)	954.56	1886	1895	100	1:125,000
Elberton (Ga.-S. C.)	487.50	1890	......	50	1:125,000
Ellijay (Ga.-N. C.-Tenn.)	957.27	1886	1896	100	1:125,000
Fort Payne (Ala.-Ga.)	3.33	1884	1898	100, 50	1:125,000
Gainesville	986.29	1889	......	100	1:125,000
McCormick (Ga.-S. C.)	448.38	1890	......	50	1:125,000

[a] East Washington sheet, on scale of 1:62,500, has been reduced and forms part of Patuxent sheet, on scale of 1:125,000.

[b] West Washington sheet, on scale of 1:62,500, has been reduced and forms part of Mount Vernon sheet, on scale of 1:125,000.

[c] East and West Washington sheets have been combined to form Washington double sheet.

[d] Cartersville sheet includes Cartersville Special sheet, which is a larger scale resurvey.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
GEORGIA—Continued.	*Sq. miles.*			*Feet.*	
Marietta	992.00	1888	......	50	1:125,000
Monroe	992.00	1894	......	50	1:125,000
Ringgold (Ga.-Tenn.)	952.57	1885	......	100	1:125,000
Rome (Ga.-Ala.)	904.49	1885	{1896 1898}	100	1:125,000
Stevenson (Ala.-Ga.-Tenn.)	99.09	1884	1891	100	1:125,000
Suwanee	986.29	1887	......	100	1:125,000
Tallapoosa (Ga.-Ala.)	815.45	1887	......	100	1:125,000
Walhalla (Ga.-S. C.-N. C.)	526.10	1885	......	100	1:125,000
Wedowee (Ala.-Ga.)	515.32	1899	......	50	1:125,000
In process of mapping—					
Opelika (Ala.-Ga.)	....	......	......	50	1:125,000
Wilkes (Ga.-S. C.)	409.00	......	......	50	1:125,000
Total, Georgia	14,952.20				
ILLINOIS:					
Brodhead (Wis.-Ill.)	0.99	1891	......	20	1:62,500
Calumet (Ill.-Ind.)	200.32	1889	1899	10	1:62,500
Chicago	120.87	1889	1899	5	1:62,500
Clinton (Iowa-Ill.) [a]	**143.30*	1890	......	20	1:62,500
Cordova (Iowa-Ill.) [a]	492.81	1896	......	20	1:125,000
Danville (Ill.-Ind.)	200.12	1897	......	10	1:62,500
Davenport (Iowa-Ill.) [b]	*7.26*	1889	......	20	1:62,500
Desplaines	223.36	1890	1899	10	1:62,500
Dunlap	225.90	1891	......	10	1:62,500
Evanston	28.55	1897	......	10	1:62,500
Goose Lake (Iowa-Ill.) [a]	*3.30*	1890	......	20	1:62,500
Hennepin	224.21	1891	......	10	1:62,500
Highwood	206.94	1897	......	10	1:62,500
Joliet	223.36	1890	......	10	1:62,500
Kahoka (Mo.-Iowa-Ill.)	3.11	1900	......	20	1:125,000
Lacon	225.06	1891	......	20	1:62,500
Lancaster (Wis.-Iowa-Ill.)	4.39	1897	......	20	1:125,000

[a] Clinton, Goose Lake, and Leclaire sheets, on scale of 1:62,500 have been reduced and form parts of Cordova sheet, on scale of 1:125,000.

[b] Davenport sheet, on scale of 1:62,500, has been reduced and forms part of Rock Island sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
ILLINOIS—Continued.	*Sq. miles.*			*Feet.*	
Lasalle	224.21	1891	......	10	1:62,500
Leclaire (Iowa–Ill.) [a]	* *104.58*	1890	......	20	1:62,500
Louisiana (Mo.–Ill.)	11.49	1887	......	50	1:125,000
Marseilles	224.21	1890	......	10	1:62,500
Metamora	225.90	1891	......	10	1:62,500
Mineral Point (Wis.–Ill.)	10.46	1900	......	20	1:125,000
Morris	224.21	1890	......	10	1:62,500
Mount Carmel (Ind.–Ill.) [b]	180.45	1902	......	20	1:62,500
New Harmony (Ill.–Ind.) [b]	44.78	1901	......	20	1:62,500
O'Fallon (Mo.–Ill.)	71.74	1898	......	50	1:125,000
Ottawa	224.21	1890	......	10	1:62,500
Patoka (Ind.–Ill.) [b]	*232.29*	1902	......	20	1:125,000
Peoria	226.73	1903	......	10	1:62,500
Peosta (Iowa–Ill.)	33.90	1896	......	20	1:125,000
Princeton (Ind.–Ill.) [b]	7.06	1901	......	20	1:62,500
Riverside	222.50	1890	1899	10	1:62,500
Rock Island (Iowa–Ill.) [c]	7.26	1889	1898	20	1:125,000
Savanna (Iowa–Ill.)	177.09	1890	......	20	1:62,500
St. Louis (Mo.–Ill.) double sheet	194.43	1888	1903	20	1:62,500
St. Louis Special (Mo.–Ill.) [d]	....	......	1903	20	1:62,500
Wilmington	224.21	1890	......	10	1:62,500
Total, Illinois	4,914.83				
INDIANA:					
Boonville [e]	234.87	1902	......	20	1:62,500
Calumet (Ill.–Ind.)	17.31	1889	1899	10	1:62,500
Danville (Ill.–Ind.)	28.28	1897	......	10	1:62,500
Degonia Springs [e]	234.87	1900	......	20	1:62,500
Ditney [e]	*937.88*	1902	......	20	1:125,000

[a] Clinton, Goose Lake, and Leclaire sheets, on scale of 1:62,500 have been reduced and form parts of Cordova sheet, on scale of 1:125,000.

[b] Princeton, New Harmony, and Mount Carmel sheets, on scale of 1:62,500, have been reduced and form parts of Patoka sheet, on scale of 1:125,000.

[c] Davenport sheet, on scale of 1:62,500, has been reduced and forms part of Rock Island sheet, on scale of 1:125,000.

[d] St. Louis Special sheet is formed by a part of the St. Louis double sheet.

[e] Boonville Degonia Springs, Petersburg, and Velpen sheets, on scale of 1:62,500, have been reduced and form Ditney sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
INDIANA—Continued.	Sq. miles.			Feet.	
Haubstadt[a]	234.87	1901	......	20	1:62,500
Mount Carmel (Ind.-Ill.)[a]	53.62	1902	......	20	1:62,500
Newburg (Ind.-Ky.)	74.66	1903	......	20	1:62,500
New Harmony (Ind.-Ill.)[a]	190.09	1901	......	20	1:62,500
Owensboro (Ind.-Ky.)	149.66	1900	......	20	1:62,000
Patoka (Ind.-Ill.)[a]	*705.59	1902	......	20	1:125,000
Petersburg[b]	234.07	1902	......	20	1:62,500
Princeton (Ind.-Ill.)[a]	227.01	1901	......	20	1:62,500
St. Meinrad	234.87	1900	......	20	1:62,500
Tell City (Ky.-Ind.)	40.10	1900	......	20	1:62,500
Toleston	122.58	1897	......	10	1:62,500
Velpen[b]	234.07	1900	......	20	1:62,500
Total, Indiana	2,310.93				
IOWA:					
Amana[c]	_222.50_	1888	......	20	1:62,500
Anamosa[d]	_221.65_	1888	......	20	1:62,500
Baldwin[e]	_221.65_	1889	......	20	1:62,500
Canton (S. Dak.-Iowa)	58.15	1897	......	20	1:125,000
Cedar Rapids[c]	_222.50_	1887	......	20	1:62,500
Clinton (Iowa-Ill.)[f]	_79.37_	1890	......	20	1:62,500
Cordova (Iowa-Ill.)[f]	398.92	1896	......	20	1:125,000
Davenport (Iowa-Ill.)[g]	_216.10_	1889	......	20	1:62,500
Decorah	870.90	1903	......	20	1:125,000

[a] Haubstadt, Mount Carmel, New Harmony, and Princeton sheets, on scale of 1:62,500, have been reduced and form Patoka sheet, on scale of 1:125,000.

[b] Boonville, Degonia Springs, Petersburg, and Velpen sheets, on scale of 1:62,500, have been reduced and form Ditney sheet, on scale of 1:125,000.

[c] Amana, Cedar Rapids, Iowa City, and Oxford sheets, on scale of 1:62,500, have been reduced and form Fairfax sheet, on scale of 1:125,000.

[d] Anamosa and Monticello sheets, on scale of 1:62,500, have been reduced and form parts of Farley sheet, on scale of 1:125,000.

[e] Baldwin and Maquoketa sheets, on scale of 1:62,500, have been reduced and form parts of Peosta sheet, on scale of 1:125,000.

[f] Clinton, Goose Lake, and Leclaire sheets, on scale of 1:62,500, have been reduced and form parts of Cordova sheet, on scale of 1:125,000.

[g] Davenport, Dewitt, Durant, and Wheatland sheets, on scale of 1:62,500, haye been reduced and form Fairfax sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
IOWA—Continued.	*Sq. miles.*			*Feet.*	
Dewitt [a]	**222.50*	1889	......	20	1:62,500
Durant [a]	*223.36*	1889	......	20	1:62,500
Elkader (Iowa-Wis.)	777.22	1898	......	20	1:125,000
Elkpoint (S. Dak.-Nebr.-Iowa)	86.37	1898	......	20	1:125,000
Fairfax [b]	891.73	1888	1898	20	1:125,000
Farley [c]	884.85	1896	......	20	1:125,000
Goose Lake (Iowa-Ill.) [d]	*219.20*	1890	......	20	1:62,500
Iowa City [b]	*223.36*	1887	......	20	1:62,500
Kahoka (Mo.-Iowa-Ill.)	16.45	1900	......	20	1:125,000
Lancaster (Wis.-Iowa-Ill.)	192.18	1897	......	20	1:125,000
Leclaire (Iowa-Ill.) [d]	*118.78*	1890	......	20	1:62,500
Maquoketa [e]	*221.65*	1889	......	20	1:62,500
Marion [f]	*221.65*	1888	......	20	1:62,500
Mechanicsville [g]	*222.50*	1887	......	20	1:62,500
Monticello [c]	*221.65*	1889	......	20	1:62,500
Oelwein	877.91	1899	......	20	1:125,000
Omaha and vicinity (Nebr.-Iowa)	189.10	1898	......	20	1:62,500
Oxford [b]	*223.36*	1888	......	20	1:62,500
Peosta (Iowa-Ill.) [e]	850.95	1896	......	20	1:125,000
Savanna (Iowa-Ill.)	44.56	1890	......	20	1:62,500
Rock Island (Iowa-Ill.) [a]	884.47	1889	1898	20	1:125,000
Shellsburg [f]	*221.65*	1888	......	20	1:62,500
Stanwood [g]	891.73	1889	1898	20	1:125,000
Tipton [g]	*225.50*	1889	......	20	1:62,500

[a] Davenport, Dewitt, Durant, and Wheatland sheets, on scale of 1:62,500, have been reduced and form Rock Island sheet, on scale of 1:125,000.

[b] Amana, Cedar Rapids, Iowa City, and Oxford sheets, on scale of 1:62,500, have been reduced and form Fairfax sheet, on scale of 1:125,000.

[c] Anamosa and Monticello sheets, on scale of 1:62,500, have been reduced and form parts of Farley sheet, on scale of 1:125,000.

[d] Clinton, Goose Lake, and Leclaire sheets, on scale of 1:62,500, have been reduced and form parts of Cordova sheet, on scale of 1:125,000.

[e] Baldwin and Maquoketa sheets, on scale of 1:62,500, have been reduced and form parts of Peosta sheet, on scale of 1:125,000.

[f] Marion and Shellsburg sheets, on scale of 1:62,500, have been reduced and form parts of Winthrop sheet, on scale of 1:125,000.

[g] Mechanicsville, Tipton, West Liberty, and Wilton Junction sheets, on scale of 1:62,500, have been reduced and form Stanwood sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
IOWA—Continued.	*Sq. miles.*			*Feet.*	
Waukon (Iowa-Wis.)	594.32	1900	......	20	1:125,000
West Liberty [a]	**222.50*	1887	......	20	1:62,500
Wheatland [b]	*222.50*	1889	......	20	1:62,500
Wilton Junction [a]	*223.36*	1889	......	20	1:62,500
Winthrop [c]	884.85	1888	1900	20	1:125,000
Total	9,394.66				
KANSAS:					
Abilene	931.51	1888	......	50	1:125,000
Albany (Colo.-Kans.)	82.93	1890	......	25	1:125,000
Anthony	950.43	1889	......	20	1:125,000
Arapahoe (Nebr.-Kans.)	5.57	1893	......	20	1:125,000
Ashland [d]	950.43	1892	......	20	1:125,000
Atchison (Kans.-Mo.)	769.23	1885	......	50	1:125,000
Beloit	925.06	1891	......	20	1:125,000
Burden	950.43	1885	......	50	1:125,000
Burlingame	931.51	1885	......	50	1:125,000
Burlington	937.88	1885	......	50	1:125,000
Caldwell	950.43	1889	......	20	1:125,000
Cheney	944.21	1889	......	20	1:125,000
Cheyenne Wells (Colo.-Kans.)	81.50	1890	......	25	1:125,000
Clay Center	925.06	1890	......	20	1:125,000
Coldwater	950.43	1890	......	20	1:125,000
Concordia	918.53	1890	......	20	1:125,000
Cottonwood Falls	937.88	1885	1895	50, 20	1:125,000
Dodge	944.21	1890	......	20	1:125,000
Eldorado	944.21	1885	......	50	1:125,000
Ellis	931.51	1891	......	20	1:125,000

[a] Mechanicsville, Tipton, West Liberty, and Wilton Junction sheets, on scale of 1:62,500 have been reduced and form Stanwood sheet, on scale of 1:125,000.

[b] Davenport, Dewitt, Durant, and Wheatland sheets, on scale of 1:62,500, have been reduced and form Rock Island sheet, on scale of 1:125,000.

[c] Marion and Shellsburg sheets, on scale of 1:62,500 have been reduced and form parts of Winthrop sheet, on scale of 1:125,000.

[d] Sitka sheet, on scale of 1:62,500, has been reduced and forms part of Ashland sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
KANSAS—Continued.	*Sq. miles.*			*Feet.*	
Ellsworth	931.51	1891	......	20	1:125,000
Emporia	937.88	1885	......	50	1:125,000
Eskridge	931.51	1885	......	50	1:125,000
Eureka	944.21	1885	......	50	1:125,000
Fort Scott (Kans.-Mo.)	724.98	1884	......	50	1:125,000
Franklin (Nebr.-Kans.)[a]	....	1893	......	20	1:62,500
Fredonia	944.21	1884	......	50	1:125,000
Garden	944.21	1892	......	20	1:125,000
Garnett	937.88	1885	......	50	1:125,000
Granada (Colo.-Kans.)	82.68	1890	......	25	1:125,000
Great Bend	937.88	1889	......	20	1:125,000
Hays	931.51	1893	......	20	1:125,000
Hebron (Nebr.-Kans.)	4.51	1894	......	20	1:125,000
Hiawatha	918.53	1886	......	50	1:125,000
Hill	925.06	1891	......	20	1:125,000
Holdrege (Nebr.-Kans.)	6.62	1893	......	20	1:125,000
Hutchinson	937.88	1889	......	20	1:125,000
Independence	950.43	1884	1903	50, 20	1:125,000
Iola	944.21	1884	1902	50, 20	1:125,000
Joplin (Kans.-Mo.-Ind. T.)[b]	594.00	1884	......	50	1:125,000
Joplin District (Kans.-Mo.)[b]	**126.01*	1900	......	10	1:62,500
Junction City	925.06	1886	......	50	1:125,000
Kansas City (Kans.-Mo.)	376.63	1887	......	50	1:125,000
Kingman	944.21	1889	......	20	1:125,000
Kinsley	944.21	1889	......	20	1:125,000
Lakin	944.21	1898	......	20	1:125,000
Larned	937.88	1889	......	20	1:125,000
Lawrence	931.51	1885	......	50	1:125,000
Lyons	937.88	1889	......	20	1:125,000
Mankato	918.53	1891	......	20	1:125,000
Marysville	918.53	1886	......	50	1:125,000
Meade	950.43	1890	......	20	1:125,000
Medicine Lodge	950.43	1890	......	20	1:125,000

[a] Franklin and Red Cloud sheets, on scale of 1:62,500, have been reduced and form parts of Red Cloud sheet on scale of 1:125,000.

[b] Joplin District sheet is formed in part by portion of Joplin sheet.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
KANSAS—Continued.	*Sq. miles.*			*Feet.*	
Minneapolis	925.06	1890	......	20	1:125,000
Mound City (Kans.-Mo.)	728.73	1885	......	50	1:125,000
Ness	937.88	1889	......	20	1:125,000
Newton	937.88	1888	......	50	1:125,000
Norton	918.53	1891	......	20	1:125,000
Olathe (Kans.-Mo.)	728.11	1885	......	50	1:125,000
Osborne	925.06	1892	......	20	1:125,000
Oskaloosa (Kans.-Mo.)	916.81	1886	......	50	1:125,000
Parkerville	931.51	1885	......	50	1:125,000
Parsons	950.43	1884	......	50	1:125,000
Phillipsburg	918.53	1891	......	20	1:125,000
Plainville	925.06	1892	......	20	1:125,000
Pratt	944.21	1889	......	20	1:125,000
Red Cloud (Nebr.-Kans.)[a]	7.43	1893	......	20	1:125,000
Red Cloud (Nebr.-Kans.)[a]	**3.71*	1893	......	20	1:62,500
Russell	931.51	1892	......	20	1:125,000
Salina	931.51	1890	......	20	1:125,000
Sedan	950.43	1885	......	50	1:125,000
Seneca	918.53	1886	......	50	1:125,000
Sitka[b]	*237.99*	1892	......	20	1:62,500
Smith Center	918.53	1891	......	20	1:125,000
Spearville	944.21	1889	......	20	1:125,000
Superior (Nebr.-Kans.)	6.44	1894	......	20	1:125,000
Syracuse	944.21	1898	......	20	1:125,000
Topeka	925.06	1886	......	50	1:125,000
Vilas (Colo.-Kans.)	83.32	1890	......	25	1:125,000
Wamego	925.06	1886	......	50	1:125,000
Washington	918.53	1890	......	20	1:125,000
Wellington	950.43	1887	......	50	1:125,000
Wichita	944.21	1888	......	50	1:125,000
Total, Kansas	64,159.37				

[a] Franklin and Red Cloud sheets, on scale of 1:62,500, have been reduced and form parts of Red Cloud sheet on scale of 1:125,000.

[b] Sitka sheet, on scale of 1:62,500, has been reduced and forms part of Ashland sheet, on scale of 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
KENTUCKY:	*Sq. miles.*			*Feet.*	
Beattyville	944.21	1890	......	100	1:125,000
Calhoun	236.44	1903	......	20	1:62,500
Cincinnati (Ohio-Ky.) [a]	**140.70*	1898	......	20	1:62,500
Cumberland Gap (Ky.-Va.-Tenn.) [b]	756.72	1886	......	100	1:125,000
East Cincinnati (Ohio-Ky.) [a]	46.98	1898	......	20	1:62,500
Estillville (Va.-Ky.-Tenn.)	64.49	1883	1888	100	1:125,000
Grundy (Va.-Ky.)	283.95	1884	......	100	1:125,000
Harrodsburg	944.21	1903	......	50	1:125,000
Hazard	950.43	1889	......	100	1:125,000
Huntington (W.Va.-Ohio-Ky.)	.20	1890	......	100	1:125,000
Ironton (Ohio-Ky.)	13.45	1898	......	20	1:62,500
Jonesville (Ky.-Va.-Tenn.) [c]	498.95	1890	......	100	1:125,000
Kenova (Ky.-W. Va.-Ohio) [d]	765.65	1901	......	100	1:125,000
London	950.43	1891	......	100	1:125,000
Manchester	950.43	1888	......	100	1:125,000
Newburg (Ind.-Ky.)	161.00	1903	......	20	1:62,500
Oceana (W. Va.-Va.-Ky.)	2.00	1884	1896	100	1:125,000
Owensboro (Ind.-Ky.)	86.00	1900	......	20	1:62,500
Prestonburg	944.21	1885	......	100	1:125,000
Richmond	944.21	1890	......	100	1:125,000
Salyersville	944.21	1889	1897	100	1:125,000
Tell City (Ky.-Ind.)	195.56	1900	......	20	1:62,500
Warfield (W. Va.-Ky.-Va.)	380.82	1885	......	100	1:125,000
West Cincinnati (Ohio-Ky.) [a]	93.72	1898	......	20	1:62,500
Whitesburg (Ky.-Va.)	800.28	1885	......	100	1:125,000
Williamsburg (Ky.-Tenn.)	768.64	1887	......	100	1:125,000

[a] Cincinnati double sheet is formed by the East Cincinnati and West Cincinnati sheets.

[b] Log Mountain, Middlesboro, and Pineville unfinished sheets are resurveys on scale of 1:62,500 of parts of Cumberland Gap sheet, on scale of 1:125,000.

[c] Harlan, Hagan, and Black Mountain unfinished sheets are resurveys on scale of 1:62,500 of parts of Jonesville sheet, on scale of 1:125,000.

[d] Ceredo unfinished sheet, on scale of 1:62,500, has been reduced and forms part of Kenova sheet, on scale of 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
KENTUCKY—Continued.	*Sq. miles.*			*Feet.*	
In process of mapping—					
Black Mountain (Ky.-Va.) [a]	**43.00*	......	......	....	1:62,500
Ceredo (W. Va.-Ohio-Ky.) [b]	*144.07*	1901	......	20	1:62,500
Hagan (Ky.-Va.-Tenn.) [a]	*55.00*	......	......	20	1:62,500
Harlan [a]	*133.00*	......	......	20	1:62,500
Log Mountain (Ky.-Tenn.) [c]	*31.00*	......	......	20	1:62,500
Middlesboro (Ky.-Va.-Tenn.) [c]	*54.00*	......	......	20	1:62,500
Pineville (Ky.-Va.-Tenn.) [c]	*19.00*	......	......	20	1:62,500
Total, Kentucky	12,727.19				
LOUISIANA:					
Barataria	259.05	1891	......	5	1:62,500
Bayou de Large	259.68	1890	......	None.	1:62,500
Bodreau	258.42	1892	......	None.	1:62,500
Bonnet Carre	121.03	1890	......	5	1:62,500
Cat Island (La.-Miss.)	52.96	1892	......	None.	1:62,500
Chandeleur	48.86	1891	......	None.	1:62,500
Chef Menteur	163.56	1890	......	None.	1:62,500
Cheniere Caminada	120.37	1891	......	None.	1:62,500
Creole	259.68	1891	......	None.	1:62,500
Cut Off	259.05	1891	......	5	1:62,500
Dime	259.05	1891	......	5	1:62,500
Donaldsonville	257.78	1891	......	5	1:62,500
Dulac	259.68	1891	......	5	1:62,500
East Delta	142.74	1891	......	None.	1:62,500
Fort Livingston	183.09	1891	......	None.	1:62,500
Forts	123.55	1891	......	None.	1:62,500
Gibson	259.05	1891	......	5	1:62,500
Hahnville	258.42	1890	......	5	1:62,500
Houma	259.05	1890	......	5	1:62,500

[a] Harlan, Hagan, and Black Mountain unfinished sheets are resurveys on scale of 1:62,500 of parts of Jonesville sheet, on scale of 1:125,000.

[b] Ceredo unfinished sheet, on scale of 1:62,500 has been reduced and forms part of Kenova sheet, on scale of 1:125,000.

[c] Log Mountain, Middlesboro, and Pineville unfinished sheets are resurveys on scale of 1:62,500 of parts of Cumberland Gap sheet, on scale of 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
LOUISIANA—Continued.	*Sq. miles.*			*Feet.*	
Lac des Allemands	258.42	1890	......	5	1:62,500
La Fortuna	58.91	1892	......	None.	1:62,500
Lake Felicity	259.68	1891	......	5	1:62,500
Mount Airy	257.78	1891	......	5	1:62,500
New Orleans	258.42	1890	......	5	1:62,500
Pointe a la Hache	259.05	1891	......	5	1:62,500
Quarantine	230.49	1891	......	5	1:62,500
Rigolets (La.-Miss.)	109.63	1892	......	None.	1:62,500
St. Bernard	237.17	1890	......	5	1:62,500
Shell Beach	183.20	1890	......	None.	1:62,500
Spanish Fort	32.61	1890	......	None.	1:62,500
Thibodeaux	258.42	1890	......	5	1:62,500
Timbalier	82.66	1891	......	None.	1:62,500
Toulme (La.-Miss.)	83.10	1892	......	None.	1:62,500
West Delta	142.14	1891	......	None.	1:62,500
In process of mapping—					
Bayou Sara	401.00	......	......	20	1:125,000
Baton Rouge	85.00	......	......	20	1:125,000
Total, Louisiana	7,002.75				
MAINE:					
Anson	211.91	1902	......	20	1:62,500
Augusta	213.72	1890	......	20	1:62,500
Bangor	211.91	1900	......	20	1:62,500
Bar Harbor	112.00	1902	......	20	1:62,500
Bath	215.51	1890	......	20	1:62,500
Berwick (Me.-N. H.)	167.63	1889	......	20	1:62,500
Biddeford	67.93	1889	......	20	1:62,500
Bingham	211.00	1903	......	20	1:62,500
Bluehill	176.00	1901	1903	20	1:62,500
Boothbay	183.90	1891	......	20	1:62,500
Bucksport	212.82	1899	......	20	1:62,500
Buxton	216.40	1889	......	20	1:62,500
Casco Bay	93.61	1889	......	20	1:62,500
Castine	107.00	1900	1903	20	1:62,500
Cherryfield	212.82	1902	......	20	1:62,500

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
MAINE—Continued.	*Sq. miles.*			*Feet.*	
Deer Isle	51.00	1901	1903	20	1:62,500
Dover (N. H.-Me.)	38.78	1888	......	20	1:62,500
Freeport	215.51	1890	......	20	1:62,500
Gardiner	214.61	1890	......	20	1:62,500
Gorham (N. H.-Me.) [a]	13.80	1891	......	20	1:62,500
Gray	215.51	1892	......	20	1:62,500
Kennebunk	195.63	1889	......	20	1:62,500
Mount Desert	182.00	1901	1903	20	1:62,500
Mount Washington and vicinity (N. H.-Me.) [a]	* *18.30*	1893	......	20	1:62,500
Newfield (Me.-N. H.)	192.66	1889	......	20	1:62,500
Norridgewock	212.82	1891	......	20	1:62,500
North Conway (N. H.-Me.) [a]	4.50	1892	......	20	1:62,500
Norway	214.61	1894	......	20	1:62,500
Orland	212.82	1899	......	20	1:62,500
Orono	211.91	1900	......	20	1:62,500
Petite Menan	57.00	1901	......	20	1:62,500
Portland	216.40	1889	......	20	1:62,500
Sebago	215.51	1894	......	20	1:62,500
Small Point	35.69	1890	......	20	1:62,500
Swan Island	33.00	1901	1903	20	1:62,500
Vassalboro	213.72	1891	......	20	1:62,500
Vinalhaven	44.00	1901	1903	20	1:62,500
Waterville	213.82	1890	......	20	1:62,500
Wiscasset	214.61	1891	......	20	1:62,500
York (Me.-N. H.)	87.83	1888	......	20	1:62,500
Total, Maine	6,121.90				
MARYLAND:					
Accident (Md.-Pa.-W. Va.)	194.21	1898	......	20	1:62,500
Annapolis [b]	98.00	1890	1902	20, 10 and 20	1:62,500
Baltimore	230.86	1890	1898 1902	20	1:62,500
Belair (Md.-Pa.)	204.04	1900	......	20	1:62,500

[a] Mount Washington and vicinity sheet includes Gorham and North Conway sheets.

[b] Annapolis, Oxford, Sharps Island, and St. Michaels sheets, on scale of 1:62,500, are resurveys of parts of Choptank sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Coutour interval.	Scale.
MARYLAND—Continued.	*Sq. miles.*			*Feet.*	
Betterton [a]	205.21	1899	......	20	1:62,500
Bloodsworth Island [b]	**54.26*	1892	1900	Less than 10	1:62,500
Brandywine [c]	233.28	1890	1900	20	1:62,500
Cecilton (Md.-Del.) [d]	*216.60*	1899	......	20	1:62,500
Chestertown [a]	231.67	1900	......	20	1:62,500
Choptank [e]	*931.51*	1895	......	20	1:125,000
Deal Island	133.87	1900	......	10	1:62,500
Denton	43.48	1902	......	20	1:62,500
Dover (Del.-Md.-N. J.) [d]	447.33	1896	......	20	1:125,000
Drum Point [b]	*169.00*	1890	1900	20	1:62,500
East Washington (Md.-D. C.) [c]	209.46	1886	1897	20	1:62,500
Elkton (Md.-Pa.-Del.)	177.40	1896	......	20	1:62,500
Ellicott	230.86	1890	1902	20	1:62,500
Flintstone (W. Va.-Md.-Pa.)	166.94	1898	......	20	1:62,500
Frederick (Md.-Va.)	849.24	1889	......	50	1:125,000
Fredericksburg (Va.-Md.)	175.82	1888	......	50	1:125,000
Frostburg (Md.-W. Va.-Pa.)	162.69	1897	......	20	1:62,500
Grantsville (Md.-Pa.)	204.18	1898	......	20	1:62,500
Green Run (Md.-Va.)	55.30	1900	......	10	1:62,500
Gunpowder [a]	213.30	1892	1900	20	1:62,500
Hancock (Md.-W. Va.-Pa.)	50.80	1899	......	20	1:62,500
Harpers Ferry (Va.-W. Va.-Md.)	190.28	1886	......	100	1:125,000
Harve de Grace (Md.-Pa.)	204.68	1899	......	20	1:62,500
Laurel	231.67	1890	1900	20	1:62,500

[a] Betterton, Chestertown, Gunpowder, and North Point sheets, on scale of 1:62,500 are resurveys of parts of Tolchester sheet, on scale of 1:125,000.

[b] Bloodsworth Island, Drum Point, and Point Lookout sheets, on scale of 1:62,500, are resurveys of parts of St. Mary sheet, on scale of 1:125,000.

[c] Brandywine, East Washington, Owensville, and Prince Frederick sheets, on scale of 1:62,500, have been reduced and form Patuxent sheet, on scale of 1:125,000.

[d] Cecilton sheet, on scale of 1:62,500, is a resurvey of part of Dover sheet, on scale of 1:125,000.

[e] Annapolis, Oxford, Sharps Island, and St. Michaels sheets, on scale of 1:62,500. are resurveys of parts of Choptank sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
MARYLAND—Continued.	*Sq. miles.*			*Feet.*	
Leonardtown [a]	234.07	1890	1900	20	1:62,500
Montross (Md.-Va.) [a]	4.00	1890	1900	20	1:62,500
Mount Vernon (Md.-Va.-D.C.) [b]	213.89	1888	......	50	1:125,000
Nanticoke	234.07	1902	......	10	1:62,500
Nomini (Md.-Va.) [a]	**486.13*	1890	......	20	1:125 000
North Point [c]	73.89	1891	1902	20	1:62,500
Oakland (Md.-W. Va.) [d]	200.00	1899	......	20	1:62,500
Ocean City (Md.-Del.)	127.17	1900	......	10	1:62,500
Owensville [e]	232.48	1890	1900	20	1:62,500
Oxford [f]	233.28	1902	......	20	1:62,500
Parkton (Md.-Pa.)	204.04	1900	......	20	1:62,500
Patuxent (Md.-D. C.) [e]	*908.50*	1897	......	20	1:125,000
Pawpaw (Md.-W. Va.-Pa.)	112.98	1898	......	20	1:62,500
Piedmont (Md.-W. Va.) [d]	*271.76*	1884	1894	100	1:125,000
Piney Point (Md.-Va.) [a]	48.60	1890	1900	20	1:62,500
Pittsville (Md.-Del.)	191.12	1901	......	10	1:62,500
Point Lookout (Md.-Va.) [g]	*84.50*	1890	1900	20	1:62,500
Princess Anne (Md.-Va.)	234.13	1900	......	10	1:62,500
Prince Frederick [e]	233.28	1890	1900	20	1:62,500
Relay	231.67	1890	1902	20	1:62,500
Romney (W. Va.-Va.-Md.) [h]	12.30	1885	......	100	1:125,000
Salisbury (Md.-Del.)	203.35	1900	......	10	1:62,500

[a] Leonardtown, Montross, Piney Point, and Wicomico sheets, on scale of 1:62,500, have been reduced and form Nomini sheet, on scale of 1:125,000.

[b] Indian Head and West Washington sheets, on scale of 1:62,500, are resurveys of parts of Mount Vernon sheet, on scale of 1:125,000.

[c] Betterton, Chestertown, Gunpowder, and North Point sheets, on scale of 1:62,500, are resurveys of parts of Tolchester sheet, on scale of 1:125,000.

[d] Davis, Oakland, and Westernport sheets, on scale of 1:62,500, are resurveys of parts of Piedmont sheet, on scale of 1:125,000.

[e] Brandywine, East Washington, Owensville, and Prince Frederick sheets, on scale of 1:62,500, have been reduced and form Patuxent sheet, on scale of 1:125,000.

[f] Annapolis, Oxford, Sharps Island, and St. Michaels sheets, on scale of 1:62,500, are resurveys of parts of Choptank sheet, on scale of 1:125,000.

[g] Bloodsworth Island, Drum Point, and Point Lookout sheets, on scale of 1:62,500, are resurveys of parts of St. Mary sheet, on scale of 1:125,000.

[h] Keyser sheet, on scale of 1:62,500, is a resurvey of part of Romney sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
MARYLAND—Continued.	*Sq. miles.*			*Feet.*	
Sharps Island [a]	48.83	1892	1902	10	1:62,500
Snow Hill (Md.-Va.)	221.95	1900	......	10	1:62,500
St. Mary (Md.-Va.) [b]	307.76	1895	......	20	1:125,000
St. Michaels [a]	212.50	1902	......	10	1:62,500
Tolchester [c]	**724.07*	1895	......	20	1:125,000
Westminster (Md.-Pa.)	204.04	1903	......	20	1:62,500
West Washington [d]	*36.08*	1886	1897	20	1:62,500
Wicomico (Md.-Va.) [e]	199.46	1890	1900	20	1:62,500
In process of mapping—					
Davis (Md.-W. Va.) [f]	8.28	......	......	20	1:62,500
Crisfield (Md.-Va.)	37.00	......	......	10	1:62,500
Hallwood (Md.-Va.)	12.22	......	......	10	1:62,500
Indian Head (Md.-Va.) [d]	*20.24*	......	......	20	1:62,500
Keyser [g]	*12.21*	......	......	20	1:62,500
Hurlock	14.09	......	......	10	1:62,500
Seaford (Md.-Del.)	8.66	......	......	10	1:62,500
Smiths Point (Md.-Va.)	10.00	......	......	10	1:62,500
Westernport [f]	63.48	......	......	20	1:62,500
Total, Maryland	9,789.88				

[a] Annapolis, Oxford, Sharps Island, and St. Michaels sheets, on scale of 1:62,500, are resurveys of parts of Choptank sheet, on scale of 1:125,000.

[b] Bloodsworth Island, Drum Point, and Point Lookout sheets, on scale of 1:62,500, are resurveys of parts of St. Mary sheet, on scale of 1:125,000.

[c] Betterton, Chestertown, Gunpowder, and North Point sheets, on scale of 1:62,500, are resurveys of parts of Tolchester sheet, on scale of 1:125,000.

[d] Indian Head and West Washington sheets, on scale of 1:62,500, are resurveys of parts of Mount Vernon sheet, on scale of 1:125,000.

[e] Leonardtown, Montross, Piney Point, and Wicomico sheets, on scale of 1:62,500, have been reduced and form Nomini sheet, on scale of 1:125,000.

[f] Davis, Oakland, and Westernport sheets, on scale of 1:62,500, are resurveys of parts of Piedmont sheet, on scale of 1:125,000.

[g] Keyser sheet, on scale of 1:62,500, is a resurvey of part of Romney sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
MASSACHUSETTS:	*Sq. miles.*			*Feet.*	
Abington	221.65	1885	......	20	1:62,500
Barnstable	155.02	1887	......	20	1:62,500
Barre	220.78	1887	......	20	1:62,500
Becket [a]	220.78	1886	......	20	1:62,500
Belchertown	220.78	1887	......	20	1:62,500
Berlin (N.Y.-Mass.-Vt.) [b]	52.00	1888	......	20	1:62,500
Blackstone (Mass.-R.I.)	208.88	1886	......	20	1:62,500
Boston	220.78	1886	1900	20	1:62,500
Boston and vicinity (double sheet) [c]	**292.78*	1900	......	20	1:62,500
Boston Bay	72.00	1887	1900	20	1:62,500
Brookfield (Mass.-Conn.)	194.29	1887	......	20	1:62,500
Chatham	31.62	1887	......	20	1:62,500
Chesterfield [d]	220.78	1886	......	20	1:62,500
Copake (N.Y.-Mass.)	.78	1902	......	20	1:62,500
Dedham	221.65	1886	......	20	1:62,500
Duxbury	62.70	1885	......	20	1:62,500
Fall River (Mass.-R.I.)	144.00	1885	......	20	1:62,500
Falmouth	150.32	1886	......	20	1:62,500
Fitchburg (Mass.-N.H.)	191.97	1887	......	20	1:62,500
Framingham	220.78	1886	......	20	1:62,500
Franklin (Mass.-R.I.)	213.85	1887	......	20	1:62,500
Gay Head	36.41	1887	......	20	1:62,500
Gloucester	40.25	1886	......	20	1:62,500
Granville (Mass.-Conn.) [d]	195.43	1887	......	20	1:62,500
Greenfield (Mass.-Vt.)	203.88	1887	......	20	1:62,500
Greylock (Mass.-Vt.) [b]	213.94	1885	......	20	1:62,500
Groton (Mass.-N.H.)	180.23	1887	......	20	1:62,500
Haverhill (Mass.-N.H.)	49.01	1888	......	20	1:62,500
Hawley (Mass.-Vt.)	209.57	1886	......	20	1:62,500
Holyoke (Mass.-Conn.) [d]	*829.14*	1887	......	40	1:125,000

[a] Becket, Pittsfield, Sandisfield, and Sheffield sheets, on scale of 1:62,500, have been reduced and form Housatonic sheet on scale of 1:125,000.

[b] Berlin and Greylock sheets, on scale of 1:62,500, have been reduced and form parts of Taconic sheet, on scale of 1:125,000.

[c] Boston and vicinity sheet includes areas shown on Boston and Boston Bay sheets.

[d] Chesterfield, Granville, Northampton, and Springfield sheets, on scale of 1:62,500, have been reduced and form Holyoke sheet, on scale of 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
MASSACHUSETTS—Continued.	*Sq. miles.*			*Feet.*	
Housatonic (Mass.-Conn.-N.Y.) [a]	**706.69*	1888	......	40	1:125,000
Lawrence (Mass.-N. H.)	218.14	1886	......	20	1:62,500
Lowell (Mass.-N. H.)	178.65	1886	......	20	1:62,500
Marlboro	220.78	1887	......	20	1:62,500
Marthas Vineyard	82.46	1887	......	20	1:62,500
Middleboro	222.50	1885	......	20	1:62,500
Muskeget	8.96	1887	......	20	1:62,500
Nantucket	55.80	1887	......	20	1:62,500
Narragansett Bay (R. I.-Mass.)	.20	1888	......	20	1:62,500
New Bedford	133.09	1885	......	20	1:62,500
Newburyport (Mass.-N. H.)	82.98	1888	......	20	1:62,500
Northampton [b]	220.78	1885	......	20	1:62,500
Palmer (Mass.-Conn.)	177.45	1887	......	20	1:62,500
Pittsfield (Mass.-N. Y.) [a]	135.51	1888	......	20	1:62,500
Plymouth	166.59	1886	......	20	1:62,500
Providence (Mass.-R. I.)	90.20	1887	......	20	1:62,500
Provincetown	22.93	1887	......	20	1:62,500
Sakonnet (R. I.-Mass.)	.50	1885	......	20	1:62,500
Salem	204.97	1886	......	20	1:62,500
Sandisfield (Mass.-Conn) [a]	184.15	1886	......	20	1:62,500
Sheffield (Mass.-Conn.-N. Y.) [a]	166.25	1885	......	20	1:62,500
Springfield (Mass.-Conn.) [b]	192.15	1887	......	20	1:62,500
Taconic (N. Y.-Mass.-Vt.) [c]	*265.94*	......	......	40	1:125,000
Taunton	222.50	1885	......	20	1:62,500
Warwick (Mass.-N. H.-Vt.)	196.91	1887	......	20	1:62,500
Webster (Mass.-Conn.-R. I.)	202.05	1887	......	20	1:62,500
Wellfleet	74.51	1887	......	20	1:62,500
Winchendon (Mass.-N. H.)	190.51	1887	......	20	1:62,500
Worcester	220.78	1885	......	20	1:62,500
Yarmouth	85.07	1887	......	20	1:62,500
Total, Massachusetts	8,331.50				

[a] Becket, Pittsfield, Sandisfield, and Sheffield sheets, on scale of 1:62,500, have been reduced and form Housatonic sheet, on scale of 1:125,000.

[b] Chesterfield, Granville, Northampton, and Springfield sheets, on scale of 1:62,500, have been reduced and form Holyoke sheet, on scale of 1:125,000.

[c] Berlin and Greylock sheets, on scale of 1:62,500, have been reduced and form parts of Taconic sheet, on scale of 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
MICHIGAN:	*Sq. miles.*			*Feet.*	
Ann Arbor	884.85	1902	......	20	1:125,000
Crystal Falls	207.32	1895	......	20	1:62,500
Gogebic Iron Range (Wis.-Mich.) [a]	....	1890	......	....	....
Iron River (Mich.-Wis.)	199.28	1895	......	20	1:62,500
Marquette Iron Range [b]	....	1890	......	....	....
Maumee Bay (Ohio-Mich.)	3.00	1899	......	20	1:62,500
Ned Lake	206.39	([c])	......	20	1:62,500
Northville [d]	**220.78*	1903	......	20	1:62,500
Passage Island	9.00	([c])	......	20	1:62,500
Perch Lake	206.39	([c])	......	20	1:62,500
Sagola	207.32	1895	......	20	1:62,500
Toledo (Ohio-Mich.)	18.00	1899	......	20	1:62,500
Witbeck	206.39	1896	......	20	1:62,500
In process of mapping—					
Bessemer [a]	11.50	......	......	....	....
Champion [b]	24.52	......	......	....	....
Detroit River [d] (Mich.-D. of Can.)	329.22	......	......	....	....
Eagle Mills [b]	36.67	......	......	....	....
Harvey [b]	5.31	......	......	....	....
Humboldt [b]	21.97	......	......	....	....
Ironwood (Mich.-Wis.) [a]	7.25	......	......	....	....
Ishpeming [b]	52.49	......	......	....	....
Marquette [b]	23.00	......	......	....	....
Menominee Special (Wis.-Mich.)	122.25	......	......	....	....
Michigamme [b]	11.50	......	......	....	....
Total, Michigan	3,014.40				

[a] Bessemer, Ironwood, unfinished sheets, form parts of Gogebic Iron Range sheet.

[b] Marquette, Harvey, Eagle Mills, Ishpeming, Champion, Humboldt, and Michigamme, unfinished sheets, form parts of Marquette Iron Range sheet.

[c] Compiled.

[d] Northville sheet, on scale of 1:62,500, has been reduced and forms part of Detroit River unfinished sheet, on scale of 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
MINNESOTA:	*Sq. miles.*			*Feet.*	
Anoka	211.00	1899	......	20	1:62,500
Duluth	204.52	1893	......	20	1:62,500
Fargo (N. Dak.-Minn.)	458.65	1895	......	20	1:125,000
Mesabi Iron Range [a]	....	1900	......	20	1:62,500
Minneapolis	211.91	1894	......	20	1:62,500
St. Criox Dalles (Wis.-Minn.)	46.81	1897	......	20	1:62,500
St. Paul	211.91	1894	......	20	1:62,500
Vermilion Iron Range [b]	....	1898	......	20	1:62,500
Wahpeton (N. Dak.-Minn.)	186.98	1902	......	20	1:125,000
White Bear	211.00	1899	......	20	1:62,500
In process of mapping—					
Basswood Lake [b]	16.50	......	......	20	1:62,500
Biwabik [a]	52.00	......	......	20	1:62,500
Cohasset [a]	11.75	......	......	20	1:62,500
Dewey Lake [a]	7.00	......	......	20	1:62,500
Dunka River [a]	32.00	......	......	20	1:62,500
Ely [b]	74.00	......	......	20	1:62,500
Ensign Lake [b]	46.00	......	......	20	1:62,500
Eveleth [a]	28.00	......	......	20	1:62,500
Fall Lake [b]	66.32	......	......	20	1:62,500
Gull Lake [b]	30.00	......	......	20	1:62,500
Gunflint Lake [b]	12.00	......	......	20	1:62,500
Hibbing [a]	38.50	......	......	20	1:62,500
Knife Lake [b]	76.00	......	......	20	1:62,500
Mesabi [a]	52.00	......	......	20	1:62,500
Pokogama Lake [a]	15.00	......	......	20	1:62,500
Snowbank Lake [b]	28.00	......	......	20	1:62,500
Soudan [b]	84.50	......	......	20	1:62,500
Sparta [a]	18.00	......	......	20	1:62,500
Swan Lake [a]	52.00	......	......	20	1:62,500
Tower [b]	59.00	......	......	20	1:62,500

[a] Mesabi Iron Range sheet is formed by parts of the unfinished Biwabik, Cohasset, Dewey Lake, Dunka River, Eveleth, Hibbing, Mesabi, Pokogama Lake, Sparta, Swan Lake, Trout Lake, and Virginia sheets, on scale of 1:62,500.

[b] Vermilion Iron Range sheet is formed by parts of the unfinished Basswood Lake, Ely, Ensign Lake, Fall Lake, Gull Lake, Gunflint Lake, Knife Lake, Tower, Soudan, and Snowbank Lake sheets, on scale of 1:62,500.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
MINNESOTA—Continued.	*Sq. miles.*			*Feet.*	
Trout Lake [a]	43.00	......	......	20	1:62,500
Virginia [a]	55.50	......	......	20	1:62,500
Total, Minnesota	2,639.85				
MISSISSIPPI:					
Cat Island (La.-Miss.)	10.62	1892	......	None.	1:62,500
Rigolets (La.-Miss.)	23.19	1892	......	None.	1:62,500
Toulme (La.-Miss.)	18.88	1892	......	None.	1:62,500
In process of mapping—					
Jackson	196.33	......	......	20	1:125,000
Total, Mississippi	249.02				
MISSOURI:					
Atchison (Kans.-Mo.)	149.30	1885	......	50	1:125,000
Bolivar	944.21	1884	......	50	1:125,000
Bonneterre [b]	* *944.21*	1895	......	50	1:125,000
Bonneterre special [b]	236.44	1903	......	20	1:62,500
Boonville	931.51	1886	......	50	1:125,000
Butler	937.88	1885	......	50	1:125,000
Carthage	950.43	1884	......	50	1:125,000
Clinton	937.88	1885	......	50	1:125,000
De Soto	937.88	1896	......	50	1:125,000
East St. Louis (Mo.-Ill.)	41.00	......	1903	20	1:62,500
Edina	911.94	1900	......	20	1:125,000
Eldon [c]	*234.07*	1902	......	20	1:62,500
Eureka Springs (Ark.-Mo.)	5.01	1900	......	50	1:125,000
Fayetteville (Ark.-Mo.)	2.79	1899	......	50	1:125,000
Fort Scott (Kans.-Mo.)	219.23	1884	......	50	1:125,000
Fulton	931.51	1887	......	50	1:125,000
Gravois Mills [c]	*234.07*	1902	......	20	1:62,500
Glasgow	925.06	1887	......	50	1:125,000
Greenfield	950.43	1884	......	50	1:125,000

[a] Mesabi Iron Range sheet is formed by parts of the unfinished Biwabik, Cohasset, Dewey Lake, Dunka River, Eveleth, Hibbing, Mesabi, Pokogama Lake, Sparta, Swan Lake, Trout Lake, and Virginia sheets, on scale of 1:62,500.

[b] Bonneterre (special) is a resurvey of the northeast quarter of Bonneterre.

[c] Gravois Mills and Eldon sheets, on scale of 1:62,500, have been reduced and form parts of Versailles sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
MISSOURI—Continued.	*Sq. miles.*			*Feet.*	
Harrisonville	931.51	1885	......	50	1:125,000
Hermann	931.51	1887	......	50	1:125,000
Independence	925.06	1884	......	50	1:125,000
Jefferson City	931.51	1886	......	50	1:125,000
Joplin (Kans.-Mo.-Ind. T.)	226.02	1884	......	50	1:125,000
Joplin District (Kans.-Mo.) [a]	**349.97*	1900	......	10	1:62,500
Kahoka (Mo.-Iowa-Ill.)	892.38	1900	......	20	1:125,000
Kansas City (Kans.-Mo.)	548.43	1887	......	50	1:125,000
Lexington	925.06	1887	......	50	1:125,000
Louisiana (Mo.-Ill.)	913.57	1887	......	50	1:125,000
Marshall	925.06	1887	......	50	1:125,000
Mexico	925.06	1887	......	50	1:125,000
Moberly	925.06	1887	......	50	1:125,000
Mound City (Kans.-Mo.)	209.15	1885	......	50	1:125,000
Mountain Home (Ark.-Mo.)	7.52	1890	......	50	1:125,000
Nevada	944.21	1884	......	50	1:125,000
O'Fallon (Mo.-Ill.)	859.77	1898	......	50	1:125,000
Olathe (Kans.-Mo.)	203.39	1885	......	50	1:125,000
Oskaloosa (Kans.-Mo.)	8.25	1886	......	50	1:125,000
Palmyra	918.53	1901	......	20	1:125,000
St. Louis (Mo.-Ill.) (double sheet) [b]	*272.13*	1888	1903	20	1:62,500
St. Louis special (Mo.-Ill.) [b]	*274.28*	1903	......	20	1:62,500
Ste. Genevieve	944.21	1895	......	50	1:125,000
Sedalia	931.51	1885	......	50	1:125,000
Springfield	950.43	1884	......	50	1:125,000
Stockton	944.21	1884	......	50	1:125,000
Sullivan	937.88	1899	......	50	1:125,000
Tuscumbia	937.88	1886	......	50	1:125,000
Versailles [c]	937.88	1886	......	50	1:125,000
Warrensburg	931.51	1885	......	50	1:125,000

[a] Joplin District sheet is formed by parts of Joplin and Carthage atlas sheets.

[b] St. Louis special sheet is formed by a part of the St. Louis double sheet.

[c] Gravois Mills and Eldon sheets, on scale of 1:62,500, have been reduced and form parts of Versailles sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
MISSOURI—Continued.	*Sq. miles.*			*Feet.*	
Warsaw	937.88	1885	......	50	1:125,000
West St. Louis	233.28	......	1903	20	1:62,500
Yellville (Ark.-Mo.)	5.28	1891	......	50	1:125,000
In process of mapping—					
Harrison (Ark.-Mo.)	3.00	......	......	50	1:125,000
Total, Missouri	32,564.12				
NEBRASKA:					
Arapahoe (Nebr.-Kans.)	906.37	1893	......	20	1:125,000
Archer[a]	**225.06*	1893	......	20	1:62,500
Bladen[b]	*227.57*	1893	......	20	1:62,500
Browns Creek	891.73	1896	......	20	1:125,000
Camp Clarke	891.73	1895	......	20	1:125,000
Chappell (Nebr.-Colo.)	895.01	1897	......	20	1:125,000
David City	898.54	1895	......	20	1:125,000
Edgemont (S. Dak.-Nebr.)	3.48	1900	......	50	1:125,000
Elk Point (S. Dak.-Nebr.-Iowa)	237.43	1898	......	20	1:125,000
Elm Creek[c]	*226.73*	1892	......	20	1:62,500
Franklin (Nebr.-Kans.)[b]	*223.86*	1893	......	20	1:62,500
Fremont[d]	898.54	1893	......	20	1:125,000
Goshen Hole (Wyo.-Nebr.)	83.49	1895	......	20	1:125,000
Gothenburg	905.27	1899	......	20	1:125,000
Grand Island[e]	*225.90*	1894	......	20	1:62,500
Grand Island[e]	905.27	1894	......	20	1:125,000
Hebron (Nebr.-Kans.)	907.43	1894	......	20	1:125,000
Holdredge (Nebr.-Kans.)	905.32	1893	......	20	1:125,000
Kearney[c]	*226.73*	1893	......	20	1:62,500
Kearney[c]	905.27	1893	......	20	1:125,000

[a] Archer, St. Libory, and St. Paul sheets, on scale of 1:62,500, have been reduced and form parts of St. Paul sheet on scale of 1:125,000.

[b] Upland, Red Cloud, Franklin, and Bladen sheets, on scale of 1:62,500, have been reduced and form Red Cloud sheet on scale of 1:125,000.

[c] Kearney, Pleasanton, Elm Creek, and Miller sheets, on scale of 1:62,500, have been reduced and form Kearney sheet on scale of 1:125,000.

[d] Omaha and vicinity sheet includes part of Fremont sheet.

[e] Grand Island sheet, on scale of 1:62,500, has been reduced and forms part of Grand Island sheet on scale of 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
NEBRASKA—Continued.	*Sq. miles.*			*Feet.*	
Kenesaw [a]	**226.73*	1892	......	20	1:62,500
Lexington	905.27	1893	......	20	1:125,000
Lincoln	905.27	1895	......	20	1:125,000
Loup	898.54	1895	......	20	1:125,000
Maxwell [b]	*225.06*	1892	......	20	1:62,500
Miller [c]	*225.90*	1893	......	20	1:62,500
Minden [a]	*226.73*	1892	......	20	1:62,500
North Platte [b]	*225.06*	1893	......	20	1:62,500
North Platte [b]	898.54	1899	......	20	1:125,000
Oelrichs (S. Dak.-Nebr.)	2.90	1893	......	50	1:125,000
Ogallala	898.54	1897	......	20	1:125,000
Omaha and vicinity (Nebr.-Iowa) [d]	155.73	1898	......	20	1:62,500
Patrick (Wyo.-Nebr.)	82.35	1895	......	20	1:125,000
Paxton	898.54	1898	......	20	1:125,000
Pleasanton [c]	*225.90*	1893	......	20	1:62,500
Red Cloud (Nebr.-Kans.) [e]	904.51	1893	......	20	1:125,000
Red Cloud (Nebr.-Kans.) [e]	*223.86*	1893	......	20	1:62,500
St. Paul [f]	*224.21*	1895	......	20	1:62,500
St. Paul [f]	898.54	1895	......	20	1:125,000
St. Libory [f]	*225.06*	1893	......	20	1:62,500
Scotts Bluff	891.73	1895	......	20	1:125,000
Sidney (Nebr.-Colo.)	895.14	1896	......	20	1:125,000
Stromsburg	898.54	1895	......	20	1:125,000
Superior (Nebr.-Kans.)	905.50	1894	......	20	1:125,000
Upland [e]	*227.57*	1893	......	20	1:62,500
Wahoo	898.54	1895	......	20	1:125,000
Weeping Water	905.27	1902	......	20	1:125,000

[a] Kenesaw, Minden, and Wood River sheets, on scale of 1:62,500, have been reduced and form parts of Wood River sheet on scale of 1:125,000.

[b] North Platte and Maxwell sheets, on scale of 1:62,500, have been reduced and form parts of North Platte sheet on scale of 1:125,000.

[c] Kearney, Pleasanton, Elm Creek, and Miller sheets, on scale of 1:62,500, have been reduced and form Kearney sheet on scale of 1:125,000.

[d] Omaha and vicinity sheet includes 114.98 square miles of Fremont sheet, its total area in Nebraska being 270.71 square miles.

[e] Upland, Red Cloud, Franklin, and Bladen sheets, on scale of 1:62,500, have been reduced and form Red Cloud sheet on scale of 1:125,000.

[f] Archer, St. Libory, and St. Paul sheets, on scale of 1:62,500, have been reduced and form parts of St. Paul sheet on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
NEBRASKA—Continued.	*Sq. miles.*			*Feet.*	
Whistle Creek	884.85	1895	......	20	1:125,000
Wood River [a]	**225.90*	1893	......	20	1:62,500
Wood River [a]	905.27	1893	......	20	1:125,000
York	905.27	1894	......	20	1:125,000
In process of mapping—					
Brady Island	....	......	......	....	....
Hazard	....	......	......	....	....
Total, Nebraska	25,773.71				
NEW HAMPSHIRE:					
Berwick (Me.-N. H.)	49.65	1889	......	20	1:62,500
Brattleboro (Vt.-N. H.)	24.67	1889	......	20	1:62,500
Crawford Notch [b]	214.61	1893	......	20	1:62,500
Dover (N. H.-Me.)	179.38	1888	......	20	1:62,500
Fitchburg (Mass.-N. H.)	27.94	1887	......	20	1:62,500
Gorham (N. H.-Me.) [b]	199.92	1891	......	20	1:62,500
Groton (Mass.-N. H.)	39.68	1887	......	20	1:62,500
Haverhill (Mass.-N. H.)	170.03	1888	......	20	1:62,500
Keene (N. H.-Vt.)	213.73	1895	......	20	1:62,500
Lawrence (Mass.-N. H.)	1.77	1886	......	20	1:62,500
Lowell (Mass.-N. H.)	41.26	1886	......	20	1:62,500
Manchester	219.04	1903	......	20	1:62,500
Monadnock	219.04	1895	......	20	1:62,500
Mount Washington [b]	213.72	1891	......	20	1:62,500
Mount Washington and vicinity, (N. H.-Me.) [b]	*835.36*	1893	......	20	1:62,500
Newburyport (Mass.-N. H.)	93.95	1888	......	20	1:62,500
Newfield (Me.-N. H.)	23.74	1889	......	20	1:62,500
North Conway (N. H.-Me.) [b]	210.11	1892	......	20	1:62,500
Peterboro	219.04	1897	......	20	1:62,500
Warwick (Mass.-N. H.-Vt.)	20.10	1887	......	20	1:62,500
Whitefield (N. H.-Vt.)	185.02	1897	......	20	1:62,500

[a] Kenesaw, Minden, and Wood River sheets, on scale of 1:62,500, have been reduced and form parts of Wood River sheet on scale of 1:125,000.

[b] Mount Washington and vicinity sheet includes Crawford Notch, Gorham, North Conway, and Mount Washington sheets.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by State and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
NEW HAMPSHIRE—Continued.	*Sq. miles.*			*Feet.*	
Winchendon (Mass.-N. H.)	29.40	1887	......	20	1:62,500
York (Me.-N. H.)	8.47	1888	......	20	1:62,500
Total, New Hampshire	2,604.27				
NEW JERSEY:					
Asbury Park[a]	202.84	1884	......	10	1:62,500
Atlantic City	83.25	1884	......	10	1:62,500
Barnegat	157.96	1884	......	10	1:62,500
Bayside (N. J.-Del.)[b]	179.55	1889	......	10	1:62,500
Bordentown (N. J.-Pa.)	225.58	1885	......	10	1:62,500
Bridgeton[b]	230.86	1886	......	10	1:62,500
Burlington (Pa.-N. J.)	89.90	1888	......	20	1:62,500
Camden (N. J.-Pa.-Del.)[c]	**693.11*	1894	......	20	1:125,000
Cape May	31.74	1893	......	10	1:62,500
Cassville[a]	228.40	1885	......	10	1:62,500
Chester (Pa.-Del.-N. J.)[c e]	60.81	1894	......	20	1:62,500
Delaware Water Gap (Pa.-N. J.)	94.89	1888	......	20	1:62,500
Dennisville	166.91	1884	......	10	1:62,500
Dover (Del.-Md.-N. J.)	13.99	1896	......	20	1:125,000
Doylestown (Pa.-N. J.)	20.47	1888	......	20	1:62,500
Easton (Pa.-N. J.)	146.55	1888	......	20	1:62,500
Franklin Furnace[d]	225.06	1884	......	20	1:62,500
Franklin Furnace Special[d]	....	1898	......	10	1:14,400
Germantown (Pa.-N. J.)[e]	3.40	1888	1894	20	1:62,500
Glassboro[c]	230.04	1886	......	10	1:62,500
Great Egg Harbor	214.00	1886	......	10	1:62,500
Greenwood Lake (N. J.-N. Y.)	185.86	1888	......	20	1:62,500

[a] New Brunswick, Sandy Hook, Cassville, and Asbury Park sheets, on scale of 1:62,500, have been reduced and form Navesink sheet, on scale of 1:125,000.

[b] Bayside, Bridgeton, and Maurice Cove sheets, on scale of 1:62,500, have been reduced and form parts of Vineland sheet, on scale of 1:125,000.

[c] Chester, Glassboro, Philadelphia, and Salem sheets, on scale of 1:62,500, have been reduced and form Camden sheet, on scale of 1:125,000.

[d] Franklin Furnace sheet, on scale of 1:62,500, contains Franklin Furnace Special sheet, on scale of 1:14,400.

[e] Philadelphia and vicinity sheet includes Chester, Germantown, Norristown, and Philadelphia sheets.

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Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
NEW JERSEY—Continued.	*Sq. miles.*			*Feet.*	
Hackettstown [a]	225.90	1883	......	20	1:62,500
Hammonton [b]	230.04	1886	......	10	1:62,500
Harlem (N. Y.-N. J.) [c]	47.04	1889	1897	20	1:62,500
High Bridge [a]	226.73	1886	......	20	1:62,500
Lake Hopatcong [a]	225.90	1881	1903	20	1:62,500
Lambertville (Pa-N. J.)	177.71	1888	......	20	1:62,500
Little Egg Harbor	230.04	1885	......	10	1:62,500
Long Beach	56.76	1883	......	10	1:62,500
Maurice Cove [d]	32.87	1886	......	10	1:62,500
Morristown [e]	225.90	1887	1903	20	1:62,500
Mount Holly [b]	229.22	1885	......	10	1:62,500
Mullica [b]	230.04	1886	......	10, 20	1:62,500
Navesink (N. J.-N. Y.) [f]	**848.84*	1885	......	20	1:125,000
New Brunswick [f]	227.57	1885	......	10	1:62,500
New York City and vicinity (N. Y.-N. J.) [c]	....	1897	......	20	1:62,500
Passaic (N. J.-N. Y.) [e]	*772.80*	1897	......	20	1:125,000
Paterson (N. J.-N. Y.) [e] [c]	224.30	1889	1897	20	1:62,500
Pemberton [b]	229.22	1885	......	10	1:62,500
Philadelphia (Pa.-N. J.) [g] [h]	173.22	1888	1894, 1896	20	1:62,500
Philadelphia and vicinity (Pa.-N. J.-Del.) [h]	*237.43*	1894	......	20	1:62,500

[a] Hackettstown, High Bridge, Lake Hopatcong, and Somerville sheets, on scale of 1:62,500, have been reduced and form Raritan sheet, on scale of 1:125,000.

[b] Hammonton, Mount Holly, Mullica, and Pemberton sheets, on scale of 1:62,500, have been reduced and form Rancocas sheet, on scale of 1:125,000.

[c] New York City and vicinity sheet includes Harlem, Paterson, Staten Island, and part of Sandy Hook sheets.

[d] Bayside, Bridgeton, and Maurice Cove sheets, on scale of 1:62,500, have been reduced and form parts of Vineland sheet, on scale of 1:125,000.

[e] Morristown, Paterson, Plainfield, and Staten Island sheets, on scale of 1:62,500, have been reduced and form Passaic sheet, on scale of 1:125,000.

[f] New Brunswick, Sandy Hook, Cassville, and Asbury Park sheets, on scale of 1:62,500, have been reduced and form Navesink sheet, on scale of 1:125,000.

[g] Chester, Glassboro, Philadelphia, and Salem sheets, on scale of 1:62,500, have been reduced and form Camden sheet, on scale of 1:125,000.

[h] Philadelphia and vicinity sheet includes Chester, Germantown, Norristown, and Philadelphia sheets.

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Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
New Jersey—Continued.	*Sq. miles.*			*Feet.*	
Philadelphia Special (Pa.-N. J.)[a b c]	....	1894	......	20	1:62,500
Plainfield (N. J.-N. Y.)[d]	226.17	1887	1899	20	1:62,500
Princeton	227.57	1885	......	10	1:62,500
Ramapo (N. Y.-N. J.)	88.66	1888	......	20	1:62,500
Rancocas[e]	**918.53*	1886	......	10	1:125,000
Raritan[f]	*905.26*	1886	......	20	1:125,000
Salem (N. J.-Del.)[a]	229.04	1886	......	10	1:62,500
Sandy Hook (N. J.-N. Y.)[g h]	190.13	1884	......	10	1:62,500
Sea Isle	46.97	1884	......	10	1:62,500
Somerville[f]	226.73	1886	......	20	1:62,500
Staten Island (N. Y.-N. J.)[d h]	96.43	1889	1897	20	1:62,500
Tarrytown (N. J.-N. Y.)	6.70	1890	......	20	1:62,500
Tuckahoe	230.86	1886	......	10	1:62,500
Vineland (N. J.-Del.)[i]	*443.28*	1896	......	20	1:125,000
Wallpack (N. J.-Pa.)	172.56	1888	......	20	1:62,500
Whiting	229.22	1884	......	10	1:62,500
Total, New Jersey	7,755.56				

[a] Chester, Glassboro, Philadelphia, and Salem sheets, on scale of 1:62,500, have been reduced and form Camden sheet, on scale of 1:125,000.

[b] Philadelphia and vicinity sheet includes Chester, Germantown, Norristown, and Philadelphia sheets.

[c] Philadelphia Special sheet includes parts of Norristown, Germantown, Chester, and Philadelphia.

[d] Morristown, Paterson, Plainfield, and Staten Island sheets, on scale of 1:62,500, have been reduced and form Passaic sheet, on scale of 1:125,000.

[e] Hammonton, Mount Holly, Mullica, and Pemberton sheets, on scale of 1:62,500, have been reduced and form Rancocas sheet, on scale of 1:125,000.

[f] Hackettstown, High Bridge, Lake Hopatcong, and Somerville sheets, on scale of 1:62,500, have been reduced and form Raritan sheet, on scale of 1:125,000.

[g] New Brunswick, Sandy Hook, Cassville, and Asbury Park sheets, on scale of 1:62,500, have been reduced and form Navesink sheet, on scale of 1:125,000.

[h] New York City and vicinity sheet includes Harlem, Paterson, Staten Island, and part of Sandy Hook sheets.

[i] Bayside, Bridgeton, and Maurice Cove sheets, on scale of 1:62,500, have been reduced and form parts of Vineland sheet, on scale of 1:125,000.

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Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
NEW YORK:	*Sq. miles.*			*Feet.*	
Albany [a]	219.91	1892	......	20	1:62,500
Albany and vicinity [a]	**877.90*	1893	......	20	1:62,500
Albion	218.16	1896	......	20	1:62,500
Alexandria Bay	134.26	1900	......	20	1:62,500
Amsterdam	219.04	1893	......	20	1:62,500
Apalachin	221.65	1901	......	20	1:62,500
Auburn	219.04	1896	......	20	1:62,500
Ausable	213.72	1893	......	20	1:62,500
Babylon [b]	125.00	1901	......	20	1:62,500
Baldwinsville	218.16	1898	......	20	1:62,500
Batavia	219.04	1902	......	20	1:62,500
Berlin (N. Y.-Mass.-Vt.) [c]	167.25	1888	......	20	1:62,500
Berne	219.91	1900	......	20	1:62,500
Big Moose	215.51	1901	......	20	1:62,500
Binghamton	221.65	1901	......	20	1:62,500
Blue Mountain	215.51	1900	......	20	1:62,500
Bolton	216.40	1895	......	20	1:62,500
Boonville	217.28	1901	......	20	1:62,500
Broadalbin	218.16	1899	......	20	1:62,500
Brockport	218.16	1897	......	20	1:62,500
Brooklyn [d]	171.00	1889	1897	20	1:62,500
Buffalo (N. Y.-Canada) [e]	140.61	1893	1900	20	1:62,500
Caledonia	219.04	1902	......	20	1:62,500
Cambridge (N. Y.-Vt.) [f]	206.40	1893	......	20	1:62,500
Canandaigua	219.04	1900	......	20	1:62,500
Canajoharie	219.04	1898	......	20	1:62,500
Cape Vincent (N. Y.-Can.)	72.66	1893	......	20	1:62,500

[a] Albany and vicinity sheet includes Albany, Cohoes, Schenectady, and Troy sheets.

[b] Babylon, Fire Island, Northport, and Setauket sheets, on scale of 1:62,500, have been reduced and form Islip sheet, on scale of 1:125,000.

[c] Berlin and Hoosic sheets, on scale of 1:62,500, have been reduced and form parts of Taconic sheet, on scale of 1:125,000.

[d] New York City and vicinity sheet includes Brooklyn, Harlem, Paterson, Staten Island, and parts of Hempstead, Oyster Bay, and Sandy Hook sheets.

[e] Niagara River and vicinity includes parts of Buffalo, Niagara Falls, and Tonawanda sheets.

[f] Cambridge, Fort Ann, and Pawlet sheets, on scale of 1:62,500, have been reduced and form parts of Mettawee sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
NEW YORK—Continued.	*Sq. miles.*			*Feet.*	
Carmel (N. Y.-Conn.)	187.89	1890	......	20	1:62,500
Carthage	215.51	1902	......	20	1:62,500
Castleton (Vt.-N. Y.)	.99	1895	1898	20	1:62,500
Catskill	221.65	1893	......	20	1:62,500
Cazenovia	219.04	1897	......	20	1:62,500
Chautauqua	221.65	1902	......	20	1:62,500
Cherry Creek	220.78	1898	......	20	1:62,500
Chittenango	218.16	1893	......	20	1:62,500
Clayton	202.35	1900	......	20	1:62,500
Clove (N. Y.-Conn.)	203.47	1891	......	20	1:62,500
Clyde	218.16	1899	......	20	1:62,500
Clymer	221.65	1903	......	20	1:62,500
Cohoes [a]	219.04	1892	......	20	1:62,500
Cornwall (Conn.-N. Y.)	1.82	1890	......	20	1:62,500
Copake (N. Y.-Mass.)	220.87	1902	......	20	1:62,500
Cortland	219.91	1901	......	20	1:62,500
Coventry	220.78	1902	......	20	1:62,500
Coxsackie	220.78	1892	......	20	1:62,500
Dryden	220.78	1898	......	20	1:62,500
Dunkirk	190.77	1898	......	20	1:62,500
Durham	220.78	1892	......	20	1:62,500
Easthampton	28.00	1903	......	20	1:62,500
Elizabethtown	214.61	1892	......	20	1:62,500
Elmira (N. Y.-Pa.)	220.10	1893	......	20	1:62,500
Fire Island [b]	85.00	1902	......	20	1:62,500
Fonda	219.04	1894	......	20	1:62,500
Fort Ann (N. Y.-Vt.) [c]	214.28	1893	1901	20	1:62,500
Fulton	232.80	1898	......	20	1:62,500
Gardiners Island	43.00	1903	......	20	1:62,500
Genesee Falls	219.91	1903	......	20	1:62,500
Geneva	219.04	1899	......	20	1:62,500
Genoa	219.91	1899	......	20	1:62,500
Gilboa	220.78	1901	......	20	1:62,500

[a] Albany and vicinity sheet includes Albany, Cohoes, Schenectady, and Troy sheets.

[b] Babylon, Fire Island, Northport, and Setauket sheets, on scale of 1:62,500, have been reduced and form Islip sheet, on scale of 1:125,000.

[c] Cambridge, Fort Ann, and Pawlet sheets, on scale of 1:62,500, have been reduced and form parts of Mettawee sheet, on scale of 1:125,000.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
NEW YORK—Continued.	*Sq. mile.*			*Feet.*	
Glens Falls	217.28	1895	......	20	1:62,500
Gloversville	218.16	1901	......	20	1:62,500
Greene	220.78	1902	......	20	1:62,500
Greenwood Lake (N. J.-N. Y.)	39.20	1888	......	20	1:62,500
Grindstone	23.60	1900	......	20	1:62,500
Hamlin	87.00	1897	......	20	1:62,500
Hammondsport	220.78	1900	......	20	1:62,500
Harford	220.78	1901	......	20	1:62,500
Harlem (N. Y.-N. J.) [a]	178.86	1889	1897	20	1:62,500
Hempstead [a]	145.00	1897	......	20	1:62,500
Hobart	220.78	1901	......	20	1:62,500
Honeoye	219.04	1901	......	20	1:62,500
Hoosic (N. Y.-Vt.) [b]	193.47	1894	......	20	1:62,500
Housatonic (Mass.-Conn.-N. Y.) [c]	**99.67*	1888	......	40	1:125,000
Indian Lake	216.40	1897	......	20	1:62,500
Islip [d]	*565.90*	1902	......	20	1:125,000
Ithaca	220.78	1893	......	20	1:62,500
Jamestown	221.65	1903	......	20	1:62,500
Kaaterskill	221.65	1892	......	20	1:62,500
Kinderhook	220.78	1900	......	20	1:62,500
Lake Placid	213.72	1894	......	20	1:62,500
Lassellsville	218.16	1901	......	20	1:62,500
Little Falls	218.16	1898	......	20	1:62,500
Lockport [e]	218.16	1896	......	20	1:62,500
Long Lake	214.61	1902	......	20	1:62,500
Luzerne	217.28	1900	......	20	1:62,500
Macedon	236.86	1898	......	20	1:62,500
Margaretville	221.65	1901	......	20	1:62,500

[a] New York City and vicinity sheet includes Brooklyn, Harlem, Paterson, Staten Island, and parts of Hempstead, Oyster Bay, and Sandy Hook sheets.

[b] Berlin and Hoosic sheets, on scale of 1:62,500, have been reduced and form parts of Taconic sheet, on scale of 1:125,000.

[c] Pittsfield and Sheffield sheets, on scale of 1:62,500, have been reduced and form parts of Housatonic sheet, on scale of 1:125,000.

[d] Babylon, Fire Island, Northport, and Setauket sheets, on scale of 1:62,500, have been reduced and form Islip sheet, on scale of 1:125,000.

[e] Lockport, Niagara Falls, Olcott, Tonawanda, and Wilson sheets, on scale of 1:62,500, have been reduced and form parts of Niagara sheet, on scale of 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
NEW YORK—Continued.	*Sq. miles.*			*Feet.*	
Medina	218.16	1896	......	20	1:62,500
Mettawee (N. Y.-Vt.) [a]	* *420.86*	1894	......	40	1:125,000
Millbrook (N. Y.-Conn.)	219.50	1899	......	20	1:62,500
Mooers	216.21	1893	......	20	1:62,500
Moravia	219.91	1896	......	20	1:62,500
Moriches	203.00	1903	......	20	1:62,500
Morrisville	219.04	1899	......	20	1:62,500
Montauk	19.00	1903	......	20	1:62,500
Mount Marcy	214.61	1892	......	20	1:62,500
Naples	219.91	1900	......	20	1:62,500
Navesink (N. Y.-N. J.) [b]	*.50*	1885	......	20	1:125,000
New Brunswick (N. J.-N. Y.) [b]	*.30*	1885	......	10	1:62,500
Newburg	223.36	1900	......	20	1:62,500
Newcomb	215.51	1896	......	20	1:62,500
New London (Conn.-N. Y.)	.33	1890	......	20	1:62,500
New York City and vicinity (N. Y.-N. J.) [c]	....	1899	......	20	1:62,500
Niagara [d]	*572.71*	1896	......	20	1:125,000
Niagara Falls (N. Y.-Can.) [d e f]	43.49	1893	......	20	1:62,500
Niagara Falls and vicinity [d e]	....	1900	......	20	1:62,500
Niagara River and vicinity [f]	....	1900	......	20	1:62,500
Nineveh	221.65	1903	......	20	1:62,500
North Creek	216.40	1895	......	20	1:62,500
Northport [g]	170.00	1901	......	20	1:62,500
Norwalk (Conn.-N. Y.)	.91	1890	......	20	1:62,500

[a] Cambridge, Fort Ann, and Pawlet sheets, on scale of 1:62,500, have been reduced and form parts of Mettawee sheet, on scale of 1:125,000.

[b] New Brunswick and Sandy Hook sheets, on scale of 1:62,500, have been reduced and form parts of Navesink sheet, on scale of 1:125,000.

[c] New York City and vicinity sheet includes Brooklyn, Harlem, Paterson, Staten Island, and parts of Hempstead, Oyster Bay, and Sandy Hook sheets.

[d] Lockport, Niagara Falls, Olcott, Tonawanda, and Wilson sheets, on scale of 1:62,500, have been reduced and form parts of Niagara sheet, on scale of 1:125,000.

[e] Niagara Falls and vicinity sheet includes Niagara Falls, Tonawanda, and Wilson sheets.

[f] Niagara River and vicinity sheet includes parts of Buffalo, Niagara Falls, and Tonawanda sheets.

[g] Babylon, Fire Island, Northport, and Setauket sheets, on scale of 1:62,500, have been reduced and form Islip sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
NEW YORK—Continued.	*Sq. miles.*			*Feet.*	
Norwich	219.91	1900	......	20	1:62,500
Nunda	219.91	1903	......	20	1:62,500
Oak Orchard	106.00	1896	......	20	1:62,500
Olcott [a]	92.90	1896	......	20	1:62,500
Old Forge	216.40	1897	1898	20	1:62,500
Olean	221.65	1896	......	20	1:62,500
Oneida	218.16	1893	......	20	1:62,500
Ontario Beach	25.50	1894	......	20	1:62,500
Oriskany	218.16	1893	......	20	1:62,500
Orwell	216.40	1903	......	20	1:62,500
Oswego	139.80	1898	......	20	1:62,500
Ovid	219.91	1899	......	20	1:62,500
Owego (N. Y.-Pa.)	221.65	1900	......	20	1:62,500
Oyster Bay (N. Y.-Conn.) [b]	157.08	1897	......	20	1:62,500
Palmyra	218.16	1899	......	20	1:62,500
Paradox Lake	215.51	1895	......	20	1:62,500
Passaic (N. J.-N. Y.) [c]	**99.07*	1897	......	20	1:125,000
Paterson (N. J.-N. Y.) [b] [c]	1.60	1889	1897	20	1:62,500
Pawlet (Vt.-N. Y.) [d]	.18	1894	1898	20	1:62,500
Penn Yan	219.91	1900	......	20	1:62,500
Phelps	219.04	1899	......	20	1:62,500
Phoenicia	221.65	1900	......	20	1:62,500
Pitcher	219.91	1901	......	20	1:62,500
Pittsfield (Mass.-N. Y.) [e]	85.27	1888	......	20	1:62,500
Plainfield (N. J.-N. Y.)	.56	1887	1899	20	1:62,500
Plattsburg (N. Y.-Vt.)	110.00	1893	......	20	1:62,500
Port Henry (N. Y.-Vt.)	90.40	1892	......	20	1:62,500
Poughkeepsie	223.36	1892	......	20	1:62,500

[a] Lockport, Niagara Falls, Olcott, Tonawanda, and Wilson sheets, on scale of 1:62,500, have been reduced and form parts of Niagara sheet, on scale of 1:125,000.

[b] New York City and vicinity sheet includes Brooklyn, Harlem, Paterson, Staten Island, and parts of Hempstead, Oyster Bay, and Sandy Hook sheets.

[c] Paterson and Staten Island sheets, on scale of 1:62,500, have been reduced and form parts of Passaic sheet, on scale of 1:125,000.

[d] Cambridge, Fort Ann, and Pawlet sheets, on scale of 1:62,500, have been reduced and form parts of Mettawee sheet, on scale of 1:125,000.

[e] Pittsfield and Sheffield sheets, on scale of 1:62,500, have been reduced and form parts of Housatonic sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
NEW YORK—Continued.	*Sq. miles.*			*Feet.*	
Pulaski	178.00	1893	......	20	1:62,500
Pultneyville	29.00	1898	......	20	1:62,500
Ramapo (N. J.-N. Y.)	136.40	1888	......	20	1:62,500
Raquette Lake	215.51	1899	......	20	1:62,500
Remsen	217.28	1897	......	20	1:62,500
Rhinebeck	222.50	1894	......	20	1:62,500
Richfield Springs	219.04	1900	......	20	1:62,500
Richmondville	219.91	1902	......	20	1:62,500
Ridgeway	110.00	1896	......	20	1:62,500
Riverhead	147.00	1903	......	20	1:62,500
Rochester	218.16	1893	......	20	1:62,500
Rosendale	222.50	1901	......	20	1:62,500
Rouse Point (N. Y.-Vt.)	124.01	1893	......	20	1:62,500
Sacketts Harbor	180.00	1893	......	20	1:62,500
Sag Harbor	82.00	1903	......	20	1:62,500
Salamanca	221.65	1897	......	20	1:62,500
Sandy Hook [a] [b]	.20	1884	......	10	1:62,500
Santanoni	214.61	1901	......	20	1:62,500
Saranac Lake	213.72	1902	......	20	1:62,500
Saratoga	218.16	1899	......	20	1:62,500
Schenectady [c]	219.04	1892	......	20	1:62,500
Schoharie	219.91	1898	......	20	1:62,500
Schroon Lake	215.51	1895	......	20	1:62,500
Schunemunk	224.21	1899	......	20	1:62,500
Schuylerville	218.16	1898	......	20	1:62,500
Setauket [d]	185.90	1902	......	20	1:62,500
Sheffield (Mass.-Conn.-N. Y.) [e]	14.40	1885	......	20	1:62,500
Shelter Island	62.00	1903	......	20	1:62,500
Silver Creek	72.00	1898	......	20	1:62,500

[a] New York City and vicinity sheet includes Brooklyn, Harlem, Paterson, Staten Island, and parts of Hempstead, Oyster Bay, and Sandy Hook sheets.

[b] New Brunswick and Sandy Hook sheets, on scale of 1:62,500, have been reduced and form parts of Navesink sheet, on scale of 1:125,000.

[c] Albany and vicinity sheet includes Albany, Cohoes, Schenectady, and Troy sheets.

[d] Babylon, Fire Island, Northport, and Setauket sheets, on scale of 1:62,500, have been reduced and form Islip sheet, on scale of 1:125,000.

[e] Pittsfield and Sheffield sheets, on scale of 1:62,500, have been reduced and form parts of Housatonic sheet, on scale of 1:125,000.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
NEW YORK—Continued.	Sq. miles.			Feet.	
Skaneateles	219.04	1896	......	20	1:62,500
Slide Mountain	222.50	1903	......	20	1:62,500
Sodus Bay	39.69	1899	......	20	1:62,500
St. Regis	213.72	1903	......	20	1:62,500
Stamford (Conn.-N. Y.)	112.95	1890	......	20	1:62,550
Staten Island (N. J.-N. Y.) [a] [b]	97.47	1889	1897	20	1:62,000
Stonington (Conn.-R. I.-N. Y.)	4.50	1888	......	20	1:62,500
Stony Island	29.00	1893	......	20	1:62,500
Syracuse	218.16	1893	......	20	1:62,500
Taberg	217.28	1903	......	20	1:62,500
Taconic (N. Y.-Mass.-Vt.) [c]	**360.72*	1896	......	40	1:125,000
Tarrytown (N. Y.-N. J.)	218.36	1890	......	20	1:62,500
Theresa	214.61	1900	......	20	1:62,500
Thirteenth Lake	216.40	1896	......	20	1:62,500
Ticonderoga (N. Y.-Vt.)	94.50	1894	......	20	1:62,500
Tonawanda [d] [e] [f]	218.16	1893	......	20	1:62,500
Troy [g]	219.91	1891	......	20	1:62,500
Tully	219.04	1897	......	20	1:62,500
Utica	218.16	1896	......	20	1:62,500
Watertown	215.51	1893	......	20	1:62,500
Watkins	220.78	1898	......	20	1:62,500
Waverly	221.65	1899	......	20	1:62,500
Wayland	219.91	1902	......	20	1:62,500
Weedsport	218.16	1899	......	20	1:62,500
West Canada Lakes	216.40	1898	......	20	1:62,500
West Point	224.21	1891	......	20	1:62,500

[a] New York City and vicinity sheet includes Brooklyn, Harlem, Paterson, Staten Island, and parts of Hempstead, Oyster Bay, and Sandy Hook sheets.

[b] Paterson and Staten Island sheets, on scale of 1:62,500, have been reduced and form parts of Passaic sheet, on scale of 1:125,000.

[c] Berlin and Hoosic sheets, on scale of 1:62,500 have been reduced and form parts of Taconic sheet, on scale of 1:125,000.

[d] Lockport, Niagara Falls, Olcott, Tonawanda, and Wilson sheets, on scale of 1:62,500, have been reduced and form parts of Niagara, on scale of 1:125,000.

[e] Niagara Falls and vicinity sheet includes Niagara Falls, Tonawanda, and Wilson sheets.

[f] Niagara River and vicinity sheet includes parts of Buffalo, Niagara Falls, and Tonawanda sheets.

[g] Albany and vicinity sheet includes Albany, Cohoes, Schenectady, and Troy sheets.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
NEW YORK—Continued.	*Sq. miles.*			*Feet.*	
Westfield	73.00	1898	......	20	1:62,500
Whitehall (N. Y.-Vt.)	151.00	1893	1901	20	1:62,500
Willsboro (N. Y.-Vt.)	157.02	1893	......	20	1:62,500
Wilmurt	217.28	1898	......	20	1:62,500
Wilson [a] [b]	50.80	1893	......	20	1:62,500
In process of mapping:					
Highmarket	6.00	......	......	20	1:62,500
Loon Lake	23.00	......	......	20	1:62,500
Piseco Lake	59.00	......	......	20	1:62,500
Tupper Lake	169.00	......	......	......	......
Total, New York	33,870.51				
NORTH CAROLINA:					
Abingdon (Tenn-Va.-N. C.)	60.00	1884	1888, 1895	100	1:125,000
Asheville (N. C.-Tenn.)	860.89	1884	1888, 1899	100	1:125,000
Ayden	243.29	1902	......	10	1:62,500
Chocowinity	242.55	1903	......	10	1:62,500
Cowee (N. C.-S. C.)	966.66	1885	1895	100	1:125,000
Cranberry (N. C.-Tenn.)	753.57	1888	1892, 1897	100	1:125,000
Dahlonega (Ga.-N. C.)	20.41	1885	1900	100	1:125,000
Edenton	241.05	1902	......	10	1:62,500
Ellijay (Ga.-N. C.-Tenn.)	15.97	1886	1896	100	1:125,000
Falkland	242.55	1902	......	10	1:62,500
Greeneville (Tenn.-N. C.)	27.27	1884	1888, 1891	100	1:125,000
Hickory	968.70	1894	......	50	1:125,000
Hillsville (Va.-N. C.)	117.22	1887	......	100	1:125,000
Kenly	242.55	1902	......	20	1:62,500
Knoxville (Tenn.-N. C.)	82.28	1884	1890	100	1:125,000
Morganton	968.70	1886	1894, 1899	100	1:125,000
Mount Guyot (Tenn.-N. C.)	395.98	1885	1892	100	1:125,000

[a] Lockport, Niagara Falls, Olcott, Tonawanda, and Wilson sheets, on scale of 1:62,500, have been reduced and form parts of Niagara sheet, on scale of 1:125,000.

[b] Niagara Falls and vicinity sheet includes Niagara Falls, Tonawanda, and Wilson sheets.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
NORTH CAROLINA—Continued.	*Sq. miles.*			*Feet.*	
Mount Mitchell (N. C.-Tenn.)	966.04	1882	1888 1900	100	1:125,000
Murphy (Tenn.-N. C.)	297.73	1885	1892	100	1:125,000
Nantahala (N. C.-Tenn.)	958.01	1886	1893	100	1:125,000
Newbern	244.03	1901	......	10	1:62,500
Norfolk (Va.-N. C.)	98.51	1891	1896	5	1:125,000
Parmele	241.80	1901	......	10	1:62,500
Pisgah (N. C.-S. C.)	791.60	1888	1896	100	1:125,000
Roan Mountain (Tenn.-N. C.)	200.98	1883	1888 1902	100	1:125,000
Rocky Mount	241.80	1902	......	10	1:62,500
Saluda (N. C.-S. C.)	605.96	1888	1903	100	1:125,000
Statesville	968.70	1891	......	50	1:125,000
Springhope	241.80	1902	......	20	1:62,500
Tarboro	241.80	1902	......	10	1:62,500
Trent River	244.03	1903	......	20	1:62,500
Virginia Beach (Va.-N. C.)	23.40	1891	......	5	1:62,500
Vanceboro	243.29	1902	......	10	1:62,500
Walhalla (Ga.-S. C.-N. C.)	11.97	1885	......	100	1:125,000
Wilkesboro	962.68	1889	......	100	1:125,000
Williamston	241.80	1901	......	10	1:62,500
Wilson	242.55	1902	......	10	1:62,500
Winterville	242.55	1903	......	10	1:62,500
Wytheville (Va.-N. C.)	140.32	1888	......	100	1:125,000
Yadkinville	962.68	1891	......	100	1:125,000
In process of mapping:					
Hertford	8.00	......	......	10	1:62,500
Total, North Carolina	15,871.67				
NORTH DAKOTA:					
Casselton	819.94	1895	......	20	1:125,000
Columbia (S. D.-N. D.)[a]	108.22	1893	......	20	1:125,000
Eckelson	819.94	1894	......	20	1:125,000

[a] Hecla and Savo sheets, on scale of 1:62,500, have been reduced and form parts of Columbia sheet, on scale of 1:125,000.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
NORTH DAKOTA—Continued.	Sq. miles.			Feet.	
Edgeley [a]	827.42	1893	......	20	1:125,000
Ellendale (S. D.-N. D.) [b]	* *153.00*	1892	......	20	1:62,500
Do	153.00	1895	......	20	1:125,000
Fargo (N. D.-Minn.)	361.29	1895	......	20	1:125,000
Fullerton [c]	*207.32*	1892	......	20	1:62,500
Hecla (S. D.-N. D.) [d]	*53.69*	1892	......	20	1:62,500
Jamestown	819.94	1893	......	20	1:125,000
Lamoure [c]	*206.39*	1893	......	20	1:62,500
Do	827.42	1893	......	20	1:125,000
Monango [a]	*207.32*	1893	......	20	1:62,500
Oakes [c]	*207.32*	1892	......	20	1:62,500
Pingree	812.40	1897	......	20	1:125,000
Savo (S. D.-N. D.) [d]	*54.53*	1892	......	20	1:62,500
Tower	819.94	1895	......	20	1:125,000
Wahpeton (N. D.-Minn.)	640.44	1902	......	20	1:125,000
Total, North Dakota	7,009.95				
OHIO:					
Akron	225.06	1903	......	20	1:62,500
Ashtabula	117.00	1903	......	20	1:62,500
Athens	230.86	1903	......	20	1:62,500
Belleville (W. Va.-Ohio)	9.77	1903	......	20	1:62,500
Bellevue	182.58	1901	......	10	1:62,500
Berea	217.93	1902	......	10	1:62,500
Bowling Green	224.21	1901	......	10	1:62,500
Cadiz	227.57	1901	......	20	1:62,500
Cameron (W. Va.-Ohio-Pa.)	1.02	1902	......	20	1:62,500
Canton	225.90	1901	......	20	1:62,500

[a] Monango sheet, on scale of 1:62,500, has been reduced and forms part of Edgeley sheet, on scale of 1:125,000.

[b] Ellendale sheet, on scale of 1:62,500, has been reduced and forms part of Ellendale sheet, on scale of 1:125,000.

[c] Fullerton, Lamoure, and Oakes sheets, on scale of 1:62,500, have been reduced and form parts of Lamoure sheet, on scale of 1:125,000.

[d] Hecla and Savo sheets, on scale of 1:62,500, have been reduced and form parts of Columbia sheet, on scale of 1:125,000.

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Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
OHIO—Continued.	*Sq. miles.*			*Feet.*	
Cincinnati (Ohio-Ky.) [a]	**322.64*	1898	......	20	1:62,500
Clarington (W. Va.-Ohio)	181.00	1903	......	20	1:62,500
Cleveland	224.21	1901	......	20	1:62,500
Delaware	227.57	1901	......	10	1:62,500
Dublin	228.40	1901	......	10	1:62,500
East Cincinnati (Ohio-Ky.)	184.69	1898	......	20	1:62,500
East Columbus	229.22	1899	......	20	1:62,500
Elmore	224.21	1901	......	10	1:62,500
Euclid	46.35	1901	......	20	1:62,500
Findlay	225.06	1901	......	10	1:62,500
Flushing	228.40	1903	......	20	1:62,500
Fostoria	225.06	1901	......	10	1:62,500
Fremont	224.21	1901	......	10	1:62,500
Guyandot (W. Va.-Ohio) [b]	46.46	1901	......	20	1:62,500
Hamilton	230.86	1903	......	20	1:62,500
Huntington (W. Va.-Ohio-Ky.) [b]	*46.46*	1890	......	100	1:125,000
Ironton (Ohio-Ky.)	219.83	1898	......	20	1:62,500
Kenova (Ohio-W. Va.-Ky.) [c]	38.97	1901	......	100	1:125,000
Macksburg	230.04	1903	......	20	1:62,500
Marietta (W. Va.-Ohio)	115.27	1902	......	20	1:62,500
Marion	226.73	1903	......	10	1:62,500
Massillon	225.90	1901	......	20	1:62,500
Maumee Bay (Ohio-Mich.)	195.55	1899	......	20	1:62,500
Mentor	184.00	1903	......	20	1:62,500
New Martinsville (W. Va.-Ohio)	77.65	1903	......	20	1:62,500
New Matamoras (Ohio-W.Va.)	218.63	1903	......	20	1:62,500
Oak Harbor	97.00	1899	......	20	1:62,500
Oberlin	209.00	1901	......	10	1:62,500
Parkersburg (W. Va.-Ohio)	194.30	1902	......	20	1:62,500
Perry	53.00	1903	......	20	1:62,500
Put in Bay	37.87	1901	......	10	1:62,500

[a] Cincinnati double sheet contains the East Cincinnati and West Cincinnati sheets.

[b] Guyandot sheet, on scale of 1:62,500, is a resurvey of part of Huntington sheet, on scale of 1:125,000.

[c] Ceredo partial sheet, on scale of 1:62,500, has been reduced and forms part of Kenova sheet, on scale of 1:125,000.

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Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
OHIO—Continued.	*Sq. miles.*			*Feet.*	
St. Clairsville	228.40	1903	......	20	1:62,500
Salineville	226.73	1903	......	20	1:62,500
Sandusky	160.97	1901	......	10	1:62,500
Scio	227.57	1902	......	20	1:62,500
Steubenville (Ohio–W. Va.–Pa.)	125.16	1902	......	20	1:62,500
Toledo (Ohio–Mich.)	205.36	1899	......	20	1:62,500
Vermilion	146.14	1901	......	10	1:62,500
Wellsville (Ohio–W. Va.–Pa.)	153.26	1902	......	20	1:62,500
Westerville	228.40	1902	......	10	1:62,500
West Cincinnati (Ohio–Ky.)	137.95	1898	......	20	1:62,500
West Columbus	229.22	1899	......	20	1:62,500
Wheeling (W. Va.–Ohio–Pa.)	38.21	1901	......	20	1:62,500
Woodsfield	229.22	1903	......	20	1:62,500
Wooster	225.90	1901	......	20	1:62,500
In process of mapping—					
Ceredo (Ohio–W. Va.–Ky.) [a]	**50.00*	......	......	20	1:62,500
Kent	150.06	......	......	20	1:62,500
Sycamore	105.00	......	......	10	1:62,500
Total, Ohio	9,528.89				
PENNSYLVANIA:					
Accident (Md.–Pa.–W. Va.)	25.86	1898	......	20	1:62,500
Allentown	226.73	1893	......	20	1:62,500
Amity	228.40	1902	......	20	1:62,500
Barnesboro	226.73	1902	......	20	1:62,500
Beaver	226.73	1901	......	20	1:62,500
Belair (Md.–Pa.)	26.00	1900	......	20	1:62,500
Blacksville (W. Va.–Pa.)	26.28	1902	......	20	1:62,500
Bloomsburg	225.06	1890	......	20	1:62,500
Bordentown (N. J.–Pa.)	2.82	1885	......	10	1:62,500
Boyertown	227.57	1900	......	20	1:62,500
Brownsville	228.40	1900	......	20	1:62,500
Bruceton (W. Va.–Pa.)	26.61	1902	......	20	1:62,500
Burlington (Pa.–N. J.)	138.50	1888	......	20	1:62,500

[a] Ceredo partial sheet, on scale of 1:62,500, has been reduced and forms part of Kenova sheet, on scale of 1:125,000.

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Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
PENNSYLVANIA—Continued.	*Sq. miles.*			*Feet.*	
Camden (N. J.-Pa.-Del.)[a]	**209.73*	1894	......	20	1:125,000
Cameron (W. Va.-Ohio-Pa.)	17.60	1902	......	20	1:62,500
Carlisle	228.40	1901	......	20	1:62,500
Catawissa	225.90	1889	......	20	1:62,500
Chambersburg	229.22	1900	......	20	1:62,500
Chester (Pa.-Del.-N. J.)[a b]	153.73	1894	......	20	1:62,500
Connellsville	228.40	1900	......	20	1:62,500
Curwensville	225.90	1902	......	20	1:62,500
Delaware Water Gap (Pa.-N. J.)	131.01	1888	......	20	1:62,500
Doylestown (Pa.-N. J.)	207.10	1888	......	20	1:62,500
Dundaff	223.36	1890	......	20	1:62,500
Easton (Pa.-N. J.)	80.18	1888	......	20	1:62,500
Ebensburg	227.57	1902	......	20	1:62,500
Elders Ridge	226.73	1902	......	20	1:62,500
Elkland	222.50	1899	......	20	1:62,500
Elkton (Md.-Del.-Pa.)	28.50	1896	......	20	1:62,500
Elmira (N. Y.-Pa.)	1.55	1893	......	20	1:62,500
Erie	114.61	1900	......	20	1:62,500
Everett	228.40	1900	......	20	1:62,500
Fairview	22.92	1899	......	20	1:62,500
Flintstone (Md.-Pa.-W. Va.)	26.91	1898	......	20	1:62,500
Frostburg (Md.-W. Va.-Pa.)	26.37	1897	......	20	1:62,500
Gaines	222.50	1899	......	20	1:62,500
Germantown (Pa.-N. J.)[b]	225.00	1888	1894	20	1:62,500
Girard	219.50	1899	......	20	1:62,500
Grantsville (Md.-Pa.)	25.86	1898	......	20	1:62,500
Hancock (W. Va.-Md.-Pa.)	25.37	1899	......	20	1:62,500
Harrisburg	227.57	1890	......	20	1:62,500
Harvey Lake	224.21	1891	......	20	1:62,500
Havre de Grace (Md.-Pa.)	25.36	1899	......	20	1:62,500
Hazleton	225.90	1889	......	20	1:62,500
Hollidaysburg	227.57	1902	......	20	1:62,500

[a] Chester and Philadelphia sheets, on scale of 1:62,500, have been reduced, and form parts of Camden sheet, on scale of 1:125,000.

[b] Philadelphia and vicinity sheet includes Chester, Germantown, Norristown, and Philadelphia sheets.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
PENNSYLVANIA—Continued.	*Sq. miles.*			*Feet.*	
Honesdale	223.36	1891	......	20	1:62,500
Houtzdale	225.90	1903	......	20	1:62,500
Hummelstown	227.57	1890	......	20	1:62,500
Huntingdon	227.57	1901	......	20	1:62,500
Indiana	226.73	1900	......	20	1:62,500
Kittanning	225.90	1900	......	20	1:62,500
Lambertville (Pa.-N. J.)	49.86	1888	......	20	1:62,500
Lancaster	228.40	1902	......	20	1:62,500
Latrobe	227.57	1900	......	20	1:62,500
Lebanon	227.57	1889	......	20	1:62,500
Littleton (W. Va.-Pa.)	1.95	1903	......	20	1:62,500
Lykens	226.73	1889	......	20	1:62,500
Mahanoy	225.90	1889	......	20	1:62,500
Mannington (W. Va.-Pa.)	26.28	1903	......	20	1:62,500
Masontown	229.22	1899	......	20	1:62,500
Mercersburg	229.22	1900	......	20	1:62,500
Millersburg	226.73	1891	......	20	1:62,500
Morgantown (W. Va.-Pa.)	26.53	1900	......	20	1:62,500
Newcastle	225.90	1902	......	20	1:62,500
Norristown [a]	228.40	1894	......	20	1:62,500
Owego (N. Y.-Pa.)	1.29	1900	......	20	1:62,500
Parkton (Md.-Pa.)	26.00	1900	......	20	1:62,500
Patton	226.73	1901	......	20	1:62,500
Pawpaw (Md.-W. Va.-Pa.)	25.86	1898	......	20	1:62,500
Philadelphia (Pa.-N. J.) [a] [b]	56.00	1888	{1894 1896}	20	1:62,500
Philadelphia and vicinity (Pa.-N. J.-Del.) [a]	* *623.13*	1894	......	20	1:62,500
Pinegrove	226.73	1889	......	20	1:62,500
Pittston	224.21	1890	......	20	1:62,500
Pottsville	226.73	1889	......	20	1:62,500
Quakertown	227.57	1888	......	20	1:62,500
Reading	227.57	1892	......	20	1:62,500

[a] Philadelphia and vicinity sheet includes Chester, Germantown, Norristown, and Philadelphia sheets.

[b] Chester and Philadelphia sheets, on scale of 1:62,500, have been reduced and from parts of Camden sheet, on scale of 1:125,000.

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Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
PENNSYLVANIA—Continued.	*Sq. miles.*			*Feet.*	
Rogersville	229.22	1903	......	20	1:62,500
Rural Valley	225.90	1901	......	20	1:62,500
Scranton	224.21	1889	......	20	1:62,500
Shamokin	225.90	1889	......	20	1:62,500
Shickshinny	225.06	1890	......	20	1:62,500
Slatington	226.73	1900	......	20	1:62,500
Steubenville (Ohio-W. V.-Pa.)	17.60	1902	......	20	1:62,500
Sunbury	225.90	1891	......	20	1:62,500
Tioga	225.50	1900	......	20	1:62,500
Uniontown	229.22	1899	......	20	1:62,500
Wallpack (N. J.-Pa.)	52.50	1888	......	20	1:62,500
Waynesburg	229.22	1901	......	20	1:62,500
Wellsville (Ohio-W. Va.-Pa.)	17.60	1902	......	20	1:62,500
Wernersville	227.57	1900	......	20	1:62,500
West Chester (Pa.-Del.)	165.55	1901	......	20	1:62,500
Westminster (Md.-Pa.)	26.00	1903	......	20	1:62,500
Wheeling (W. Va.-Ohio-Pa.)	17.60	1901	......	20	1:62,500
Wilkesbarre	225.06	1891	......	20	1:62,500
York special	75.33	1901	......	20	1:62,500
In process of mapping—					
Carnegie	117.00	......	......	20	1:62,500
Johnstown	126.00	......	......	20	1:62,500
McKeesport	156.00	......	......	20	1:62,500
Punxsutawney	113.00	......	......	20	1:62,500
Sewickley	36.00	......	......	20	1:62,500
Sharpsburg	15.00	......	......	20	1:62,500
Total, Pennsylvania	15,422.04				
RHODE ISLAND:					
Blackstone (Mass.-R. I.)	12.77	1886	......	20	1:62,500
Block Island	10.44	1886	......	20	1:62,500
Burrillville	222.50	1888	......	20	1:62,500
Charlestown	128.38	1888	......	20	1:62,500
Fall River (Mass.-R. I.)	79.36	1885	......	20	1:62,500
Franklin (Mass.-R. I.)	7.80	1887	......	20	1:62,500
Kent	223.36	1888	......	20	1:62,500

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
RHODE ISLAND—Continued.	*Sq. miles.*			*Feet.*	
Moosup (Conn.-R. I.)	38.00	1888	......	20	1:62,500
Narragansett Bay (R. I.-Mass.)	142.95	1888	......	20	1:62,500
Newport	37.17	1888	......	20	1:62,500
Providence (Mass.-R. I.)	132.30	1887	......	20	1:62,500
Putnam (Conn.-R. I.)	41.50	1888	......	20	1:62,500
Sakonnet (R. I.-Mass.)	7.42	1885	......	20	1:62,500
Stonington (Conn.-R. I.-N. Y.)	45.30	1888	......	20	1:62,500
Webster (Mass.-Conn.-R. I.)	1.60	1887	......	20	1:62,500
Total, Rhode Island	1,130.85				
SOUTH CAROLINA:					
Abbeville	986.29	1890	......	50	1:125,000
Carnesville (Ga.-S. C.)	2.11	1889	......	50	1:125,000
Columbia	986.29	1902	......	20	1:125,000
Cowee (N. C.-S. C.)	7.98	1885	1895	100	1:125,000
Elberton (Ga.-S. C.)	498.79	1890	......	50	1:125,000
McCormick (Ga.-S. C.)	543.62	1890	......	50	1:125,000
Pickens	980.50	1886	......	100	1:125,000
Pisgah (N. C.-S. C.)	183.04	1888	1896	100	1:125,000
Saluda (N. C.-S. C.)	368.68	1888	1903	100	1:125,000
Walhalla (Ga.-S. C.-N. C.)	442.43	1885	......	100	1:125,000
In process of mapping—					
Wilkes (Ga.-S. C.)	16.00	......	......	50	1:125,000
Total, South Carolina	5,015.73				
SOUTH DAKOTA:					
Aberdeen [a]	842.18	1893	......	20	1:125,000
Aladdin (Wyo.-S. Dak.-Mont.)	85.51	1901	......	50	1:125,000
Alexandria	863.82	1895	......	20	1:125,000
Byron	849.46	1893	......	20	1:125,000
Canton (S. Dak.-Iowa)	812.75	1897	......	20	1:125,000
Columbia (S. Dak.-N. Dak.) [b]	726.61	1893	......	20	1:125,000
Columbia [b]	* *209.17*	1892	......	20	1:62,500

[a] Conde sheet, on scale of 1:62,500, has been reduced and forms part of Aberdeen sheet, on scale of 1:125,000.

[b] Columbia, Hecla, Frederick, and Savo sheets, on scale of 1:62,500, have been reduced and form Columbia sheet on scale of 1:125,000.

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Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
SOUTH DAKOTA—Continued.	*Sq. miles.*			*Feet.*	
Conde [a]	**211.00*	1893	......	20	1:62,500
Deadwood [b]	856.67	1892	1898	100	1:125,000
Desmet	856.67	1895	......	20	1:125,000
Edgemont (S. Dak.-Nebr.)	867.42	1900	......	50	1:125,000
Elkpoint (S. Dak.-Nebr.-Iowa)	554.11	1898	......	20	1:125,000
Ellendale (N. Dak.-S. Dak.) [c]	681.83	1895	......	20	1:125,000
Ellendale (S. Dak.-N. Dak.) [c]	*153.06*	1892	......	20	1:62,500
Frederick (S. Dak.-N. Dak.) [d]	*208.25*	1892	......	20	1:62,500
Harney Peak	863.82	1893	......	100	1:125,000
Hecla (S. Dak.-N. Dak.) [d]	*154.56*	1892	......	20	1:62,500
Hermosa	863.82	1892	......	100	1:125,000
Huron	856.67	1894	......	20	1:125,000
Mitchell	863.82	1895	......	20	1:125,000
Newcastle (Wyo.-S. Dak.)	85.21	1899	......	50	1:125,000
Northville	842.18	1895	......	20	1:125,000
Oelrichs (S. Dak.-Nebr.)	868.00	1893	......	50	1:125,000
Olivet	870.90	1896	......	20	1:125,000
Parker	870.90	1896	......	20	1:125,000
Rapid	856.67	1898	......	50	1:125,000
Redfield	849.46	1895	......	20	1:125,000
St. Onge	212.82	1903	......	20	1:62,500
Savo (N. Dak.-S. Dak.) [d]	*154.46*	1892	......	20	1:62,500
Spearfish [b]	*213.72*	1898	......	50	1:62,500
Sturgis [b]	*213.72*	1897	......	50	1:62,500
Sundance (Wyo.-S. Dak.)	86.45	1899	......	50	1:125,000
In process of mapping—					
Bellefourche	115.00	......	......	20	1:62,500
Total, South Dakota	17,103.42				

[a] Conde sheet, on scale of 1:62,500, has been reduced and forms part of Aberdeen sheet, on scale of 1:125,000.

[b] Spearfish and Sturgis sheets, on scale of 1:62,500, are resurveys of parts of Deadwood sheet, on scale of 1:125,000.

[c] Ellendale sheet on scale of 1:62,500 has been reduced and forms part of Ellendale sheet on scale of 1:125,000.

[d] Columbia, Hecla, Frederick, and Savo sheets, on scale of 1:62,500, have been reduced and form Columbia sheet on scale of 1:125,000.

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Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
TENNESSEE:	*Sq. miles.*			*Feet.*	
Abingdon (Tenn.-Va.-N. C.)	133.24	1884	1888, 1895	100	1:125,000
Asheville (N. C.-Tenn.)	107.81	1884	1888, 1899	100	1:125,000
Briceville	962.68	1891	......	100	1:125,000
Bristol (Va.-Tenn.)	176.20	1884	1888, 1895	100	1:125,000
Chattanooga	974.64	1886	......	100	1:125,000
Cleveland	974.64	1885	1891, 1895	100	1:125,000
Columbia	968.70	1899	......	50	1:125,000
Cranberry (N. C.-Tenn.)	209.11	1888	1892, 1897	100	1:125,000
Cumberland Gap (Ky.-Va.-Tenn.) [a]	172.75	1886	......	100	1:125,000
Dalton (Ga.-Tenn.)	25.94	1886	1895	100	1:125,000
Ellijay (Ga.-N. C.-Tenn.)	7.26	1886	1896	100	1:125,000
Estillville (Va.-Ky.-Tenn.)	187.54	1883	1888	100	1:125,000
Greeneville (Tenn.-N. C.)	935.41	1884	1888, 1891	100	1:125,000
Huntsville (Ala.-Tenn.)	25.28	1885	......	100	1:125,000
Jonesville (Ky.-Va.-Tenn.)	179.78	1890	......	100	1:125,000
Kingston	968.70	1885	......	100	1:125,000
Knoxville (Tenn.-N. C.)	886.42	1884	1890	100	1:125,000
Loudon	968.70	1885	1891	100	1:125,000
McMinnville	968.70	1891	......	100	1:125,000
Maynardville	962.68	1885	1892, 1895	100	1:125,000
Morristown	962.68	1884	1890, 1892	100	1:125,000
Mount Guyot	572.72	1885	1892	100	1:125,000
Mount Mitchell (N. C.-Tenn.)	2.66	1882	1888, 1903	100	1:125,000
Murphy (Tenn.-N. C.)	676.91	1885	1892	100	1:125,000
Nantahala (N. C.-Tenn.)	16.63	1886	1893	100	1:125,000
Nashville	962.68	1901	......	50	1:125,000

[a] Cumberland Gap sheet, on scale of 1:125,000, has been partly resurveyed and includes Log Mountain partial sheet, on scale of 1:62,500.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
TENNESSEE—Continued.	*Sq. miles.*			*Feet.*	
Pikeville	968.70	1890	......	100	1:125,000
Ringgold (Ga.-Tenn.)	27.93	1885	......	100	1:125,000
Roan Mountain (Tenn.-N. C.)	761.70	1883	1888 1902	100	1:125,000
Scottsboro (Ala.-Tenn.)	17.29	1885	......	100	1:125,000
Sewanee	974.64	1890	1894	100	1:125,000
Standingstone	962.68	1895	......	100	1:125,000
Stevenson (Ala.-Ga.-Tenn.)	28.59	1884	1891	100	1:125,000
Wartburg	962.68	1893	......	100	1:125,000
Waynesboro (Ala.-Tenn.)	966.24	1903	......	50	1:125,000
Williamsburg (Ky.-Tenn.)	187.96	1887	......	100	1:125,000
In process of mapping—					
Log Mountain (Ky.-Tenn.)[a]	**10.00*	......	......	20	1:62,500
Total, Tennessee	19,848.87				
VERMONT:					
Bennington[b]	219.04	1896	......	20	1:62,500
Berlin (N. Y.-Mass.-Vt.)[b]	.66	1888	......	20	1:62,500
Brandon	215.51	1902	......	20	1:62,500
Brattleboro (Vt.-N. H.)	194.37	1889	......	20	1:62,500
Cambridge (N. Y.-Vt.)[c]	11.76	1893	......	20	1:62,500
Castleton (Vt.-N. Y.)	215.41	1895	1898	20	1:6,2500
Equinox[c]	218.16	1894	......	20	1:62,500
Fort Ann (N. Y.-Vt.)[c]	3.00	1893	1901	20	1:62,500
Greenfield (Mass.-Vt.)	16.03	1887	......	20	1:62,500
Greylock (Mass.-Vt.)[b]	5.97	1885	......	20	1:62,500
Hawley (Mass.-Vt.)	10.34	1886	......	20	1:62,500
Hoosick (N. Y.-Vt.)[b]	25.57	1894	......	20	1:62,500
Keene (N. H.-Vt.)	5.31	1895	......	20	1:62,500
Londonderry	218.16	1892	......	20	1:62,500
Mettawee (N. Y.-Vt.)[c]	*451.02*	1894	......	40	1:125,000

[a] Cumberland Gap sheet, on scale of 1:125,000, has been partly resurveyed and includes Log Mountain partial sheet, on scale of 1:62,500.

[b] Bennington, Berlin, Greylock, and Hoosic sheets, on scale of 1:62,500, have been reduced and form Taconic sheet, on scale of 1:125,000.

[c] Cambridge, Equinox, Fort Ann, and Pawlet sheets, on scale of 1:62,500, have been reduced and form Mettawee sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
VERMONT—Continued.	*Sq. miles.*			*Feet.*	
Middlebury	214.61	1903	......	20	1:62,500
Pawlet (Vt.-N. Y.)[a]	217.10	1894	1898	20	1:62,500
Plattsburg (N. Y.-Vt.)	102.82	1893	......	20	1:62,500
Port Henry (N. Y.-Vt.)	124.21	1892	......	20	1:62,500
Rouse Point (N. Y.-Vt.)	87.90	1893	......	20	1:62,500
Rutland (N. Y.-Vt.)	216.40	1891	......	20	1:62,500
Strafford	215.51	1894	......	20	1:62,500
Taconic (N. Y.-Mass.-Vt.)[b]	**251.24*	1896	......	40	1:12,5000
Ticonderoga (N. Y.-Vt.)	121.01	1894	......	20	1:62,500
Wallingford	217.28	1891	......	20	1:62,500
Warwick (Mass.-N. H.-Vt.)	2.90	1887	......	20	1:62,500
Whitefield (N. H.-Vt.)	28.70	1897	......	20	1:62,500
Whitehall (N. Y.-Vt.)	65.40	1893	......	20	1:62,500
Willsboro (N. Y.-Vt.)	56.70	1893	......	20	1:62,500
Wilmington	219.04	1889	1896	20	1:62,500
Total, Vermont	3,248.87				
VIRGINIA:					
Abingdon (Tenn.-Va.-N.C.)	763.36	1884	1888, 1895	100	1:125,000
Amelia	950.43	1895	......	50	1:125,000
Appomattox	950.43	1890	......	50	1:125,000
Bermuda Hundred	237.22	1892	......	20	1:62,500
Beverly (W. Va.-Va.)	40.56	1887	......	100	1:125,000
Bristol (Va.-Tenn.)	780.40	1884	1888, 1895	100	1:125,000
Buckingham	944.21	1888	......	100	1:125,000
Christiansburg (Va.-W. Va.)	926.43	1887	......	100	1:125,000
Cumberland Gap (Ky.-Va.-Tenn.)[c]	27.13	1886	......	100	1:125,000
Dublin (Va.-W. Va.)	743.62	1887	......	100	1:125,000
Estillville (Va.-Ky.-Tenn.)	704.57	1883	1888	100	1:125,000

[a] Cambridge, Equinox, Fort Ann, and Pawlett sheets, on scale of 1:62,500, have been reduced and form Mettawee sheet, on scale of 1:125,000.

[b] Bennington, Berlin, Greylock, and Hoosic sheets, on scale of 1:62,500, have been reduced and form Taconic sheet, on scale of 1:125,000.

[c] Middlesboro sheet, on scale of 1:62,500, is a resurvey of part of Cumberland Gap sheet, on scale 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
VIRGINIA—Continued.	*Sq. miles.*			*Feet.*	
Farmville	950.43	1889	......	50	1:125,000
Franklin (W. V.-Va.)	133.60	1887	1895	100	1:125,000
Frederick (Md.-Va.)	75.82	1889	......	50	1:125,000
Fredericksburg (Va.-Md.)	762.06	1888	......	50	1:125,000
Goochland	944.21	1888	......	50	1:125,000
Gordonsville	937.88	1887	......	100	1:125,000
Green Run (Md.-Va.)	.12	1900	......	10	1:62,500
Grundy (Va.-Ky.)	666.48	1884	......	100	1:125,000
Harpers Ferry (Va.-W. Va.-Md.)	456.15	1886	......	100	1:125,000
Harrisonburg	937.88	1887	......	100	1:125,000
Hillsville (Va.-N. C.)	839.38	1887	......	100	1:125,000
Jonesville (Ky.-Va.-Tenn.)	277.87	1890	......	100	1:125,000
Lewisburg (Va.-W. Va.)	401.13	1887	......	100	1:125,000
Lexington	944.21	1888	......	100	1:125,000
Luray	931.51	1886	......	100	1:125,000
Lynchburg	950.43	1890	......	100	1:125,000
Monterey (Va.-W. Va.)	631.05	1887	......	100	1:125,000
Montross (Va.-Md.) [a]	175.00	1890	......	20	1:62,500
Mount Vernon (Va.-Md.-D. C.) [b]	670.94	1888	......	50	1:125,000
Natural Bridge	944.21	1888	......	100	1:125,000
Nomini (Md.-Va.) [a]	**296.32*	1890	......	20	1:125,000
Norfolk (Va.-N. C.)	715.48	1891	1896	5	1:125,000
Oceana (W. Va.-Va.-Ky.)	6.90	1884	1896	100	1:125,000
Palmyra	944.21	1889	......	50	1:125,000
Petersburg	237.99	1892	......	20	1:62,500
Piney Point (Md.-Va.) [a]	119.00	1890	1900	20	1:62,500
Pocahontas (Va.-W. Va.)	534.19	1885	1892	100	1:125,000
Point Lookout (Md.-Va.) [c]	1.20	1890	1900	20	1:62,500
Princess Anne (Md.-Va.)	.74	1900	......	10	1:62,500
Richmond	236.44	1892	......	20	1:62,500

[a] Montross, Piney Point, and Wicomico sheets, on scale of 1:62,500, have been reduced and form parts of Nomini sheet, on scale of 1:125,000.

[b] Indian Head and West Washington sheets are resurveys of parts of Mount Vernon sheet, on scale of 1:125,000.

[c] Point Lookout sheet, on scale of 1:62,500, has been reduced and forms part of St. Mary sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern sections, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
VIRGINIA—Continued.	*Sq. miles.*			*Feet.*	
Roanoke	950.43	1888	......	100	1:125,000
Romney (W. Va.-Va.-Md.)	14.36	1885	......	100	1:125,000
St. Mary (Md.-Va.) [a]	**1.20*	1895	......	20	1:125,000
Snow Hill (Md.-Va.)	12.92	1900	......	10	1:62,500
Spottsylvania	937.88	1888	......	50	1:125,000
Staunton (Va.-W. Va.)	874.24	1887	......	100	1:125,000
Tazewell (Va.-W. Va.)	537.43	1885	1893	100	1:125,000
Virginia Beach (Va.-N. C.)	6.64	1891	......	5	1:62,500
Warfield (W. Va.-Ky.-Va.)	1.60	1885	......	100	1:125,000
Warrenton	931.51	1887	......	50	1:125,000
Washington (D. C.-Md.-Va.)	149.72	1897	......	20	1:62,500
West Washington (Md.-D. C.-Va.) [b] [d]	*149.72*	1886	1897	20	1:62,500
Whitesburg (Ky.-Va.)	150.15	1885	......	100	1:125,000
Wicomico (Md.-Va.) [c]	2.32	1890	1900	20	1:62,500
Winchester (Va.-W. Va.)	576.69	1885	1891	100	1:125,000
Woodstock (Va.-W. Va.)	734.87	1886	......	100	1:125,000
Wytheville (Va.-N. C.)	816.28	1888	......	100	1:125,000
In process of mapping—					
Crisfield (Md.-Va.)	....	......	......	10	1:62,500
Hallwood (Md.-Va.)	....	......	......	10	1:62,500
Indian Head (Md.-Va.) [d]	*66.08*	......	......	20	1:62,500
Smiths Point (Md.-Va.)	11.20	......	......	10	1:62,500
Middlesboro, (Ky.-Va.-Tenn.) [e]	....	......	......	20	1:62,500
Total, Virginia	29,063.11				

[a] Point Lookout sheet, on scale of 1:62,500, has been reduced and forms part of St. Mary sheet, on scale of 1:125,000.

[b] Washington double sheet is composed of East Washington and West Washington sheets.

[c] Montross, Piney Point, and Wycomico sheets, on scale of 1:62,500, have been reduced and form parts of Nomini sheet, on scale of 1:125,000.

[d] Indian Head and West Washington sheets are resurveys of parts of Mount Vernon sheet, on scale of 1:125,000.

[e] Middlesboro sheet, on scale of 1:62,500, is a resurvey of part of Cumberland Gap sheet, on scale 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
WEST VIRGINIA:	*Sq. miles.*			*Feet.*	
Accident (Md.-Pa.-W. Va.)	9.97	1898	......	20	1:62,500
Belleville (W. Va.-Ohio)	221.90	1903	......	20	1:62,500
Beverly (W. Va.-Va.)	890.95	1887	......	100	1:125,000
Blacksville (W. Va.-Pa.)	203.76	1902	......	20	1:62,500
Bruceton (W. Va.-Pa.)	203.43	1902	......	20	1:62,500
Buckhannon	931.51	1891	......	100	1:125,000
Burnsville[a]	**232.48*	1903	......	20	1:62,500
Cameron (W. Va.-Ohio-Pa.)	210.60	1902	......	20	1:62,500
Charleston	937.88	1890	1897	100	1:125,000
Christiansburg (Va.-W. Va.)	24.00	1887	......	100	1:125,000
Clarington (W. Va.-Ohio)	48.22	1903	......	20	1:62,500
Clarksburg	230.86	1901	......	20	1:62,500
Dublin (Va.-W. Va.)	206.81	1887	......	100	1:125,000
Fairmont	230.86	1901	......	20	1:62,500
Flintstone (Md.-W. Va.-Pa.)	36.19	1898	......	20	1:62,500
Franklin (W. Va.-Va.)	797.91	1887	1895	100	1:125,000
Frostburg (Md.-W. Va.-Pa.)	40.98	1897	......	20	1:62,500
Glenville[a]	*232.48*	1903	......	20	1:62,500
Guyandot (W. Va.-Ohio)[b]	*187.61*	1901	......	20	1:62,500
Hancock (Md.-W. Va.-Pa.)	153.87	1899	......	20	1:62,500
Harpers Ferry (Va.-W. Va.-Md.)	278.63	1886	......	100	1:125,000
Hinton	944.21	1887	......	100	1:125,000
Huntersville	937.88	1889	......	100	1:125,000
Huntington (W. Va.-Ohio-Ky.)[b]	891.42	1890	......	100	1:125,000
Kanawha Falls	937.88	1890	1895	100	1:125,000
Kenova (Ky.-W. Va.-Ohio)[c]	133.26	1901	......	100	1:125,000
Lewisburg (Va.-W. Va.)	543.08	1887	......	100	1:125,000
Littleton (W. Va.-Pa.)	228.09	1903	......	20	1:62,500
Mannington (W. Va.-Pa.)	203.76	1903	......	20	1:62,500
Marietta (W. Va.-Ohio)	115.59	1902	......	20	1:62,500

[a] Glenville and Burnsville sheets, on scale of 1:62,500, are resurveys of the north half of Sutton sheet, on scale of 1:125,000.

[b] Guyandot and Milton sheets, on scale of 1:62,500, are resurveys of the north half of Huntington sheet, on scale of 1:125,000.

[c] Ceredo, unfinished sheet, on scale of 1:62,500, has been reduced and forms part of Kenova sheet, on scale of 1:125,000.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
West Virginia—Continued.	Sq. miles.			Feet.	
Milton [a]	***234.07*	1901	......	20	1:62,500
Monterey (Va.-W. Va.)	306.83	1887	......	100	1:125,000
Morgantown (W. Va.-Pa.)	203.51	1900	......	20	1:62,500
New Martinsville (W. Va.-Ohio)	152.39	1903	......	20	1:62,500
New Matamoras (Ohio-W. Va.)	11.41	1903	......	20	1:62,500
Nicholas	937.88	1889	1899	100	1:125,000
Oakland (Md.-W. Va.) [b]	*30.86*	1899	......	20	1:62,500
Oceana (W. Va.-Va.-Ky.)	935.31	1884	1896	100	1:125,000
Parkersburg (W. Va.-Ohio)	36.56	1902	......	20	1:62,500
Pawpaw (Md.-W. Va.-Pa.)	91.20	1898	......	20	1:62,500
Philippi	231.67	1902	......	20	1:62,500
Piedmont (W. Va.-Md.) [b]	653.30	1884	1894	100	1:125,000
Pocahontas (Va.-W. Va.)	416.24	1885	1892	100	1:125,000
Raleigh	944.21	1885	1895	100	1:125,000
Romney (W. Va.-Va.-Md.)	898.40	1885	......	100	1:125,000
Center Point	230.86	1903	......	20	1:62,500
St. George	925.06	1885	......	100	1:125,000
Staunton (Va.-W. Va.)	63.64	1887	......	100	1:125,000
Steubenville (W. Va.-Ohio-Pa.)	84.81	1902	......	20	1:125,000
Sutton [c]	931.51	1891	......	100	1:125,000
Tazewell (Va.-W. Va.)	413.00	1885	1893	100	1:125,000
Vadis	231.67	1902	......	20	1:62,500
Warfield (W. Va.-Ky.-Va.)	561.79	1885	......	100	1:125,000
Wellsville (W. Va.-Ohio-Pa.)	55.87	1902	......	20	1:62,500
West Union	230.86	1903	......	....	....
Wheeling (W. Va.-Ohio-Pa.)	172.59	1901	......	20	1:62,500
Winchester (Va.-W. Va.)	348.37	1885	1891	100	1:125,000
Woodstock (Va.-W. Va.)	196.64	1886	......	100	1:125,000

[a] Guyandot and Milton sheets, on scale of 1:62,500, are resurveys of the north half of Huntington sheet, on scale of 1:125,000.

[b] Oakland sheet, on scale of 1:62,500, is a resurvey of parts of Piedmont sheet, on scale of 1:125,000.

[c] Glenville and Burnsville sheets, on scale of 1:62,500, are resurveys of the north half of Sutton sheet, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
WEST VIRGINIA—Continued.	*Sq. miles.*			*Feet.*	
In process of mapping—					
Ceredo (W. Va.-Ohio-Ky.)[a]	**50.00*	1901	......	20	1:62,500
Holbrook	113.00	......	......	20	....
Total, West Virginia	20,944.82				
WISCONSIN:					
Baraboo	217.28	1892	......	20	1:62,500
Bay View	153.64	1899	......	20	1:62,500
Briggsville	216.40	1900	......	20	1:62,500
Brodhead (Wis.-Ill)	218.92	1891	......	20	1:62,500
Delavan	219.91	1891	......	20	1:62,500
Denzer	217.28	1898	......	20	1:62,500
Eagle	219.04	1889	1903	20	1:62,500
Elkader (Iowa-Wis.)	100.69	1898	......	20	1:125,000
Evansville	219.04	1888	......	20	1:62,500
Geneva	219.91	1891	......	20	1:62,500
Gogebic Iron Range (Wis.-Mich.)[c]	....	1890	......	....	....
Hartford	217.28	1901	......	20	1:62,500
Iron River (Mich.-Wis.)	308.04	1895	......	20	1:62,500
Janesville	219.91	1891	......	20	1:62,500
Koshkonong	219.04	1888	......	20	1:62,500
Lancaster (Wis.-Iowa-Ill.)	681.34	1897	......	20	1:125,000
Madison	218.16	1887	......	20	1:62,500
Marathon Special[d]	*845.82*	1900	......	20	1:125,500
Milwaukee	92.20	1890	1899	20	1.62,500
Mineral Point (Wis.-Ill.)	867.45	1900	......	20	1:125,000
Muskego	219.04	1899	......	20	1:62,500
Oconomowoc	218.16	1890	......	20	1:62,500

[a] Ceredo, unfinished sheet, on scale of 1:62,500, has been reduced and forms part of Kenova sheet, on scale of 1:125,000.

[b] Oakland and Davis sheets, on scale of 1:62,500, are resurveys of parts of Piedmont sheet, on scale of 1:125,000.

[c] Gogebic Iron Range sheet is formed by parts of Upson and Ironwood unfinished sheets, on scale of 1:62,500.

[d] Marathon Special sheet, on scale of 1:125,000, is formed by parts of Marshfield, Medford, Merrill, and Wausau unfinished sheets, on scale of 1:125,000.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in eastern section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
WISCONSIN—Continued.	*Sq. miles.*			*Feet.*	
Port Washington	122.49	1890	1901	20	1:62,500
Portage	216.40	1899	......	20	1:62,500
Poynette	217.28	1899	......	20	1:62,500
Racine	172.52	1890	1903	20	1:62,500
Richland Center	870.90	1903	......	20	1:125,000
St. Croix Dalles (Wis.-Minn.)	163.28	1897	......	20	1:62,500
Shopiere	219.91	1891	......	20	1:62,500
Silver Lake	219.91	1891	......	20	1:62,500
Stoughton	219.04	1889	......	20	1:62,500
Sun Prairie	218.16	1889	......	20	1:62,500
The Dells	216.40	1899	......	20	1:62,500
Waterloo	218.16	1888	......	20	1:62,500
Watertown	218.16	1889	......	20	1:62,500
Waukesha	218.16	1890	1899	20	1:62,500
Waukon (Iowa-Wis.)	276.58	1900	......	20	1:125,000
Wausau Special [a]	**845.82*	1899	......	20	1:125,000
West Bend	217.28	1901	......	20	1:62,500
Whitewater	219.04	1889	1903	20	1:62,500
In process of mapping—					
Antigo [a]	210.54	......	......	20	1:125,000
Eland [a]	212.36	......	......	20	1:125,000
Ironwood (Wis.-Mich.) [b]	11.75	......	......	20	1:125,000
Marshfield [c]	212.36	......	......	20	1:125,000
Medford [c]	210.54	......	......	20	1:125,000
Merrill [a c]	421.09	......	......	20	1:125,000
Upson [b]	19.50	......	......	20	1:125,000
Wausau [a b]	424.73	......	......	20	1:125,000
Total, Wisconsin	10,909.27				

[a] Wausau Special sheet, on scale of 1:125,000, is formed by parts of Antigo, Eland, Merrill, and Wausau unfinished sheets, on scale of 1:125,000.

[b] Gogebic Iron Range sheet is formed by parts of Upson and Ironwood unfinished sheets, on scale of 1:62,500.

[c] Marathon Special sheet, on scale of 1:125,000, is formed by parts of Marshfield, Medford, Merrill, and Wausau unfinished sheets, on scale of 1:125,000.

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WESTERN SECTION.

FIELD WORK.

Topographic work in the western section was carried on under two appropriations—that for topographic surveys and that for survey of forest reserves. The following table shows the combined results:

Topographic surveys in the western section from May 1, 1903, to April 30, 1904.

State or Territory.	Contour interval.	Scale of publication. 1:125,000. New.	1:125,000. Resurvey.	1:62,500. New.	1:62,500. Resurvey.	Total area surveyed.	Levels. Distance run.	Levels. Bench marks.
		Sq. mi.	*Sq. mi.*	*Sq. mi.*	*Sq. mi.*	*Sq. mi.*	*Miles.*	
Arizona	50–100	2,363	......	......	311	2,674	523	137
California	{ 5–20–50 100	2,227	......	282	229	[a] 2,786	802	134
Colorado	50–100	....	......	694	......	[b] 709	321	95
Indian Territory	50	....	40	......	......	40	......	......
Montana	5–20–100	303	......	763	......	[c] 1,259	330	96
Oregon	100	641	......	......	......	641	498	160
South Dakota	20	....	......	328	......	328	136	32
Texas	100	1,430	......	99	......	1,529	......	......
Utah	100	....	84	......	......	[d] 98	23	9
Washington	100	2,891	......	......	......	2,891	969	140
Wyoming	50	1,273	899	......	......	2,172	332	69
Total	....	11,128	1,023	2,166	540	15,127	3,934	872

[a] 25 square miles resurvey and 23 square miles new area on scale of 1:24,000.

[b] 15 square miles resurvey on scale of 1:25,000.

[c] 185 square miles new area on scale of 1:24,000, and 8 square miles resurvey on scale of 1:25,000.

[d] 14 square miles new area on scale of 1:25,000.

SUMMARY.

Topographic work was carried on during the season by various parties in California, Colorado, Indian Territory, Montana, South Dakota, Texas, Utah, Washington, and Wyoming, which resulted in the completion of surveys of nineteen quadrangles and three special districts, and the partial survey of ten quadrangles and three special districts. The total new area surveyed was

6,652 square miles, of which 4,264 square miles were for publication on the scale of 1:125,000; 2,166 square miles were for publication on the scale of 1:62,500, and 222 square miles were on special scales. In addition, an area of 1,216 square miles was resurveyed, 939 square miles of which were on the scale of 1:125,000; 229 square miles were on the scale of 1:62,500, and 48 square miles were on special scales. In connection with this work 2,526 miles of levels were run and 533 permanent bench marks were established.

DETAILS OF FIELD WORK, BY STATES.

California.—Part of the work in California was carried on under a cooperative agreement between the Director of the United States Geological Survey and the State board of examiners of California, whereby $10,000 appropriated by the State legislature was to be met by a like sum from the Geological Survey, thus making a total of $20,000 for cooperative surveys. Of this sum, $6,250 of the Federal funds was to be chargeable to the appropriation for topographic work.

The locality selected for the cooperative work was the Sacramento Valley, and one party was engaged in the topographic survey of the Vina and Tehama quadrangles, for publication on the scales of 1:62,500 and 1:31,680, with contour intervals of 20 and 5 feet, respectively.

Two parties were engaged in other localities in California in the topographic survey of one quadrangle and four special districts—the Bakersfield, for publication on the scale of 1:62,500, with a contour interval of 50 feet; the Bully Hill, Little Backbone, and Iron Mountain specials, for publication on the scale of 1:24,000, with a contour interval of 50 feet; and the Oil Center special, for publication on the scale of 1:24,000, with a contour interval of 20 feet.

After October, 1903, Mr. R. B. Marshall, topographer, had immediate supervision over all work in this State.

MAP OF ARIZONA AND NEW MEXICO, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Topographic surveys made in 1903–4 in cooperation with the State of California.

County.	Sheet.	Topographer.	Area mapped	Levels.		Traverse.
				Spirit levels.	Bench marks.	
			Sq. miles.	*Miles.*		*Miles.*
Tehama	Tehama	A. I. Oliver, A. H. Sylvester, C. L. Nelson.	229	50	4	......
Tehama and Glenn.	Vina	A. H. Sylvester, A. I. Oliver, G. R. Davis, C. L. Nelson.	229	143	7	58
Shasta	Bully Hill Special	A. B. Searle	6	......	......	17
Do	Little Backbone Special.	......do	14	......	......	31
Do	Iron Mountain Special.	......do	5	15	......	8
Kern	Bakersfield	G. R. Davis, A. B. Searle, H. R. Ferriss.	53	61	13	......
Do	Oil Center Special	A. B. Searle, H. R. Ferriss.	23	41	7	9
Colusa	Colusa	E. W. Glafcke	......	176	50	......
Do	Arbuckle					
Tehama	Tehama					
Glenn	Willow					
Glenn and Tehama.	Vina					
Total			559	486	81	123

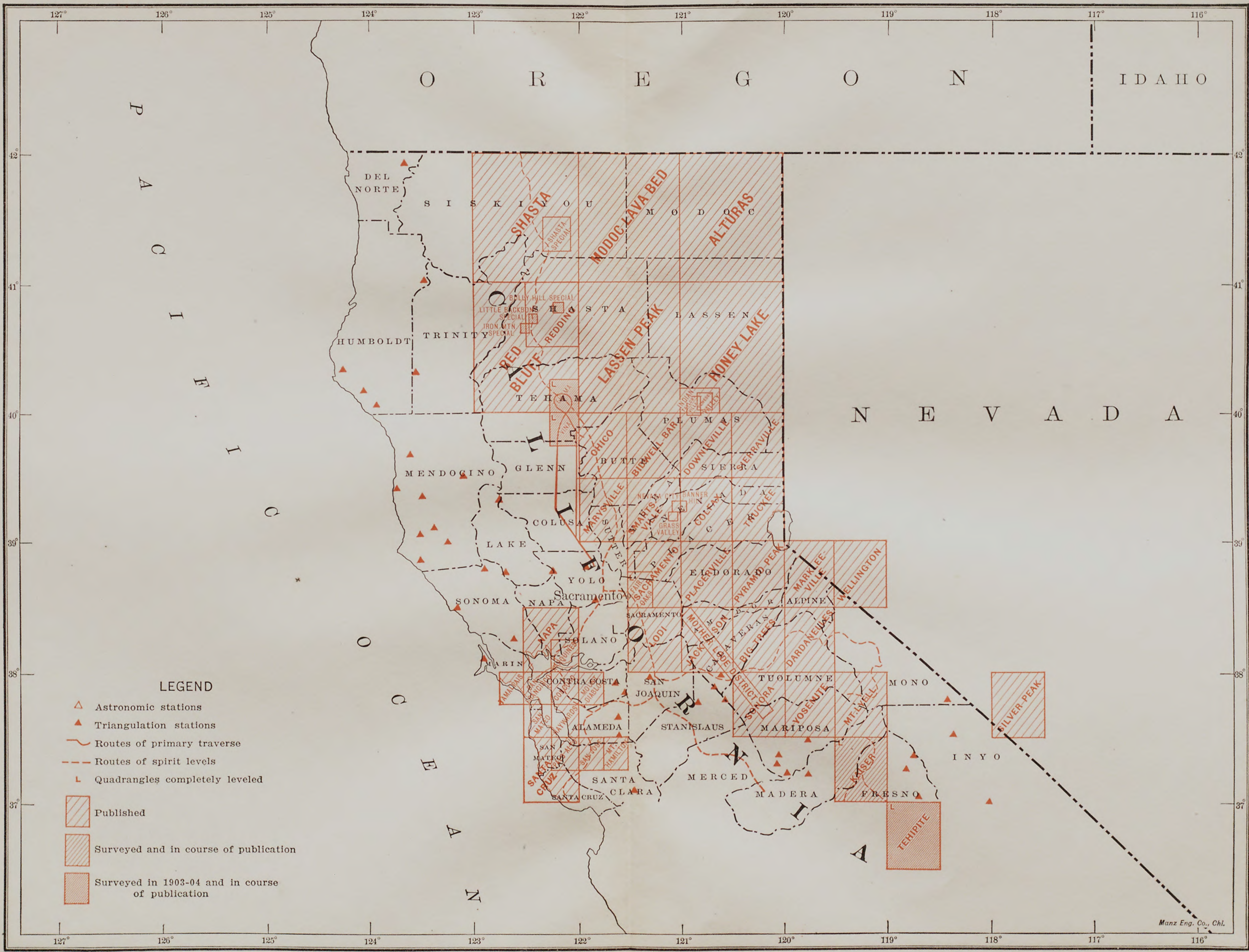
Colorado.—Three parties were engaged in the topographic survey of three quadrangles, the Central City, Georgetown, and Lake City, for publication on the scale of 1:62,500, with a contour interval of 100 feet, and the resurvey of the Cripple Creek Special district, for publication on the scale of 1:25,000, with a contour interval of 50 feet.

Topographic surveys in Colorado, 1903-4.

County.	Sheet.	Topographer.	Area mapped.	Levels.		Traverse.
				Spirit levels.	Bench marks.	
			Sq. miles.	*Miles.*		*Miles.*
Boulder, Gilpin, Grand, and Clear Creek.	Central City	Frank Tweedy	229	80	20	736
Clear Creek and Park.	Georgetown	do	230	40	14	294
	Black Hawk	Frank Tweedy, in charge.		50	10	
	Boulder	do		16	4	
Teller	Cripple Creek special.	R. T. Evans	15	82	35	145
Hinsdale	Lake City	J. F. McBeth	235	53	12	422
Total			709	321	95	1,597

Indian Territory.—Two parties were engaged in revision of three quadrangles. Mr. R. A. Farmer, topographer, ran 953 miles of traverse in the Chickasaw quadrangle, in the Chickasaw Nation; and Mr. Fred McLaughlin revised 40 square miles of the Sansbois and Tuskahoma quadrangles, in the Choctaw Nation. All of this work is designed for publication on the scale of 1: 125,000, with a contour interval of 50 feet.

Montana.—In connection with the reclamation service, five parties were engaged in topographic surveys on four quadrangles—the Harlem, Wayne Creek, Bowdoin, and Saco—and on parts of the Hinsdale, Fort Belknap, Malta, Coburg, and those north of Bowdoin and south of Saco. This work was done on two scales—1:62,500 and 1:24,000—with contour intervals of 20 and 5 feet, respectively. Another party was engaged during October in the extension of the Butte Special map, on the scale of 1:15,000, with a contour interval of 20 feet.



MAP OF NORTHERN CALIFORNIA, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Topographic surveys in Montana, 1903–4.

County.	Sheet.	Topographer.	Area mapped.	Levels.		
				Spirit levels.	Bench marks.	Traverse.
			Sq. mi.	*Miles.*		*Miles.*
Choteau	Harlem	H. L. Baldwin, jr., in charge; H. H. Hodgeson, Fred. McLaughlin, J. E. Blackburn.	198	......	......	857
Valley	Bowdoin	H. L. Baldwin, jr., in charge; H. H. Hodgeson, Pearson Chapman, E. R. Bartlett, J. E. Blackburn, Wm. P. Flynn.	199	21	6	847
Choteau	Wayne Creek	H. L. Baldwin, jr., in charge; H. H. Hodgeson, Fred. McLaughlin, E. R. Bartlett, J. E. Blackburn.	198	36	10	823
Do	Saco	H. L. Baldwin, jr., in charge; H. H. Hodgeson, Fred. McLaughlin, E. R. Bartlett, Pearson Chapman, J. E. Blackburn, Wm. P. Flynn.	198	102	24	948
Valley	Hinsdale	H. L. Baldwin, jr., in charge; Pearson Chapman, H. H. Hodgeson, E. R. Bartlett, W. B. Freeman.	118	34	10	560
Choteau	Fort Belknap	W. B. Freeman	18	12	3	75
Valley	South of Saco	H. H. Hodgeson	6	18	5	22
Do	Beaver Creek	M. S. Bright	......	43	18	53
Do	Malta	W. B. Freeman	8½	......	......	41
Do	North of Bowdoin	J. E. Blackburn	4½	6	2	35
Do	Coburg and north of.	M. S. Bright	......	33	9	......
Silverbow Jefferson	Butte Special	R. H. Chapman	8	......	......	......
Total			956	305	87	4,261

Oregon.—In connection with the reclamation service a level line was run from Huntington, via Ontario, to Prineville, by Mr. C. H. Semper, levelman. There were completed 323 miles of line, and 100 permanent bench marks were established.

South Dakota.—In connection with the reclamation service, one party was engaged in the topographic survey of two quadrangles in the western part of the State, the St. Onge and Belle Fourche, for publication on the scale of 1: 62,500, with a contour interval of 20 feet, the former only having been completed.

Topographic surveys in South Dakota, 1903-4.

County.	Sheet.	Topographer.	Area mapped.	Levels.		Traverse.
				Spirit levels.	Bench marks.	
			Sq. miles.	*Miles.*		*Miles.*
Butte; Lawrence	Belle Fourche	Wm. H. Herron	115	64	15	699
Butte; Meade	St. Onge	do	213	72	17	474
Total			328	136	32	1, 173

Texas.—Two parties were engaged in topographic surveys on four quadrangles—the Chisos Mountain, Boquillas, and Montague, for publication on the scale of 1:125,000, with contour intervals of 100 and 50 feet; and the West San Antonio, for publication on the scale of 1:62,500, with a contour interval of 10 feet. The leveling for these sheets has been previously reported.

Topographic surveys in Texas, 1903-4.

County.	Sheet.	Topographer.	Area mapped.	Levels.		Traverse.
				Spirit levels.	Bench marks.	
			Sq. miles.			*Miles.*
Brewster	Chisos Mountain	Arthur Stiles	696			1, 106
Do	Boquillas	do	210			248
Clay; Montague	Montague	Fred. McLaughlin	524			775
Bexar	West San Antonio	do	99			177
Total			1, 529			2, 306

MAP OF SOUTHERN CALIFORNIA, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Utah.—One party was engaged on the topographic survey of the Cottonwood Special district for publication on the scale of 1: 25,000 with a contour interval of 50 feet.

Topographic surveys in Utah, 1903–4.

County.	Sheet.	Topographer.	Area mapped.	Levels.		Tra-verse.
				Spirit levels.	Bench marks.	
			Sq. miles.	*Miles.*		*Miles.*
Wasatch ...... Summit .... Utah	Cottonwood Special	R. H. Sargent....	14	23	7	162

Washington.—Two parties were engaged in topographic work on four quadrangles—the Okanogan and Chopaka, with a contour interval of 100 feet; and the Oakesdale and Pullman, with a contour interval of 50 feet, all for publication on the scale of 1:125,000. Two lines of levels were run in connection with the reclamation service.

Topographic surveys in Washington, 1903–4.

County.	Sheet.	Topographer.	Area mapped.	Levels.		Trav-erse.
				Spirit levels.	Bench marks.	
			Sq. miles.	*Miles.*		*Miles.*
Okanogan	Chopaka	L. C. Fletcher.........	639	65	......	245
Do	Okanogan	.....do	797	119	10	779
Spokane...... Whitman.....	Oakesdale	A. E. Murlin	797	141	10	2, 026
Do	Pullman.......	A. E. Murlin, L. C. Fletcher.	227	304	37	678
Adams .... Douglas	....	R. B. Shaw...........	....	55	19	......
		R. A. Farmer........	....	148	38	......
Total...	....	....	2, 460	832	114	3, 728

Wyoming.—Two parties were engaged in topographic surveys on two quadrangles, the completion of the Devils Tower and the resurvey of the Laramie, both for publication on the scale of 1:125,000, with a contour interval of 50 feet. Leveling was also carried on near Rawlins in connection with the reclamation service.

Topographic surveys in Wyoming, 1903–4.

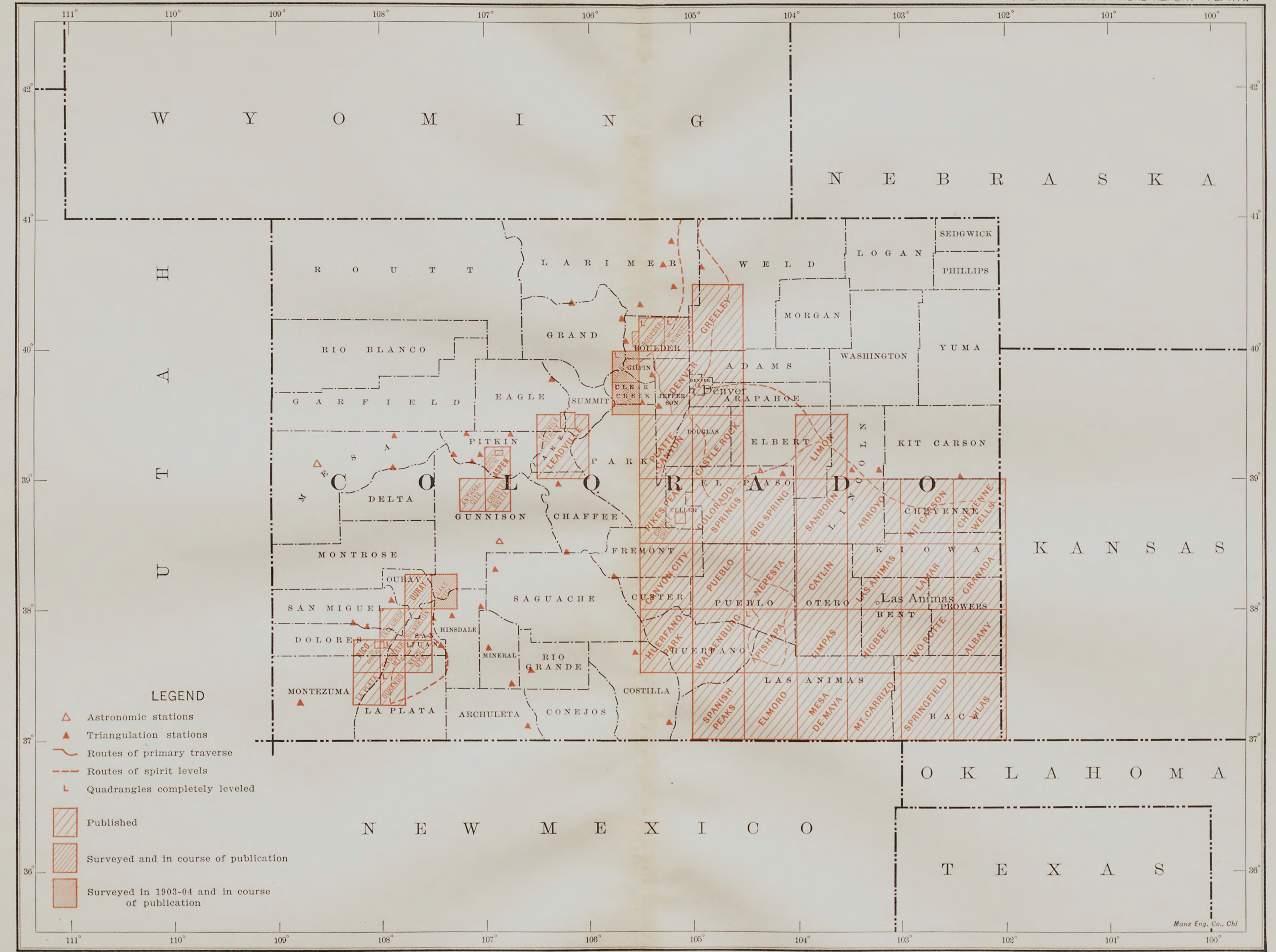
County.	Sheet.	Topographer.	Area mapped.	Levels.		Traverse.
				Spirit levels.	Bench marks.	
			Sq. miles.	*Miles.*		*Miles.*
Crook	Devils Tower	W. H. Herron	374			878
Albany	Laramie	Wm. Stranahan	899	188	42	973
Carbon		E. W. Glafcke		88	25	
Total			*1,273*	*276*	*67*	*1,851*

SURVEYS OF FOREST RESERVES.

The topographic survey of forest reserves was placed under the direction of Mr. E. M. Douglas, geographer, and the forest examinations under the direction of Mr. Henry Gannett, geographer.

Topographic surveys were conducted in the following reserves: Sierra, Santa Barbara, Wallowa (proposed), Mount Rainier, Flathead, Crow Creek, Uinta, Santa Rita, Santa Catalina, and Grand Canyon. Portions of the boundary lines of the Washington, Mount Rainier, Bitterroot, Lewis and Clarke, Madison, and Uinta reserves were surveyed. Eight quadrangles were mapped, and the survey of five others was commenced. The total new area surveyed was 6,864 square miles, for publication on the scale of 1 : 125,000. In addition, 395 square miles were resurveyed, of which 84 square miles were for publication on the scale of 1 : 125,000 and 311 square miles for publication on the scale of 1 : 62,500. In connection with the above, 1,232 miles of level lines were run and 289 permanent bench marks established; and 278 miles of boundary lines were surveyed and marked. Details follow, by States.

Arizona.—Four parties were engaged in the topographic survey of five quadrangles—the Bright Angel and Vishnu, for



MAP OF COLORADO, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL publication on the scale of 1 : 62,500, with a contour interval of 50 feet; and the Tucson, Patagonia, and Nogales, for publication on the scale of 1:125,000, with a contour interval of 100 feet. Level lines from the Nogales datum were connected with those based on the Phoenix datum.

Topographic surveys in forest reserves in Arizona, 1903–4.

County.	Sheet.	Reserve.	Topographer.	Area mapped.	Levels.		Traverse.
					Spirit levels.	Bench marks.	
				Sq. miles.	*Miles.*		*Miles.*
Coconino	Bright Angel	Grand Canyon	F. E. Matthes, in charge; R. T. Evans.	70			143
Do	Vishnu	do	do	241		2	346
Pima	Tucson	Santa Catalina	T. M. Bannon, in charge; H. H. Hodgeson, R. T. Evans.	1,009	223	52	1,219
Do	Patagonia	Santa Rita	do	1,014	59	16	1,570
Santa Cruz	Nogales		do	340			790
			M. S. Bright		241	67	
Total				2,674	523	137	4,068

California.—Under the cooperative arrangement with California previously mentioned, $3,750 of the Geological Survey funds were allotted to surveying forest reserves, and two parties were engaged in the survey of the Tehipite quadrangle, for publication on the scale of 1 : 125,000, with a contour interval of 100 feet.

Another party was engaged in the survey of the Santa Maria quadrangle and adjoining area, for publication on the scale of 1 : 125,000, with a contour interval of 100 feet.

Topographic surveys in forest reserves in California, 1903–4.

County.	Sheet.	Reserve.	Topographer.	Area mapped.	Levels.		Traverse.
					Spirit levels.	Bench marks.	
				Sq. miles.	*Miles.*		*Miles.*
Tulare Fresno	Tehipite	Sierra	R. B. Marshall, in charge; G. R. Davis, C. L. Nelson.	957	97	27	713
			L. D. Ryus		65	14	
Santa Barbara San Luis Obispo	Santa Maria	Santa Barbara.	S. N. Stoner, J. P. Harrison.	1,270	154	12	1,163
Total				2,227	316	53	1,876

Idaho.—Bitterroot Reserve: The survey of a portion of the north boundary of this reserve was commenced in May by Mr. Sledge Tatum, topographer. In June Mr. Tatum was transferred to other work and Mr. J. P. Walker, United States surveyor, was left in charge of the party. Work was continued until September, when the party was disbanded.

Montana.—One party was engaged in the topographic survey of the Kintla Lakes quadrangle, for publication on the scale of 1:125,000, with a contour interval of 100 feet.

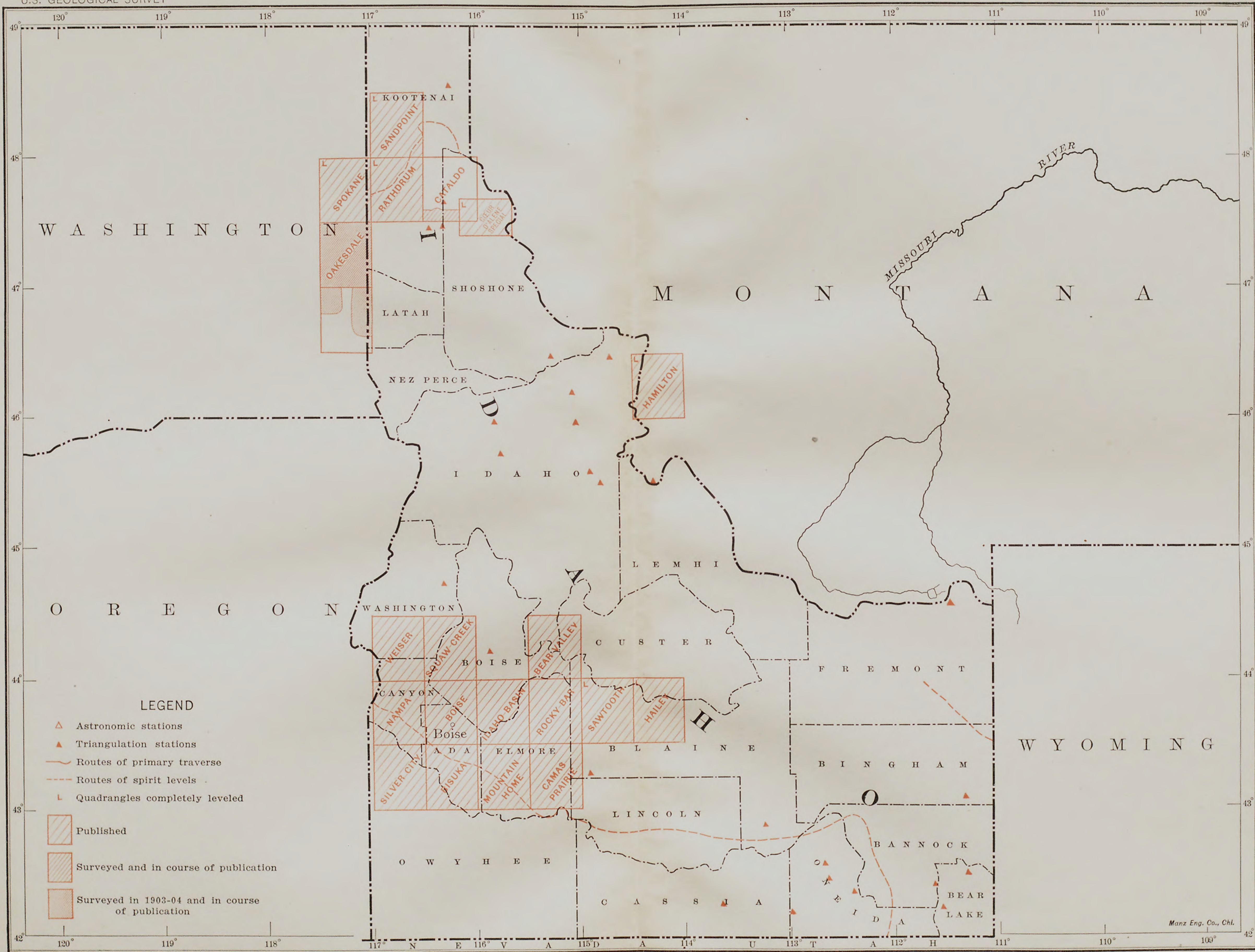
Topographic surveys in forest reserves in Montana in 1903–4.

County.	Sheet.	Reserve.	Topographer.	Area mapped.	Levels.		Traverse.
					Spirit levels.	Bench marks.	
				Sq. miles.	*Miles.*		*Miles.*
Flathead	Kintla Lakes.	Lewis and Clarke.	R. H. Chapman.	303	25	9	143

Lewis and Clarke Reserve: About July 1 Mr. W. H. Thorn, U. S. surveyor, began a survey of portions of the south and east boundaries of the Lewis and Clarke Forest Reserve. He commenced at the corner of Ts. 15 and 16 N., Rs. 11 and 12 W., on the south boundary. From this point he ran east to the southeast corner of the reserve, and then north along the east boundary. About the middle of November, because of inclement weather, work was discontinued for the season, 93 miles of line having been surveyed.

Madison Reserve: Mr. F. E. Joy, United States surveyor, was detailed to survey portions of the boundary of the Madison Reserve. He commenced operations about the middle of July and continued until about the 1st of November. During this interval 51 miles of line were surveyed.

Oregon.—One party was engaged in the topographic survey of the Telocaset quadrangle, for publication on the scale of 1:125,000, with a contour interval of 100 feet.



MAP OF IDAHO, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Topographic surveys in forest reserves in Oregon, 1903–4.

County.	Sheet.	Reserve.	Topographer.	Area mapped.	Levels.		Traverse.
					Spirit levels.	Bench marks.	
				Sq. miles.	*Miles.*		*Miles.*
Union	Telocaset	Wallowa	C. W. Sutton	641	175	60	858

Utah.—One party was engaged for a part of the month of August in the topographic survey of the Strawberry Valley quadrangle, for publication on the scale of 1:125,000, with a contour interval of 100 feet.

Topographic surveys in forest reserves in Utah, 1903–4.

County.	Sheet.	Reserve.	Topographer.	Area mapped.	Levels.		Traverse.
					Spirit levels.	Bench marks.	
				Sq. miles.	*Miles.*		*Miles.*
Wasatch	Strawberry Valley	Uinta	A. F. Dunnington	84	....	2	44

Washington.—One party was engaged in topographic surveys of the Mount Adams quadrangle, for publication on the scale of 1:125,000, with a contour interval of 100 feet.

Topographic surveys in forest reserves in Washington, 1903–4.

County.	Sheet.	Reserve.	Topographer.	Area mapped.	Levels.		Traverse.
					Spirit levels.	Bench marks.	
				Sq. miles.	*Miles.*		*Miles.*
Yakima	Mount Adams	Mount Rainier	A. H. Sylvester	431	137	26	1,000

Mount Rainier Reserve: Mr. S. E. Blout, surveyor, commenced the season's work about May 1 on the survey of portions of the northern and eastern boundaries of this reserve, and continued the work until about the middle of July, when he had completed the survey of 42 miles of line. Mr. Blout then began the survey of the southern boundary of the Washington Reserve, as stated below.

Washington Reserve: Plans were made for the survey of the southern and eastern boundaries of this reserve. Mr. R. A. Farmer, topographer, was detailed for the latter and part of the former. Mr. Farmer commenced operations at the corner of

Ts. 35 and 36 N., Rs. 22 and 23 E., and ran north on portions of the east boundary to an intersection with the international boundary. He then returned to the south boundary of the reserve, and from the southeast corner of T. 29 N., R. 19 E., ran west along the seventh standard parallel north to the summit of the Cascade Mountains, where connection was to be made with the line brought eastward by Mr. Blout, who began operations at the southeast corner of T. 29 N., R. 7 E., this point being the southwest corner of the reserve. Mr. Blout's line fell to the south of that of Mr. Farmer about 3 miles. Owing to the beginning of the severe storms of the wet season, work was discontinued until the following year. The combined results of the two parties above were 92 miles of surveyed line. Mr. Farmer finished on September 7 and Mr. Blout on September 18.

Wyoming.—One topographic party was engaged in the survey of the Sherman quadrangle, for publication on the scale of 1:125,000, with a contour interval of 50 feet.

Topographic surveys in forest reserves in Wyoming, 1903–4.

County.	Sheet.	Reserve.	Topographer.	Area mapped.	Levels.		Traverse.
					Spirit levels.	Bench marks.	
				Sq. miles.	*Miles.*		*Miles.*
Laramie	Sherman	Crow Creek	T. M. Bannon	899	56	2	1,701

Uinta Forest Reserve: Mr. A. F. Dunnington, topographer, was detailed to survey a portion of the south boundary of this reserve, and on August 1 organized a party at Heber, Utah, for this purpose. Before work was commenced, however, Mr. Dunnington learned that a contract had been let for the survey of the north boundary of the Uinta Indian Reservation, this line being coincident with the south boundary of the forest reserve. To prevent duplication of the work, Mr. Dunnington surveyed only the fractional east boundary of T. 5 S., R. 6 E., thus completing the survey of the west boundary of the forest reserve, after which he was engaged on topographic work in the same reserve.

In addition to this work Mr. Dunnington also exercised supervision over the work—both field and office—of Messrs.

MAP OF INDIAN TERRITORY, OKLAHOMA, AND NORTHERN TEXAS, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Joy, Farmer, Thorn, Blout, and Walker, United States surveyors.

OFFICE WORK.

In the western section all party chiefs, with the exception of those engaged in California, reported for office work in Washington at the end of the field season. A branch office was opened and maintained in the post-office building at Sacramento, in charge of Mr. R. B. Marshall, topographer, where all office work for the California sheets was completed.

Mr. A. F. Hassan, topographer, acted as proof reader and office draftsman for the western section, and also took charge of the office file of maps.

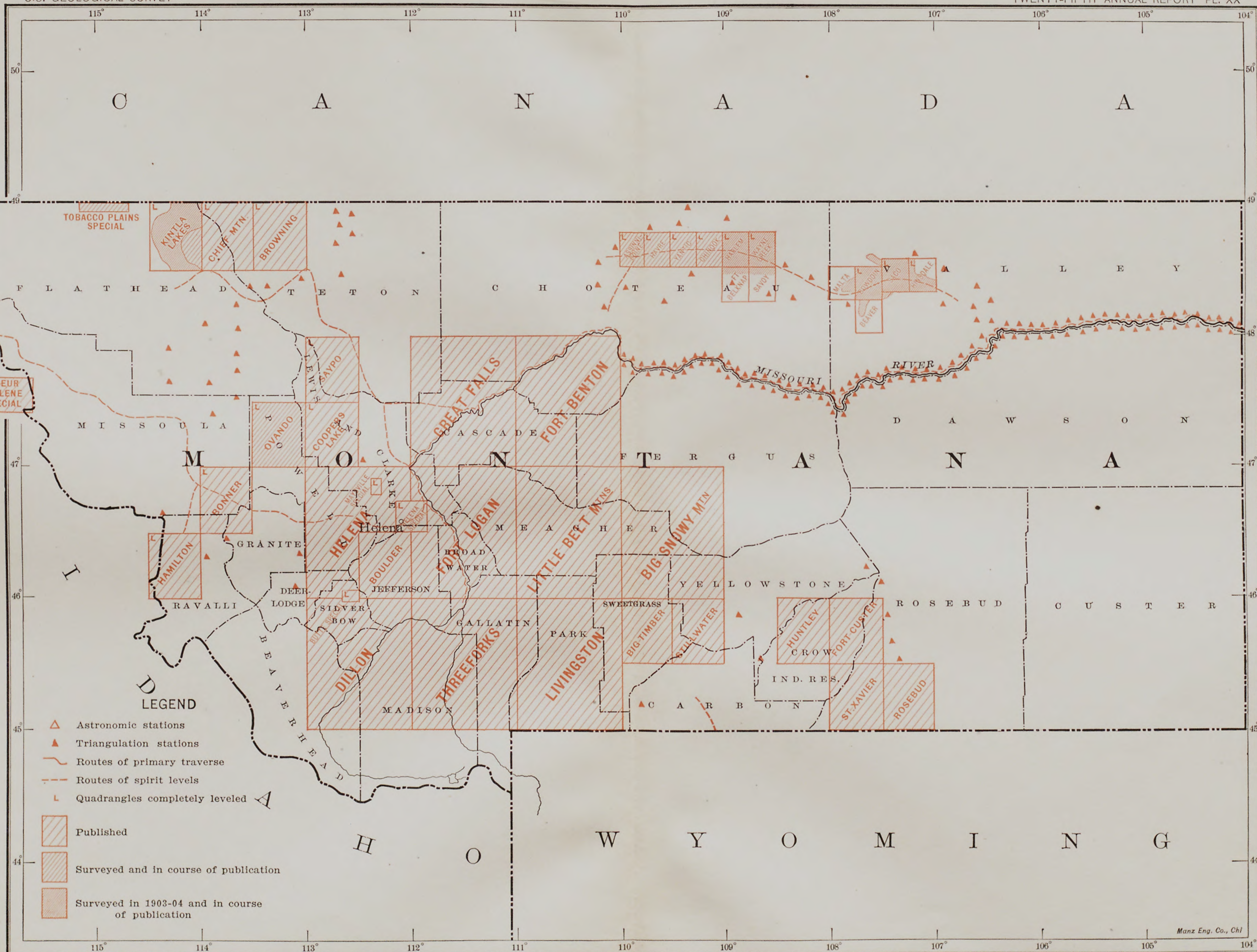
Mr. A. F. Dunnington, topographer, had supervision of the examination and copying of notes for all forest-reserve-boundary surveys, as well as of the drawing of the various plats connected therewith.

Miss Mary H. Corbett and Miss Mary Mitchell, in addition to attending to correspondence, were engaged in the tabulation of reports, copying land-survey notes, cataloguing maps, and other clerical duties.

Following is a list of the sheets completed in the office during the year:

Topographic sheets completed in office during 1903–4.

State and sheet.	Scale.	Contour interval.
ARIZONA:		*Feet.*
Bright Angel	1:62,500	50
Congress	1:125,000	100
Nogales	1:125,000	100
Patagonia	1:125,000	100
Tucson	1:125,000	100
Yuma	1:125,000	50
CALIFORNIA:		
Bully Hill Special	1:24,000	50
Little Backbone Special	1:24,000	50
Santa Maria	1:125,000	100
Tehama	1:62,500	20
Tehipite	1:125,000	100
Vina	1:125,000	20
COLORADO:		
Central City	1:62,500	100
Cripple Creek Special	1:25,000	50
Georgetown	1:62,500	100
Lake City	1:62,500	100
INDIAN TERRITORY:		
Chickasha	1:125,000	50
MONTANA:		
Bowdoin	1:62,500	20
Harlem	1:62,500	20
Saco	1:62,500	20
Wayne Creek	1:62,500	20
SOUTH DAKOTA:		
St. Onge	1:62,500	20
TEXAS:		
Boquillas	1:125,000	100
Chisos Mountain	1:125,000	100
Montague	1:125,000	50
West San Antonio	1:62,500	10
WASHINGTON:		
Chopaka	1:125,000	100
Oakesdale	1:125,000	50
Okanogan	1:125,000	100
WYOMING:		
Devils Tower	1:125,000	50
Laramie	1:125,000	50
Sherman	1:125,000	50



MAP OF MONTANA, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

QUADRANGLES MAPPED IN WESTERN SECTION SINCE 1879.

Following is a complete list of all quadrangles mapped by the Geological Survey in the western section from the date of its organization, in 1879, to the close of the fiscal year 1904:

Topographic surveys in western section, by States and quadrangles, to June 30, 1904.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
ARIZONA:	*Sq. miles.*			*Feet.*	
Bisbee (Ariz.-Mexico) [a]	160.00	1901, 1902	....	50	1:62,500
Bisbee Special [a]	**8.10*	1902	....	20	1:12,000
Bradshaw Mountains [b]	*986.29*	1900, 1901	....	100	1:125,000
Bright Angel [c]	*241.05*	1902, 1903	....	50	1:62,500
Camp Mohave (Ariz.-Nev.-Cal.)	2,507.67	1876, 1884	....	250	1:250,000
Canyon de Chelly (Ariz.-N. Mex.)	2,634.26	1883	....	200	1:250,000
Chino	3,886.67	1880 and Powell	....	250	1:250,000
Clifton	249.76	1900, 1901	....	100	1:62,500
Congress [b]	*986.29*	1902, 1903	....	100	1:125,000
Diamond Creek	3,886.67	1884 and Powell	....	250	1:250,000
Echo Cliffs [d]	3,838.56	1884 and Powell	....	250	1:250,000
Ehrenberg (Cal.)	53.00	1903	....	10	1:31,680
Florence	997.64	1900	....	100	1:125,000
Fort Defiance (Ariz.-N. Mex.)	3,689.97	1883	....	200	1:250,000
Globe	248.36	1900, 1901	....	50	1:62,500
Globe Special [e]	*6.00*	1901	....	20	1:12,000
Holbrook	3,933.59	1886	....	200	1:250,000
Jerome [b]	*980.50*	1902, 1903	....	100	1:125,000
Kaibab [c]	3,838.56	Powell	....	250	1:250,000
Marsh Pass	3,838.56	1883	....	200	1:250,000
Mount Trumbull	3,838.56	Powell	....	250	1:250,000
Needles (Ariz.-Cal.)	505.00	1902, 1903	....	50	1:125,000
Nogales	340.00	1902, 1903	....	100	1:125,000
Parker (Ariz.-Cal.)	140.00	1903	....	50	1:125,000
Patagonia	1,014.10	1903, 1904	....	100	1:125,000
Prescott [b]	3,933.59	1885	....	200	1:250,000
St. Johns (Ariz.-N. Mex.)	3,734.39	1886	....	200	1:250,000
St. Thomas (Ariz.-Nev.)	462.00	1884 and Powell	....	250	1:250,000
San Francisco Mountain	3,886.67	1878, 1880, 1884	....	250	1:250,000
Santa Maria [b]	*980.50*	1902	....	100	1:125,000
Tucson	1,008.69	1903, 1904	....	50	1:125,000
Tusayan	3,886.67	1883	....	200	1:250,000
Verde	3,933.59	1885	....	200	1:250,000
Vishnu [d]	*241.05*	1903	....	50	1:62,500
Yuma (Ariz.-Cal.-Mex.)	366.00	1902, 1903	....	50	1:125,000
Total	60,812.53				

[a] Bisbee sheet, on scale of 1:62,500, covers area of Bisbee Special sheet.

[b] Prescott sheet, on scale of 1:250,000, covers area of Bradshaw Mountains, Congress, Jerome, and Santa Maria sheets.

[c] Kaibab sheet, on scale of 1:250,000, covers area of Bright Angel sheet.

[d] Echo Cliffs sheet, on scale of 1:250,000, covers area of Vishnu sheet.

[e] Globe sheet, on scale of 1:62,500, covers area of Globe Special sheet.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
CALIFORNIA:	*Sq. miles.*			*Feet.*	
Ahwanee	4.00	1901	....	50	1:45,000
Alturas	3,580.54	1885 and Wheeler	....	200	1:250,000
Anaheim[a]	**247.65*	1894	1900	25	1:62,500
Arroyo Grande[b]	*170.00*	1895	....	50	1:62,500
Bakersfield	53.00	1903, 1904	....	50	1:62,500
Banner Hill Special[c]	11.90	1892	....	20	1:14,400
Bidwell Bar	918.53	1885, 1886, 1888	....	100	1:125,000
Big Trees	937.88	1890, 1891	....	100	1:125,000
Bully Hill Special[d]	*6.00*	1903	....	50	1:20,000
Calabasas[e]	*214.00*	1900, 1901	....	50	1:62,500
Camp Mohave (Cal.-Ariz.-Nev.)	189.00	1876, 1884	....	250	1:250,000
Camulos[e]	880.20	1893, 1900, 1901	....	100	1:125,000
Capistrano	88.00	1899	....	100	1:125,000
Cayucos[b]	*149.00*	1895	....	50	1:62,500
Chico	918.53	1886, 1888	....	100	1:125,000
Colfax[c]	925.06	1885, 1887	....	100	1:125,000
Concord	235.66	1893, 1894	....	25	1:62,500
Corona[a]	992.00	1894, 1899	....	100	1:125,000
Cucamonga	246.93	1894	....	50	1:62,500
Cuyamaca[f]	878.00	1891, 1901, 1902	....	100	1:125,000
Dardanelles	937.88	1891, 1896	....	100	1:125,000
Deep Creek	246.21	1898, 1899	....	50	1:62,500
Downey	247.65	1893, 1894	....	25	1:62,500
Downieville	918.53	1886, 1888	....	100	1:125,000
Ehrenberg (Cal.-Ariz.)	1.00	1903	....	10	1:31,680
El Cajon[f]	*250.45*	1891	1901	25	1:62,500
Elsinore[g]	992.00	1897, 1898	....	100	1:125,000
Escondido[h]	*249.76*	1891	1898	25	1:62,500
Fairoaks[i]	*233.28*	1901	....	10	1:62,500
Fernando	246.21	1897	....	50	1:62,500
Genesee Special[j]	33.20	1891	....	50	1:31,680
Goleta Special	76.00	1902	....	50	1:62,500

[a] Anaheim and Santa Ana sheets, on scale of 1:62,500, have been reduced and form parts of Corona sheet.

[b] Arroyo Grande, Cayucos, Port Harford, and San Luis Obispo sheets, on scale of 1:62,500, have been combined and form San Luis sheet, on scale of 1:125,000 sheet.

[c] Colfax sheet, on scale of 1:125,000, covers area of Banner Hill Special sheet, on scale of 1:14,400.

[d] Red Bluff sheet, on scale of 1:250,000, covers areas of Redding sheet, on scale of 1:125,000, and Tehama sheet, on scale of 1:62,500; also of the Bully Hill Special, Iron Mountain Special, and Little Backbone Special sheets, on scale of 1:24,000.

[e] Calabasas and Santa Susana sheets, on scale of 1:62,500, have been reduced and form parts of Camulos sheet.

[f] El Cajon and Jamul sheets, on scale of 1:62,500, have been reduced and form parts of Cuyamaca sheet.

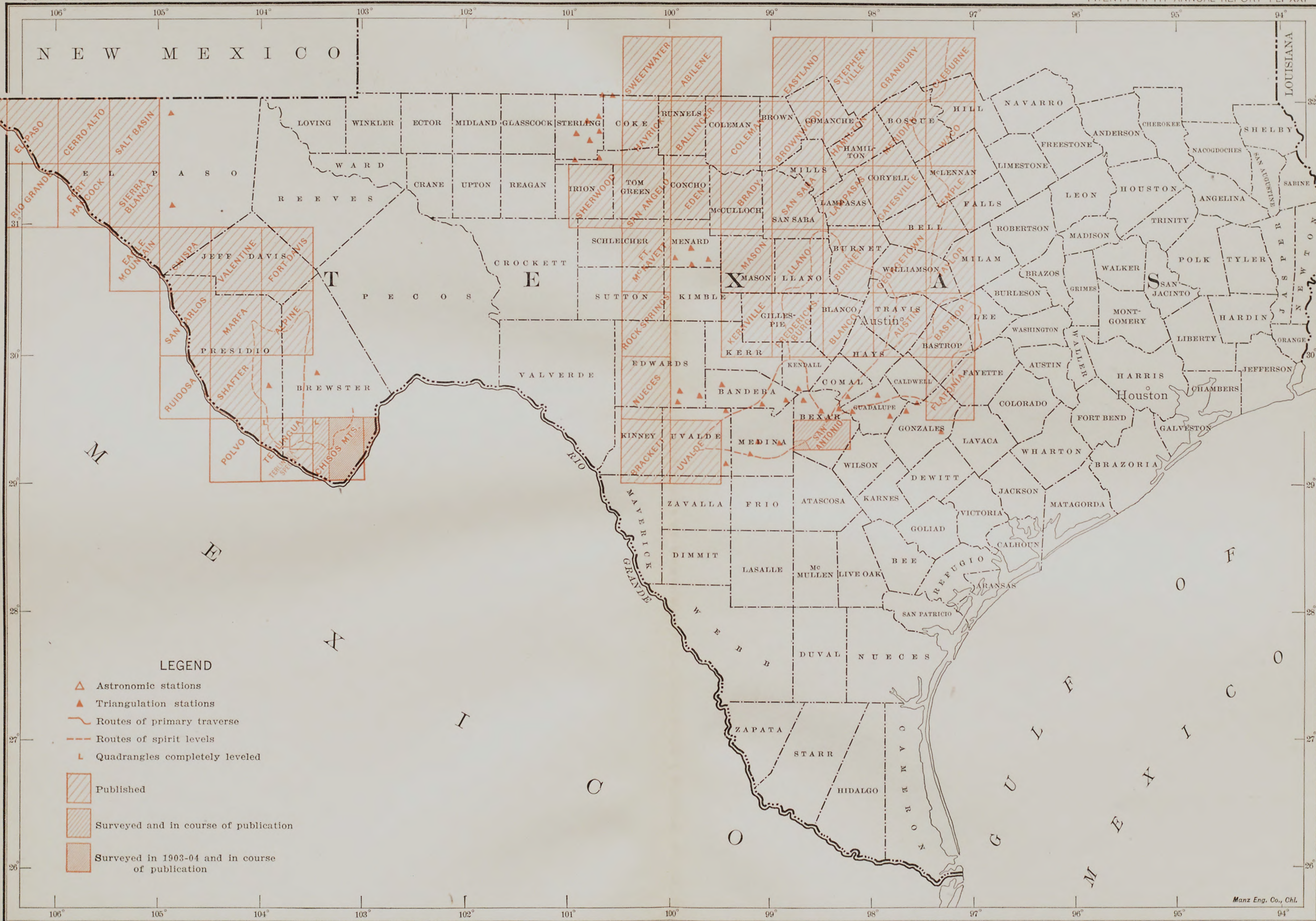
[g] Riverside sheet, on scale of 1:62,500, has been reduced and forms part of Elsinore sheet.

[h] Escondido and Oceanside sheets, on scale of 1:62,500, have been reduced and form parts of San Luis Rey sheet.

[i] Sacramento sheet, on scale of 1:125,000, covers area of Fairoaks sheet, on scale of 1:62,500.

[j] Honey Lake sheet, on scale of 1:250,000, covers areas of Taylorsville and Genesee Special sheets, on scale of 1:31,680, and Indian Valley sheet, on scale of 1:65,500.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.



MAP OF SOUTHERN TEXAS, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
CALIFORNIA—Continued.	*Sq. miles.*			*Feet.*	
Grass Valley Special [a]	11.90	1891	....	20	1:14,400
Haywards	236.44	1896	....	25	1:62,500
Hesperia	246.21	1898, 1899	....	50	1:62,500
Honey Lake [b]	3,634.42	1882	....	200	1:250,000
Hueneme	138.00	1901	....	50	1:62,500
Indian Valley [b]	241.20	1891	....	100	1:65,500
Indio Special	900.00	1901	....	100	1:125,000
Iron Mountain Special [c]	* *5.00*	1903	....	50	1:24,000
Jackson [d]	937.88	1888	....	100	1:125,000
Jamul [e]	*198.00*	1902	....	25	1:62,500
Kaiser	950.43	1901, 1902	....	100	1:125,000
Karquines [f]	*234.87*	1896	....	25	1:62,500
Kaweah	962.68	1902	....	100	1:125,000
La Jolla	264.00	1901, 1902	....	25	1:62,500
Lake Tahoe Special (Cal.-Nev.) [g]	*3,713.14*	1879, 1888, 1889	....	100	1:125,000
Las Bolsas	22.36	1894	....	25	1:62,500
Lassen Peak	3,634.42	1882, 1884	....	200	1:250,000
Little Backbone Special [c]	*14.40*	1903	....	50	1:24,000
Lodi	937.88	1888, 1891	....	50, 100	1:125,000
Los Angeles [h]	493.86	1893, 1894	....	50	1:62,500
Markleeville (Cal.-Nev.) [g]	596.00	1889	....	100	1:125,000
Marysville	925.06	1886	....	100	1:125,000
Modoc Lava Bed	3,580.54	1884, 1885	....	200	1:250,000
Mono Lake (Cal.-Nev.)	1,680.00	1887	....	200	1:250,000
Mother Lode [d]	*480.00*	1897	....	100	1:63,360
Mount Diablo	235.66	1896	....	50	1:62,500
Mount Hamilton	237.22	1895	....	50	1:62,500
Mount Lyell	944.21	1898, 1899	....	100	1:125,000
Mount Pinos	980.50	1901	....	100	1:125,000
Napa	937.88	1896, 1899	....	100	1:125,000
Needles (Cal.-Ariz.)	476.00	1902, 1903	....	50	1:125,000
Nevada City Special [a]	11.90	1891	....	20	1:14,400

[a] Smartsville sheet, on scale of 1:125,000, covers areas of Nevada City Special and Grass Valley Special sheets, on scale of 1:14,400.

[b] Honey Lake sheet, on scale of 1:250,000, covers areas of Taylorsville and Genesee Special sheets, on scale of 1:31,680, and Indian Valley sheet, on scale of 1:65,500.

[c] Red Bluff sheet, on scale of 1:250,000, covers areas of Redding sheet, on scale of 1:125,000, and Tehama sheet, on scale of 1:62,500; also of the Bully Hill Special, Iron Mountain Special, and Little Backbone Special sheets, on scale of 1:24,000.

[d] Mother Lode district (4 sheets) is a narrow strip extending across the Jackson and Sonora quadrangles; the scale of the sheet is 1:62,360.

[e] El Cajon and Jamul sheets, on scale of 1:62,500, have been reduced and form parts of Cuyamaca sheet.

[f] Karquines sheet, on scale of 1:62,500, has been reduced and forms part of Napa sheet.

[g] Carson (Nev.), Markleeville, Pyramid Peak, and Truckee sheets, on scale of 1:125,000, have been combined and form Lake Tahoe Special sheet (area in California, 2,453 square miles; in Nevada, 1,260.14 square miles).

[h] Pasadena and Santa Monica sheets, on scale of 1:62,500, have been combined and form Los Angeles sheet.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
CALIFORNIA—Continued.	*Sq. miles.*			*Feet.*	
Oceanside[a]	* *96.00*	1891	1898	25	1:62,500
Oil Center	23.00	1904	....	20	1:24,000
Palo Alto[b]	*237.22*	1895	....	25	1:62,500
Parker (Cal.-Ariz.)	373.00	1903	....	50	1:125,000
Pasadena[c]	*246.93*	1894	....	50	1:62,500
Placerville	931.51	1887	....	100	1:125,000
Pomona	246.93	1894	....	50	1:62,500
Port Harford[d]	*34.00*	1895	....	50	1:62,500
Pyramid Peak[e]	931.51	1889	....	100	1:125,000
Ramona	997.64	1900, 1901	....	100	1:125,000
Randsburg	243.29	1900	....	50	1:62,500
Red Bluff[f]	3,634.42	1882, 1883, 1884	....	200	1:250,000
Redding[f]	*905.27*	1900	....	100	1:125,000
Redlands	246.93	1893	1898-1899	50	1:62,500
Redondo	180.00	1894	....	25	1:62,500
Riverside[g]	*247.65*	1897	....	25	1:62,500
Rock Creek	246.21	1899, 1900	....	50	1:62,500
Sacramento[h]	931.51	1887, 1888	....	100	1:125,000
San Antonio	246.21	1899, 1900	....	50	1:62,500
San Bernardino	246.93	1893, 1894	....	50	1:62,500
San Diego	118.00	1902	....	25	1:62,500
San Francisco	235.66	1892, 1893, 1894	....	25	1:62,500
San Gorgonio	986.29	1899	....	100	1:125,000
San Jacinto	992.00	1897, 1898	....	100	1:125,000
San Jose	237.22	1895	....	25	1:62,500
San Luis[d]	596.29	1895	....	100	1:125,000
San Luis Obispo[d]	*243.29*	1895	....	50	1:62,500
San Luis Rey[a]	835.80	1891, 1898	....	100	1:125,000
San Mateo	236.44	1892	....	25	1:62,500
San Pedro	13.50	1894	....	25	1:62,500
Santa Ana[i]	*163.00*	1894	1900	25	1:62,500
Santa Barbara	95.00	1901	....	50	1:62,500
Santa Cruz[b]	710.43	1895, 1899	....	100	1:125,000
Santa Maria	1,270.00	1903	....	100	1:125,000
Santa Monica[c]	*245.68*	1893	....	50	1:62,500

[a] Escondido and Oceanside sheets, on scale of 1:62,500, have been reduced and form parts of San Luis Rey sheet.

[b] Palo Alto sheet, on scale of 1:62,500, has been reduced and forms part of Santa Cruz sheet.

[c] Pasadena and Santa Monica sheets, on scale of 1:62,500, have been combined and form Los Angeles sheet.

[d] Arroyo Grande, Cayucos, Port Harford, and San Luis Obispo sheets, on scale of 1:62,500, have been combined and form San Luis sheet, on scale of 1:125,000.

[e] Carson (Nev.), Markleeville, Pyramid Peak, and Truckee sheets, on scale of 1:125,000, have been combined and form Lake Tahoe Special sheet (area in California, 2,453 square miles; in Nevada, 1,260.14 square miles).

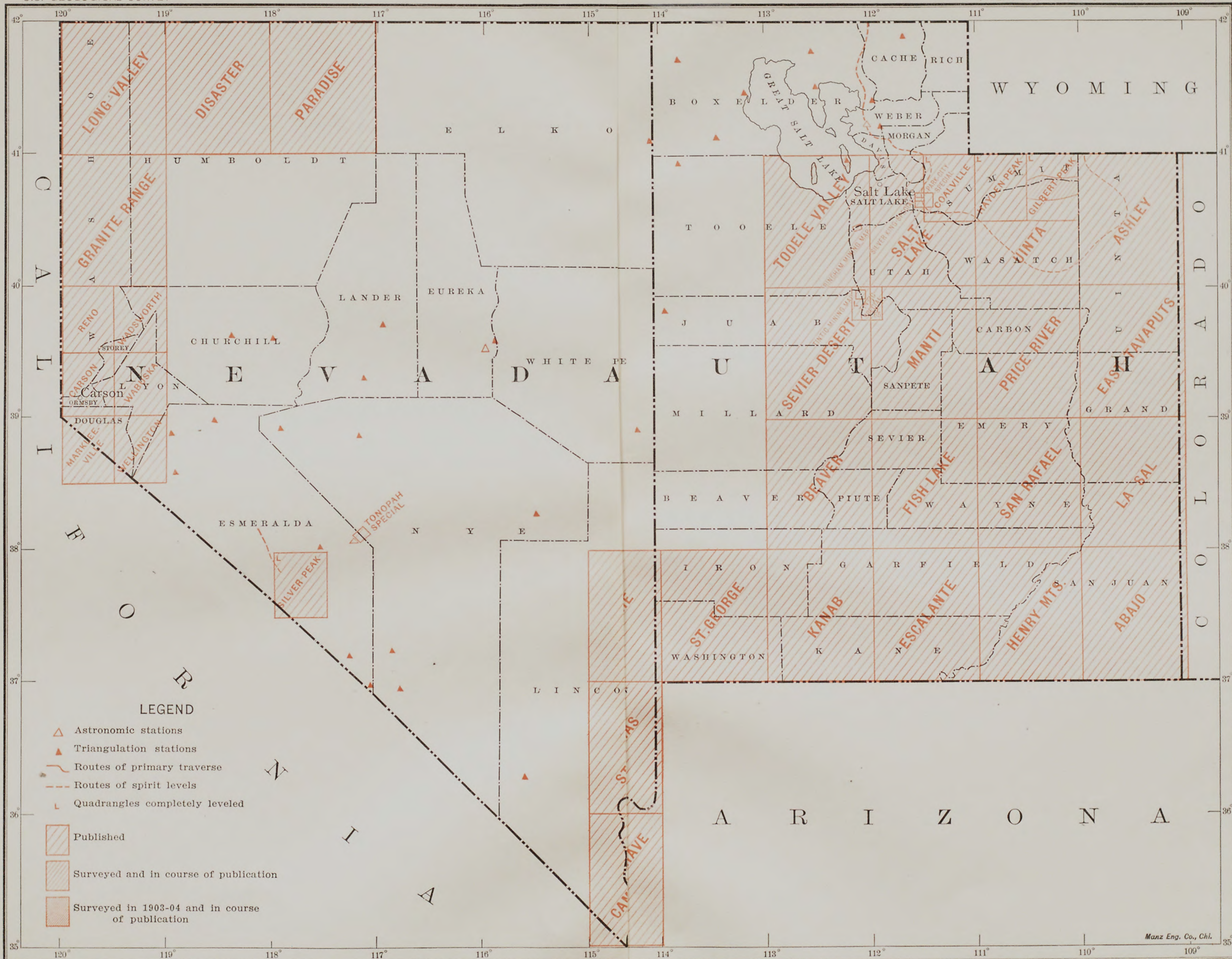
[f] Red Bluff sheet, on scale of 1:250,000, covers areas of Redding sheet on scale of 1:125,000 and Tehama sheet on scale of 1:62,500; also the Bully Hill, Iron Mountain, and Little Backbone specials, on scale of 1:24,000.

[g] Riverside sheet, on scale of 1:62,500, has been reduced and forms part of Elsinore sheet.

[h] Sacramento sheet, on scale of 1:125,000, covers areas of Fairoaks sheet on scale of 1:62,500.

[i] Anaheim and Santa Ana sheets, on scale of 1:62,500, have been reduced and form parts of Corona sheet.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.



MAP OF NEVADA AND UTAH, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
CALIFORNIA—Continued.	*Sq. miles.*			*Feet.*	
Santa Paula	246.21	1901, 1902	....	50	1:62,500
Santa Susana [a]	*246.21	1900	....	50	1:62,500
Santa Ynez	980.50	1901, 1902	....	100	1:125,000
Shasta [b]	3,580.54	1883, 1884, 1885	....	200	1:250,000
Shasta Special [b]	224.21	1884	....	100	1:62,500
Sierraville	918.53	1889, 1890	....	100	1:125,000
Silver Peak (Cal.-Nev.)	18.50	1897, 1898	....	100	1:125,000
Smartsville [c]	925.06	1885, 1886	....	100	1:125,000
Sonora [d]	944.21	1891	....	100	1:125,000
Taylorsville [e]	32.50	1891	....	50	1:31,680
Tamalpais	112.00	1894, 1895	....	25	1:62,500
Tehama [f]	228.40	1903, 1904	....	10, 20	1:62,500
Tehipite	956.60	1903	....	100	1:125,000
Tejon	980.50	1900, 1901	....	100	1:125,000
Truckee [g]	925.06	1889	....	100	1:125,000
Tujunga	246.21	1897	....	50	1:62,500
Ventura	246.21	1901, 1902	....	50	1:62,500
Vina	229.22	1903, 1904	....	10, 20	1:62,500
Wellington (Cal.-Nev.)	61.00	1890	....	100	1:125,000
Yosemite	944.21	1893, 1894	....	100	1:125,000
Yuma (Cal.-Ariz.)	563.00	1902, 1903	....	50	1:125,000
Total	67,147.74				
COLORADO:					
Abajo (Colo.-Utah)	191.90	1884	....	250	1:250,000
Albany (Colo.-Kans.)	862.71	1890	....	25	1:125,000
Anthracite	232.48	1883, 1888	....	100	1:62,500
Apishapa	944.21	1889	1896	25	1:125,000
Arroyo	931.51	1889	....	25	1:125,000
Ashley (Colo.-Utah)	184.10	King and Powell.	....	250	1:250,000
Aspen [h]	231.67	1893	....	100	1:62,500
Aspen Special [h]	*6.40*	1891	....	25	1:9,600
Big Springs	931.51	1889	....	25	1:125,000
Boulder	228.40	1902	....	100	1:62,500

[a] Calabasas and Santa Susana sheets, on scale of 1:62,500, have been reduced and form parts of Camulos sheet.

[b] Shasta sheet, on scale of 1:250,000, covers area of Shasta Special sheet, on scale of 1:62,500.

[c] Smartsville sheet, on scale of 1:125,000, covers area of Nevada City and Grass Valley Special sheets on scale of 1:14,400.

[d] Mother Lode district (4 sheets) is a narrow strip extending across the Jackson and Sonora quadrangles and is mapped on the scale of 1:62,360.

[e] Honey Lake sheet, on scale of 1:250,000, covers area of Taylorsville and Genesee Special sheets, on scale of 1:31,680, and Indian Valley sheet on scale of 1:65,500.

[f] Red Bluff sheet, on scale of 1:250,000, covers area of Redding sheet, on scale of 1:125,000, and Tehama sheet, on scale of 1:62,500; also the Bully Hill, Iron Mountain, and Little Backbone Special sheets, on scale of 1:24,000.

[g] Carson (Nev.), Markleeville, Pyramid Peak, and Truckee sheets, on scale of 1:125,000, have been combined and form Lake Tahoe Special sheet (area in California, 2,453 square miles; in Nevada, 1,260.14 square miles).

[h] Aspen sheet, on scale of 1:62,500, covers area of Aspen Special, Richmond Hill Special, and Tourtelotte Park Special sheets.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
COLORADO—Continued.	*Sq. miles.*			*Feet.*	
Canyon	937.88	1889	....	25, 50, 100	1:125,000
Castle Rock	925.06	1891	....	50, 100	1:125,000
Catlin	937.88	1889	....	25	1:125,000
Central City	229.22	1903	....	100	1:62,500
Cheyenne Wells (Colo.-Kans.)	850.01	1890	....	25	1:125,000
Colorado Springs	931.51	1889	....	25, 50, 100	1:125,000
Crested Butte	232.48	1883, 1888	....	100	1:62,500
Cripple Creek Special [a]	**41.80*	1894	1902, 1903	50	1:19,495
Denver	918.53	1888	....	50, 100	1:125,000
Durango	237.22	1896	....	100	1:62,500
East Tavaputs (Colo.-Utah)	186.70	1876, 1877	....	250	1:250,000
Elmoro	950.43	1889	1895	50	1:125,000
Encampment Special (Colo.-Wyo.)	9.00	1901	....	100	1:90,000
Engineer Mountain [b]	236.44	1897, 1898	....	100	1:62,500
Georgetown	230.04	1903	....	100	1:62,500
Granada (Colo.-Kans.)	856.38	1890	....	25	1:125,000
Greeley	911.94	1899, 1900	....	20	1:125,000
Higbee	944.21	1889	....	25, 50	1:125,000
Huerfano Park	944.21	1889	....	25, 50, 100	1:125,000
Kit Carson	931.51	1890	....	25	1:125,000
Lake City	234.87	1903	....	100	1:62,500
Lamar	937.88	1890, 1891	....	25	1:125,000
La Plata	237.22	1895	....	100	1:62,500
La Sal (Colo.-Utah)	189.30	Hayden, Powell	....	250	1:250,000
Las Animas	937.88	1889	....	25	1:125,000
Leadville [c]	925.06	1879, 1880, 1881	1889, 1901	25, 50, 100	1:125,000
Limon	925.06	1890, 1891	....	25	1:125,000
Mesa de Maya	950.43	1890	....	25, 50, 100	1:125,000
Mount Carrizo	950.43	1890	....	25, 50, 100	1:125,000
Needle Mountain	236.44	1899, 1900	....	100	1:62,500
Nepesta	937.88	1889	1894, 1903	25	1:125,000
Niwot	228.40	1902	....	20	1:62,500
Ouray	234.87	1901, 1902	....	100	1:62,500
Pikes Peak [a]	931.51	1892, 1893	....	100	1:125,000
Platte Canyon	925.06	1891	....	25, 50, 100	1:125,000
Pueblo	937.88	1888	1894	50	1:125,000
Richmond Hill Special [d]	*3.20*	1893	....	25	1:9,600
Rico [b]	236.44	1894	....	100	1:62,500
Rico Special [b]	*33.40*	1898	....	50	1:23,600
Sanborn	931.51	1889	....	25	1:125,000
Silver Basin Special [e]	*2.10*	1900	....	50	1:21,120
Silverton [e]	235.66	1895	1900, 1901	100	1:62,500

[a] Pikes Peak sheet, on scale of 1:125,000, covers area of Cripple Creek Special sheet.

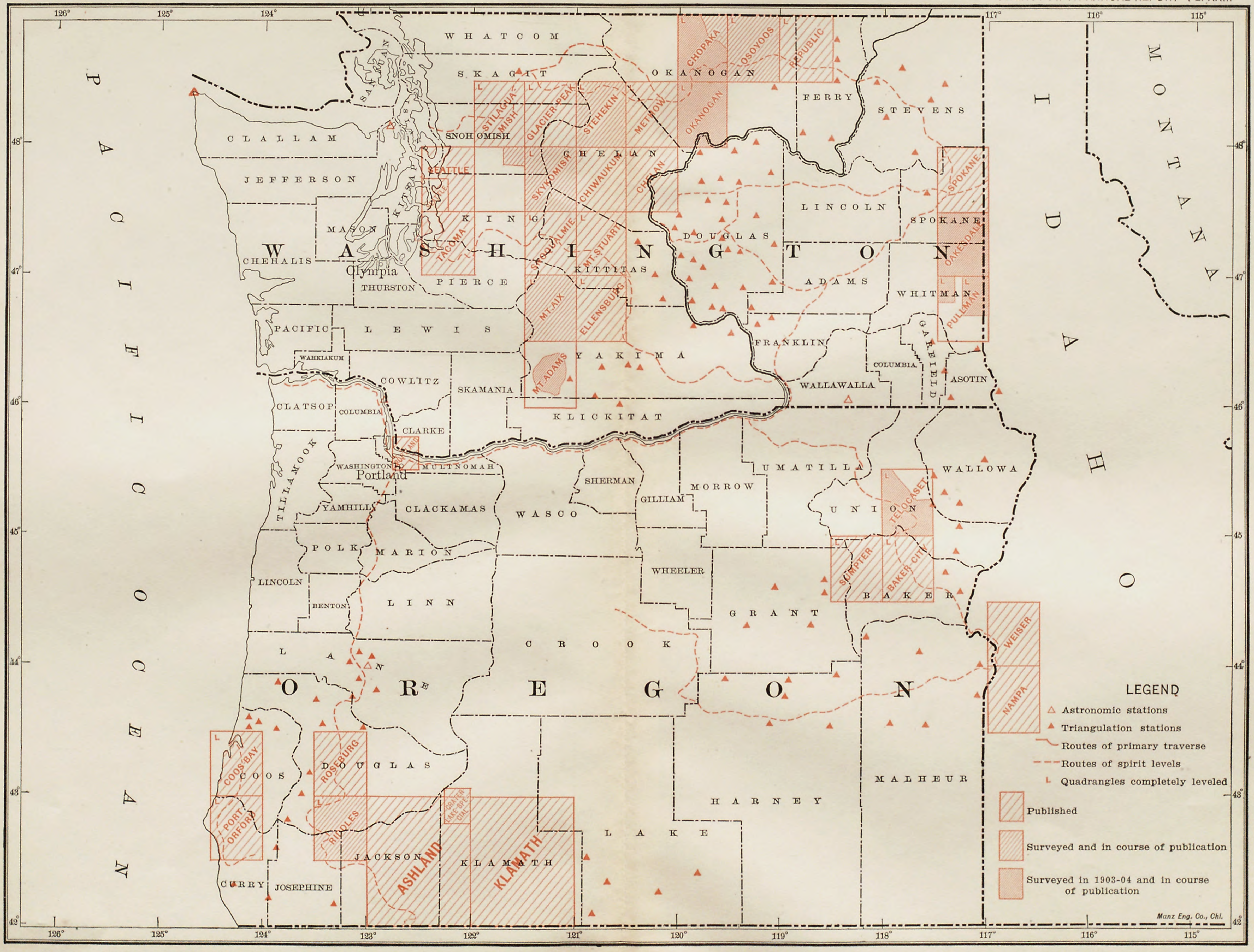
[b] Rico and Engineer Mountain sheets, on scale of 1:62,500, each contain part of Rico Special sheet.

[c] Leadville sheet, on scale of 1:125,000, covers area of Tenmile District Special sheet.

[d] Aspen sheet, on scale of 1:62,500, covers area of Aspen Special, Richmond Hill Special, and Tourtelotte Park Special sheets.

[e] Silverton sheet, on scale of 1:62,500, covers area of Silver Basin Special sheet.

*Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.



MAP OF WASHINGTON AND OREGON, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
COLORADO—Continued.	*Sq. miles.*			*Feet.*	
Spanish Peaks	950.43	1889	1895	100	1:125,000
Springfield	950.43	1890	....	25, 50	1:125,000
Telluride	235.66	1894	....	100	1:62,500
Tenmile District Special [a]	* *61.90*	1880, 1882	....	100	1:31,680
Timpas	944.21	1889	....	25, 50	1:125,000
Tourtelotte Park Special [b]	*58.24*	....	....	25	1:9,600
Two Butte	944.21	1890	....	25, 50	1:125,000
Vilas (Colo.-Kans.)	868.93	1890	....	25	1:125,000
Walsenburg	944.21	1888, 1889	1894	50	1:125,000
Total	35,101.00				
IDAHO:					
Bear Valley	856.67	1891	....	100	1:125,000
Bisuka	870.90	1890	....	25, 50, 100	1:125,000
Boise	863.82	1890	....	100	1:125,000
Camas Prairie	870.90	1889	....	50, 100	1:125,000
Coeur d'Alene Special (Idaho-Mont.).	364.00	1900, 1901	....	50	1:62,500
Garden Valley	856.67	1892, 1893	....	100	1:125,000
Hailey	863.82	1894, 1895	....	100	1:125,000
Hamilton (Idaho-Mont.)	100.00	1897, 1898	....	100	1:125,000
Idaho Basin	863.82	1892	....	100	1:125,000
Mountain Home	870.90	1889	....	50, 100	1:125,000
Nampa (Idaho-Oreg.)	847.32	1891	....	100	1:125,000
Oakesdale (Idaho-Wash.)	70.00	1903	....	50	1:125,000
Pullman (Idaho-Wash.)	35.00	1903	....	50	1:125,000
Rathdrum	804.79	1899, 1901	....	100	1:125,000
Rocky Bar	863.82	1891	....	100	1:125,000
Sand Point	797.13	1898, 1899	....	100	1:125,000
Sawtooth	863.82	1895, 1896	....	100	1:125,000
Silver City	870.90	1892	....	100	1:125,000
Spokane (Idaho-Wash.)	734.79	1898	....	100	1:125,000
Squaw Creek	856.67	1891	....	100	1:125,000
Weiser (Idaho-Oreg.)	807.67	1894	....	100	1:125,000
Total	14,933.41				
INDIAN TERRITORY:					
Addington	986.29	1897, 1898	....	50	1:125,000
Alikchi	986.29	1897, 1898	....	50	1:125,000
Antlers	986.29	1895, 1896	....	50	1:125,000
Ardmore	986.29	1898	....	50	1:125,000
Atoka	986.29	1895, 1896, 1897, 1898	....	50	1:125,000
Bonham (Ind. T.-Tex.)	434.27	1895, 1896	....	50	1:125,000
Canadian	974.64	1895, 1896	....	50	1:125,000

[a] Leadville sheet, on scale of 1:125,000, covers area of Tenmile District Special sheet.

[b] Aspen sheet, on scale of 1:62,500, covers area of Aspen Special, Richmond Hill Special, and Tourtelotte Park Special sheets.

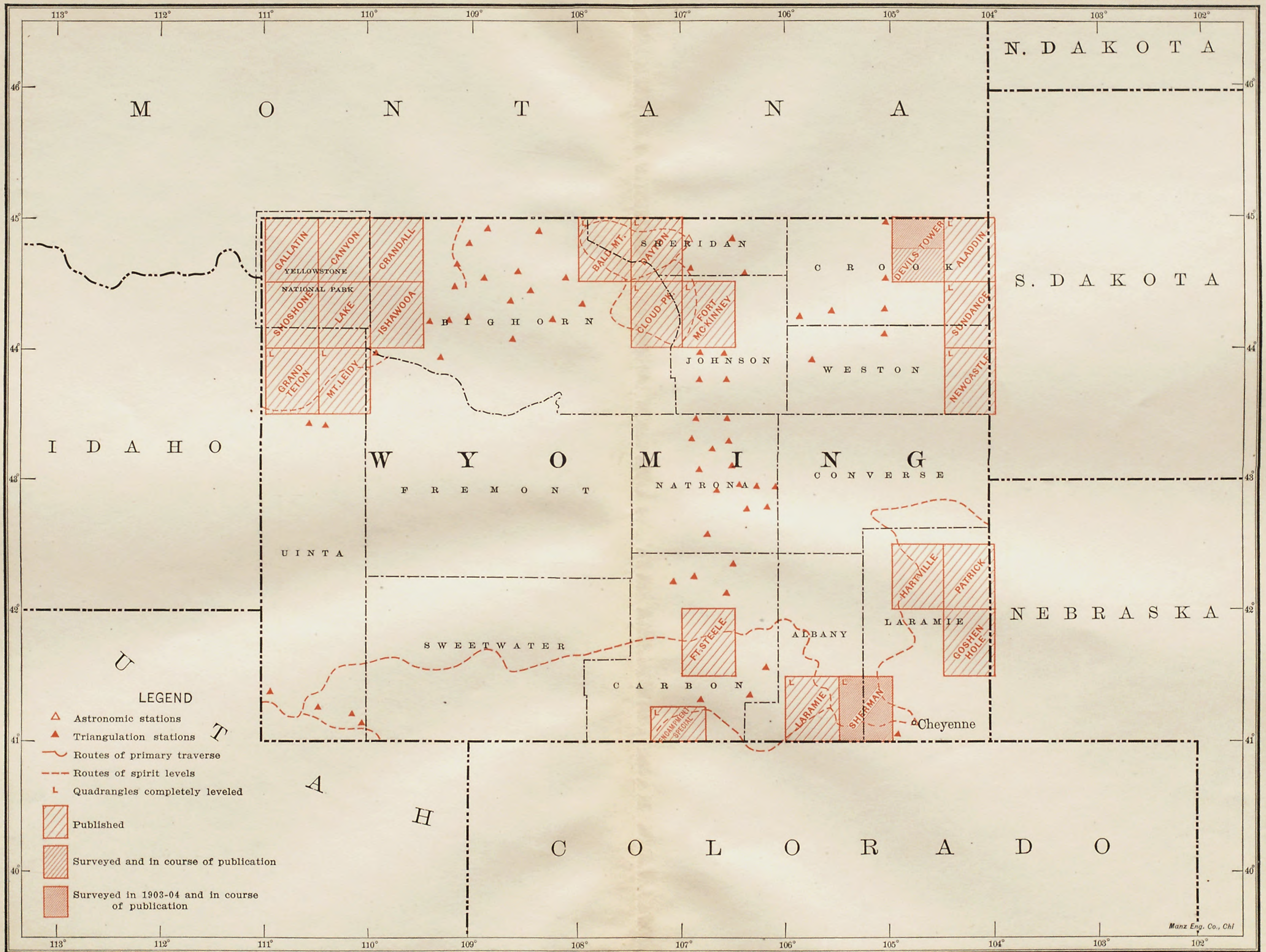
* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
INDIAN TERRITORY—Continued.	*Sq. miles.*			*Feet.*	
Chickasha (Ind. T.-Okla.)	626.00	1893, 1898, 1899	1900	50	1:125,000
Claremore	962.68	1896, 1897	....	50	1:125,000
Clarksville (Ind. T.-Tex.)	192.75	1896	....	50	1:125,000
Coalgate	980.50	1895, 1896	....	50	1:125,000
Denison (Ind. T.-Tex.)	255.50	1898, 1899	....	50	1:125,000
Eagletown	986.29	1896	....	50	1:125,000
Fort Smith (Ind. T.-Ark.)	124.50	1887	....	50	1:125,000
Gainesville (Ind. T.-Tex.)	314.65	1898, 1901, 1902	....	50	1:125,000
Hominy (Ind. T.-Okla.)	315.00	1896	....	50	1:125,000
Joplin (Ind. T.-Mo.)	4.40	1884	1900	50	1:125,000
McAlester	980.50	1895, 1896	....	50	1:125,000
Montague (Ind. T.-Tex.)	147.15	1898, 1902, 1903, 1904	....	50	1:125,000
Muscogee	968.70	1896, 1898	....	50	1:125,000
Nowata	956.60	1896, 1897	....	50	1:125,000
Nuyaka	968.70	1896	....	50	1:125,000
Okmulgee	968.70	1896	....	50	1:125,000
Paris (Ind. T.-Tex.)	179.55	1896	....	50	1:125,000
Pauls Valley (Ind. T.-Okla.)	893.65	1897, 1898	....	50	1:125,000
Pawnee (Ind. T.-Okla.)	78.75	1897	....	50	1:125,000
Poteau Mountain (Ind. T.-Ark.)	91.70	1887	....	50	1:125,000
Pryor	962.68	1896	....	50	1:125,000
Purcell (Ind. T.-Okla.)	70.00	1898	....	50	1:125,000
Rush Springs	980.50	1898	....	50	1:125,000
Sac and Fox (Ind. T.-Okla.)	241.50	1896	....	50	1:125,000
Sallisaw	974.64	1897	....	50	1:125,000
Sansbois	974.64	1896, 1897	....	50	1:125,000
Seminole (Ind. T.-Okla.)	493.58	1896	....	50	1:125,000
Shawneetown (Ind. T.-Tex.)	534.95	1897, 1898	....	50	1:125,000
Siloam Springs (Ind. T.-Ark.)	816.50	1896, 1897, 1899	....	50	1:125,000
Stonewall (Ind. T.-Okla.)	912.20	1895, 1897, 1898	....	50	1:125,000
Tahlequah	956.70	1896, 1897, 1898	....	50	1:125,000
Tishomingo	986.29	1897, 1898	....	50	1:125,000
Tuskahoma	980.50	1896, 1897	....	50	1:125,000
Vinita	956.60	1896, 1897	....	50	1:125,000
Wewoka	974.64	1895, 1896	....	50	1:125,000
Winding Stair	980.50	1897, 1898	....	50	1:125,000
Winslow (Ind. T.-Ark.)	29.21	1898	....	50	1:125,000
Wyandotte	391.20	1897	....	50	1:125,000
Narrow Strip	66.22	....	....	50	1:125,000
Total	30,619.68				
MONTANA:					
Assiniboine	197.83	1902	....	20	1:62,500
Big Snowy Mountain	3,294.71	1882, 1887	....	200	1:250,000
Big Timber	834.83	1889	....	50	1:125,000
Bonner	819.94	1900	....	100	1:125,000
Boulder[a]	**827.42*	1896, 1897	....	100	1:125,000

[a] Helena sheet, on scale of 1:250,000 covers area of Boulder and Butte Special and Marysville Special sheets, and part of Helena Special sheet.

* Figures in italic are not included in total, as the sheets form parts of others whose total area are given.



MAP OF WYOMING, SHOWING PROGRESS OF TOPOGRAPHIC SURVEYING AND PRIMARY CONTROL

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
MONTANA—Continued.	*Sq. miles.*			*Feet.*	
Bowdoin	198.80	1903	....	20	1:62,500
Browning	789.39	1900, 1901	....	100	1:125,000
Butte Special[a]	**23.00*	1895	1903	20	1:15,000
Chief Mountain	789.39	1900, 1901, 1902	....	100	1:125,000
Chinook	197.83	1902	....	20	1:62,500
Coeur d'Alene Special (Mont.-Idaho)	38.00	1900, 1901	....	50	1:62,500
Coopers Lake	812.40	1900	....	100	1:125,000
Dillon	3,354.01	1887, 1888	....	200	1:250,000
Elkhorn Special[b]	*9.00*	1899	....	50	1:31,250
Fort Belknap	18.00	1903	....	20	1:62,500
Fort Benton	3,234.89	1883, 1887	1896	200	1:250,000
Fort Custer	834.83	1891, 1892	....	50	1:125,000
Fort Logan[b]	3,294.71	†N. T. S.	....	200	1:250,000
Great Falls	3,234.39	†N. T. S.	....	200	1:250,000
Hamilton (Mont.-Idaho)	727.42	1897, 1898	....	100	1:125,000
Harlem	197.83	1903	....	20	1:62,500
Havre	197.83	1902	....	20	1:62,500
Helena[a]	3,294.71	1888	1895, 1899	200	1:250,000
Helena Special[a b]	*205.45*	1897, 1898	....	50	1:62,500
Hinsdale	117.75	1903	....	20	1:62,500
Huntley	834.83	1891	....	50	1:125,000
Kintla Lakes	573.00	1902, 1903	....	100	1:125,000
Little Belt Mountains	3,294.71	1882	1896	200	1:250,000
Livingston	3,354.01	1886, 1887	....	200	1:250,000
Malta	8.50	1903	....	5	1:24,000
Marysville Special[a]	*44.00*	1899	....	50	1:31,250
Ovando	812.40	1902	....	100	1:125,000
Rosebud	842.18	1891, 1892	....	50	1:125,000
Saco	197.83	1903	....	20	1:62,500
St. Xavier Mission	842.18	1891, 1892	....	50–100	1:125,000
Saypo	804.79	1901	....	100	1:125,000
Stillwater	834.83	1889	....	50	1:125,000
Three Forks	3,354.01	1886	....	200	1:250,000
Wayne Creek	197.83	1903	....	20	1:62,500
Yantic	197.83	1902	....	20	1:62,500
Total	42,628.42				
NEVADA:					
Camp Mohave (Nev.-Ariz.-Cal.)	1,190.00	1876, 1884	....	250	1:250,000
Carson[c]	925.06	1879, 1888, 1889	....	100	1:125,000
Disaster	3,580.54	1882	....	200	1:250,000
Eureka district	390.00	....	....	50	....
Granite Range	3,634.42	Wheeler and King	....	200	1:250,000
Lake Tahoe Special (Nev.-Cal.)[c]	*3,713.14*	1879, 1888, 1889	....	100	1:125,000

[a] Helena sheet, on scale of 1:250,000, covers areas of Boulder, Butte, and Marysville Special sheets and part of Helena Special sheet.

[b] Fort Logan sheet, on scale of 1:250,000, covers areas of Elkhorn Special sheet and part of Helena Special sheets.

[c] Carson, Markleeville, Pyramid Peak (Cal.), and Truckee (Cal.) sheets, on scale of 1:125,000, have been combined and form Lake Tahoe Special sheet (area in California, 2,453 square miles; in Nevada, 1,260.14 square miles).

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

† Northern Transcontinental Survey.

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
NEVADA—Continued.	*Sq. miles.*			*Feet.*	
Long Valley	3,580.54	1882, 1885	....	200	1:250,000
Markleeville (Nev.-Cal.)[a]	335.51	1889	....	100	1:125,000
Mono Lake (Nev.-Cal.)	194.00	1887	....	200	1:250,000
Paradise	3,580.54	1882	....	200	1:250,000
Pioche (Nev.-Utah)	3,600.00	Powell, Wheeler	....	250	1:250,000
Reno	918.53	1889, 1890	....	100	1:125,000
St. Thomas (Nev.-Ariz.)	3,376.56	1884 and Powell	....	250	1:250,000
Silver Peak (Nev.-Cal.)	925.71	1897, 1898	....	100	1:125,000
Tonopah mining map	7.00	1902, 1903	....	20	1:12,000
Wabuska	925.06	1888, 1890	....	100	1:125,000
Wadsworth	918.53	1890	....	100	1:125,000
Wellington (Nev.-Cal.)	870.51	1890	....	100	1:125,000
Total	28,952.51				
NEW MEXICO:					
Albuquerque	974.64	1888	....	50	1:125,000
Bernal	974.64	1890	....	50	1:125,000
Canyon de Chelly (N.Mex.-Ariz.)	194.30	1883	....	200	1:250,000
Chaco	3,838.56	1875, 1887	....	200	1:250,000
Corazon	974.64	1890	....	50	1:125,000
Deming	1,008.69	1892	....	100	1:125,000
Fort Defiance (N. Mex.-Ariz.)	196.70	1883	....	200	1:250,000
Jemes	968.70	1887, 1888	....	100	1:125,000
Lamy	974.64	1890	....	50, 100	1:125,000
Largo	3,838.56	1875, 1887	....	200	1:250,000
Las Cruces	1,008.69	1889, 1891	....	25, 50	1:125,000
Las Vegas	968.70	1889	....	50	1:125,000
Mount Taylor	3,886.67	1883	....	200	1:250,000
St. Johns (N. Mex.-Ariz.)	199.20	1886	....	200	1:250,000
San Pedro	974.64	1888, 1889	....	100	1:125,000
Santa Clara	968.70	1887, 1888	....	100	1:125,000
Santa Fe	968.70	1888, 1889	....	100	1:125,000
Watrous	968.70	1889	....	50	1:125,000
Wingate	3,886.67	1882, 1883	....	200	1:250,000
Total	27,774.74				
OKLAHOMA:					
Buggy Creek	243.29	1893	....	20	1:62,500
Chickasha (Okla.-Ind. T.)	361.00	1893, 1898, 1899	1900	50	1:125,000
Darlington	242.55	1893	....	20	1:62,500
Edmond	242.55	1892	....	20	1:62,500
Guthrie	241.80	1892	....	20	1:62,500
Hennessey	241.05	1893	....	20	1:62,500
Kingfisher	968.70	1892	....	20	1:125,000
Lacey	241.05	1893	....	20	1:62,500

[a] Carson Markleville, Pyramid Peak (Cal.), and Truckee (Cal.) sheets on scale of 1:125,000 have been combined and form Lake Tahoe Special sheet (area in California, 2,453 square miles; in Nevada, 1,260.14 square miles).

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
OKLAHOMA—Continued.	*Sq. miles.*			*Feet.*	
Moore [a]	* *243.29*	1892	....	20	1:62,500
Mulhall	241.05	1893	....	20	1:62,500
Norman [a]	*244.03*	1893	....	20	1:62,500
Omega	241.80	1893	....	20	1:62,500
Purcell [a]	407.32	1898	....	50	1:125,000
Sheridan	241.05	1893	....	20	1:62,500
Stillwater	241.05	1893	....	20	1:62,500
Total	4,154.26				
OREGON:					
Ashland	3,525.54	1886, 1887	....	200	1:250,000
Baker City	849.46	1898, 1899	....	100	1:125,000
Coos Bay	637.90	1895, 1896	....	100	1:125,000
Crater Lake Special [b]	61.00	1886	....	100	1:62,500
Klamath [b]	3,525.54	1885, 1886, 1887	....	200	1:250,000
Nampa (Oreg.-Idaho)	16.50	1891	....	100	1:125,000
Portland (Oreg.-Wash.)	100.00	1896	....	25	1:62,500
Port Orford	835.91	1897, 1898	....	100	1:125,000
Riddles	877.91	1901, 1902	....	100	1:125,000
Roseburg	870.90	1894, 1895	....	100	1:125,000
Sumpter	849.46	1899, 1900	....	100	1:125,000
Telocaset	641.00	1903	....	100	1:125,000
Weiser (Oreg.-Idaho)	49.00	1894	....	100	1:125,000
Total	12,840.12				
TEXAS:					
Abilene	1,008.69	1890	....	50	1:125,000
Albany	1,003.20	1889	....	50	1:125,000
Alpine	1,029.85	1893	....	50	1:125,000
Anson	1,003.20	1890	....	50	1:125,000
Austin	1,029.85	1884	1895, 1896	25	1:125,000
Baird	1,008.69	1888	....	50	1:125,000
Ballinger	1,014.10	1890	....	50	1:125,000
Bastrop	1,029.85	1885	1899	25	1:125,000
Blanco	1,029.85	1884, 1885	....	50	1:125,000
Boquillas (Tex.-Mex.)	210.00	1903	....	100	1:125,000
Brackett	1,039.87	1891, 1895	....	50	1:125,000
Brady	1,019.43	1886	....	50	1:125,000
Breckenridge	1,003.20	1888	....	50	1:125,000
Brownwood	1,014.10	1887	....	50	1:125,000
Burnet	1,024.68	1885	1900, 1901	25	1:125,000
Cerro Alto	1,014.10	1901, 1902	....	50	1:125,000
Chisos Mountain (Tex.-Mex.)	904.00	1903	....	100	1:125,000
Chispa	970.00	1892	....	50	1:125,000
Cleburne	1,008.69	1889	....	50	1:125,000

[a] Moore and Norman sheets, on scale of 1:62,500, have been reduced and form western half of Purcell sheet, which is still incomplete.

[b] Klamath sheet, on scale of 1:250,000, covers all of the area of Crater Lake Special sheet except 61 square miles.

* Figures in italics are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
TEXAS—Continued.	*Sq. miles.*			*Feet.*	
Coleman	1,014.10	1887	....	50	1:125,000
Dallas	1,003.20	1889	....	50	1:125,000
Denison (Tex.-Ind. T.)	736.50	1898, 1899	....	50	1:125,000
Eagle Mountain (Tex.-Mex.)	414.00	1896	....	100	1:125,000
Eastland	1,008.69	1883	....	50	1:125,000
Eden	1,019.43	1886, 1887	....	50	1:125,000
El Paso (Tex.-Mex.)	819.00	1891	....	50	1:125,000
Flatonia	1,034.95	1898	....	25	1:125,000
Fort Davis	1,024.68	1894	....	100	1:125,000
Fort Hancock (Tex.-Mex.)	670.00	1891	....	50	1:125,000
Fort McKavett	1,024.68	1891	....	25	1:125,000
Fort Worth	1,003.20	1889	....	50	1:125,000
Fredericksburg	1,029.85	1884, 1885	....	50	1:125,000
Gainesville (Tex.-Ind. T.) [a]	677.35	1898, 1901, 1902	....	50	1:125,000
Gatesville	1,019.43	1886	....	50	1:125,000
Georgetown	1,024.68	1885	....	50	1:125,000
Granbury	1,008.69	1887	....	50	1:125,000
Hamilton	1,014.10	1886	....	50	1:125,000
Hayrick	1,014.10	1890	....	50	1:125,000
Kerrville	1,029.85	1885	....	50	1:125,000
Lampasas	1,019.43	1885	....	50	1:125,000
Llano	1,024.68	1885	1898, 1899	25	1:125,000
Marfa	1,029.85	1893	....	50	1:125,000
Mason	1,024.68	1885	....	50	1:125,000
Meridian	1,014.10	1886	....	50	1:125,000
Montague (Tex.-Ind. T.) [a]	844.85	1898, 1902, 1903, 1904	....	50	1:125,000
Nueces	1,034.95	1891, 1892	....	50	1:125,000
Palo Pinto	1,003.20	1889	....	50	1:125,000
Polvo (Tex.-Mex.)	115.00	1895	....	100	1:125,000
Rio Grande (Tex.-Mex.)	77.00	1891	....	50	1:125,000
Roby	1,003.20	1891	....	25	1:125,000
Rock Springs	1,029.85	1891	....	25	1:125,000
Ruidosa (Tex.-Mex.)	168.00	1895	....	100	1:125,000
Saint Jo Special [a]	* *27.30*	1902	....	25	1:45,000
Salt Basin	1,014.10	1891	....	50	1:125,000
San Angelo	1,019.43	1890	....	50	1:125,000
San Antonio Special	518.10	1901, 1902, 1903	....	10	1:62,500
San Carlos (Tex.-Mex.)	533.00	1895	....	100	1:125,000
San Saba	1,019.43	1885	....	50	1:125,000
Shafter (Tex.-Mex.)	967.00	1895	....	100	1:125,000
Sherwood	1,019.43	1893	....	25	1:125,000
Sierra Blanca	1,019.43	1891	....	50	1:125,000
Stephenville	1,008.69	1887	....	50	1:125,000
Sweetwater	1,008.69	1891	....	25	1:125,000
Taylor	1,024.68	1885	....	50	1:125,000
Temple	1,019.43	1890	....	50	1:125,000

[a] Montague and Gainesville sheets, on scale of 1:125,000, each cover a part of the area of Saint Jo Special sheet.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
TEXAS—Continued.	*Sq. miles.*			*Feet.*	
Terlingua (Tex.-Mex.) [a]	590.00	1902, 1903	....	100	1:125,000
Terlingua Special [a]	*75.00	1902	....	25	1:50,000
Uvalde	1,039.97	1896	....	25	1:125,000
Valentine	1,024.68	1894	....	100	1:125,000
Waco	1,014.10	1890	....	50	1:125,000
Weatherford	1,003.20	1889	....	50	1:125,000
Total	63,187.98				
UTAH:					
Abajo (Utah-Colo.)	3,597.36	1884	....	250	1:250,000
Ashley (Utah-Colo.)	3,450.32	Powell and King	....	250	1:250,000
Beaver	3,738.80	Powell, Wheeler	....	250	1:250,000
Bingham mining [b]	*24.00*	1899, 1900	....	50	1:20,000
Coalville [c]	*905.27*	1899, 1900	....	100	1:125,000
Cottonwood Special [c]	*14.00*	1903	....	50	1:21,120
East Tavaputs (Utah-Colo.)	3,500.48	1876, 1877	....	250	1:250,000
Escalante	3,789.26	Powell	....	250	1:250,000
Fish Lake	3,738.80	Powell	....	250	1:250,000
Gilbert Peak [d]	*390.00*	1902	....	100	1:125,000
Hayden Peak [d] (Utah-Wyo.)	*925.27*	1900, 1901	....	100	1:125,000
Henry Mountains	3,789.26	1884	....	250	1:250,000
Kanab	3,789.26	Powell	....	250	1:250,000
La Sal (Utah-Colo.)	3,549.50	Hayden, Powell	....	250	1:250,000
Manti [e]	3,687.18	Powell	....	250	1:250,000
Park City Special [c]	*32.30*	1901	....	50	1:25,000
Pioche (Utah-Nev.)	191.90	Powell, Wheeler	....	250	1:250,000
Price River	3,687.18	Powell	....	250	1:250,000
Saint George	3,789.26	Powell	....	250	1:250,000
Salt Lake [c]	3,634.42	King and Powell	....	250	1:250,000
San Rafael	3,738.80	Powell	....	250	1:250,000
Sevier Desert [e]	3,687.18	Wheeler, Powell	....	250	1:250,000
Silver King Special [c]	*3.00*	1901, 1902	....	50	1:12,000
Strawberry Valley [d]	*84.00*	1903	....	100	1:125,000
Tintic mining [e]	*12.00*	1896, 1897	....	20	1:9,600
Tintic Special [e]	*229.22*	1897	....	50	1:62,500
Tooele Valley [b]	3,634.42	King and Wheeler	....	250	1:250,000
Uinta [d]	3,634.42	King and Powell	....	250	1:250,000
Total	62,627.80				

[a] Terlingua sheet, on scale of 1:125,000, covers the area of Terlingua Special sheet.

[b] Tooele Valley sheet covers the area of Bingham mining sheet.

[c] Salt Lake sheet, on scale of 1:250,000, covers the area of Coalville sheet, on scale of 1:125,000; also the areas of Cottonwood Special, Park City Special, and Silver King Special sheets.

[d] Uinta sheet, on scale of 1:250,000, covers the area of Gilbert Peak Hayden Peak, and Strawberry Valley sheets.

[e] Sevier Desert and Manti sheets, on scale of 1:250,000, cover parts of the area of Tintic Special sheet, and the former covers the area of the Tintic mining sheet.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year. Original survey.	Year. Resurvey or revision.	Contour interval.	Scale.
WASHINGTON:	*Sq. miles.*			*Feet.*	
Chelan	804.79	1897, 1898	....	100	1:125,000
Chiwaukum	804.79	1900, 1901	....	100	1:125,000
Chopaka	789.39	1902, 1903	....	100	1:125,000
Ellensburg	819.94	1899	....	100	1:125,000
Glacier Peak	797.13	1897, 1899	....	100	1:125,000
Methow	797.13	1897, 1899	....	100	1:125,000
Mount Adams	431.00	1903	....	100	1:125,000
Mount Aix	819.94	1900, 1901, 1902	....	100	1:125,000
Mount Stuart	812.40	1896, 1897	....	100	1:125,000
Oakesdale (Wash.-Idaho)	742.40	1903	....	50	1:125,000
Okanogan	797.13	1903	....	100	1:125,000
Osoyoos	789.39	1902	....	100	1:125,000
Portland (Wash.-Oreg.)	109.00	1896	....	25	1:62,500
Pullman	192.00	1903	....	50	1:125,000
Republic	789.39	1901	....	100	1:125,000
Seattle[a]	804.79	1893, 1894, 1895	....	50	1:125,000
Seattle[a]	* *201.67*	1893	....	25	1:62,500
Skykomish	804.79	1897	1902	100	1:125,000
Snoqualmie	812.40	1897, 1898	1900, 1901	100	1:125,000
Spokane (Wash.-Idaho)	734.79	1898	....	100	1:125,000
Stehekin	797.13	1901, 1902	....	100	1:125,000
Stillaguamish	797.13	1897, 1899	....	100	1:125,000
Tacoma	812.40	1894, 1895	....	50	1:125,000
Total	15,859.25				
WYOMING:					
Aladdin (Wyo.-S. Dak.)	763.46	1901	....	50	1:125,000
Bald Mountain	849.46	1898	....	100	1:125,000
Canyon[b]	849.46	1884, 1885	....	100	1:125,000
Cloud Peak	856.67	1897, 1899	....	100	1:125,000
Crandall	849.46	1893	....	100	1:125,000
Dayton	849.46	1891	1899	100	1:125,000
Devils Tower	849.46	1902, 1903	....	50	1:125,000
Encampment Special (Wyo.-Colo.)	441.00	1901	....	100	1:90,000
Fort McKinney	856.67	1900	....	100	1:125,000
Fort Steele	891.73	1891	....	25-50	1:125,000
Gallatin[b]	849.46	1883, 1884, 1885	....	100	1:125,000
Goshen Hole (Wyo.-Nebr.)	801.33	1895	....	20	1:125,000
Grand Teton	963.82	1899	....	100	1:125,000
Hartville	884.85	1895	....	50	1:125,000
Hayden Peak (Wyo.-Utah)	4.00	1900, 1901	....	100	1:125,000
Ishawooa	856.67	1893	....	100	1:125,000
Lake[b]	856.67	1885	....	100	1:125,000
Laramie	898.54	1892, 1893	1903	50	1:125,000
Mount Leidy	863.82	1899	....	100	1:125,000
Newcastle (Wyo.-S. Dak.)	776.32	1899	....	50	1:125,000

[a] Seattle sheet on scale of 1:62,500 has been reduced and forms part of Seattle sheet on scale of 1:125,000.

[b] Yellowstone National Park sheet, on scale of 1:125,000, covers the areas of Canyon, Gallatin, Lake, and Shoshone sheets, on same scale.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

Topographic surveys in western section, by States and quadrangles, to June 30, 1904—Continued.

State and quadrangle.	Area mapped.	Year.		Contour interval.	Scale.
		Original survey.	Resurvey or revision.		
WYOMING—Continued.	*Sq. miles.*			*Feet.*	
Patrick (Wyo.-Nebr.)	795.25	1895	....	20	1:125,000
Sherman	898.50	1903	....	50	1:125,000
Shoshone[a]	856.67	1884, 1885	....	100	1:125,000
Sundance (Wyo.-S. Dak.)	769.87	1894	1899	50	1:125,000
Yellowstone National Park [a]	* *3,412.26*	1883, 1884, 1885	....	100	1:125,000
Total	19,132.60				

[a] Yellowstone National Park sheet, on scale of 1:125,000, covers the areas of Canyon, Gallatin, Lake, and Shoshone sheets, on same scale.

* Figures in italic are not included in total, as the sheets form parts of others whose total areas are given.

TRIANGULATION AND COMPUTING SECTION.

FIELD WORK.

EASTERN SECTION.

Mr. S. S. Gannett, geographer, continued to exercise general supervision of the primary control executed during the season in this section, under the general direction of Mr. H. M. Wilson, geographer in charge.

Primary triangulation was carried on at various times by six parties, and primary traverse by four of the same parties. This work was distributed over portions of sixteen States: Indiana, Illinois, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Missouri, New York, North Dakota, Ohio, Pennsylvania, Vermont, West Virginia, and Wisconsin. The total area covered by this primary control was 11,760 square miles, of which 10,000 square miles were controlled by primary traverse. The result of this control was to make available forty-four 15-minute quadrangles and two 30-minute quadrangles in which to prosecute future topographic surveys. In the progress of this work twenty-nine triangulation stations were permanently marked and their geodetic positions determined, and 2,283 miles of primary traverse were run.

Illinois-Indiana.—Eighty-six miles of primary traverse were run by Mr. J. R. Ellis, topographic aid, for the control of two 15-minute quadrangles, covering portions of Posey County, Ind., and Gallatin, Hamilton, Saline, and White counties, Ill.

Illinois–Missouri.—Mr. J. R. Ellis controlled the St. Louis quadrangle, in the counties of Madison and St. Clair, Ill., and St. Louis County, Mo., by a traverse line 80 miles in length.

Kansas.—The Independence (30-minute) quadrangle, covering portions of Montgomery, Neosho, and Wilson counties, was controlled by 167 miles of primary traverse, run by Mr. George T. Hawkins, topographer.

Kentucky.—Partial control of one quadrangle in Daviess and Henderson counties was obtained by the running of 51 miles of primary traverse by Mr. J. R. Ellis.

Louisiana.—The Bayou Sara (30-minute) quadrangle, covering portions of East and West Feliciana and East and West Baton Rouge counties, was controlled by 81 miles of primary traverse, run by Mr. E. L. McNair, topographer, in December, 1903.

Maryland.—Two quadrangles in Caroline, Queen Anne, and Talbot counties were controlled by 85 miles of primary traverse by Mr. C. B. Kendall, field assistant. Two quadrangles in Anne Arundel, Howard, Montgomery, and Prince George counties were controlled in a similar manner by Mr. Kendall, who ran 81 miles of traverse for this purpose.

Michigan.—Additional control for the Detroit quadrangle, in Oakland and Macomb counties, was obtained by Mr. J. R. Ellis, who ran 46 miles of primary traverse.

Minnesota-North Dakota.—Two 15-minute quadrangles in Norman County, Minn., and Cass and Traill counties, N. Dak., were controlled by 159 miles of primary traverse, run by Mr. George T. Hawkins, topographer.

Missouri.—The Farmington and Bonneterre quadrangles, covering portions of Jefferson, St. Francois, Ste. Genevieve, and Washington counties, were controlled by 140 miles of traverse, run by Mr. J. R. Ellis. The St. Louis quadrangle was also controlled by Mr. Ellis, as previously noted under the heading "Illinois-Missouri."

New York.—The Belfast (15-minute) quadrangle, in Allegany County, was controlled by Mr. E. L. McNair, topographer, who occupied two old triangulation stations and located two new stations for this purpose. Mr. McNair also obtained control for two quadrangles in Oneida and Oswego counties and two quadrangles in Erie, Genesee, and Wyoming counties by running 241 miles of primary traverse.

Ohio.—During the season of 1903 primary control in Ohio was obtained exclusively by lines of primary traverse. In the northeastern portion of the State, in Ashtabula County, Mr. C. B. Kendall controlled two 15-minute quadrangles by this method. In the southwestern portion of the State, in the counties of Allen, Auglaize, Butler, Clark, Clinton, Darke, Franklin, Greene, Madison, Mercer, Miami, Montgomery, Preble, Van Wert, and Warren, thirteen quadrangles were thus controlled by Messrs. George T. Hawkins and J. R. Ellis, the total number of miles run by the three parties during the season being 867.

Pennsylvania.—One 15-minute quadrangle in Crawford County and one quadrangle in Chester County were controlled by 96 miles of primary traverse by Mr. C. B. Kendall.

Vermont.—In Chittenden County two 15-minute quadrangles were controlled by Mr. E. L. McNair, who occupied 4 triangulation stations and located 6 points by intersections.

West Virginia.—The New Martinsville quadrangle, in Tyler County, was controlled by Mr. S. S. Gannett, geographer, who located 4 triangulation points. Four quadrangles in Wood, Wirt, Jackson, Roane, Mason, and Putnam counties were controlled by Mr. D. H. Baldwin and Mr. E. L. McNair, who occupied 21 triangulation stations and located 7 points by intersections.

Wisconsin.—Mr. George T. Hawkins ran 103 miles of primary traverse for the control of two 15-minute quadrangles in Columbia and Dodge counties.

WESTERN SECTION.

Triangulation was carried on at various times during the year by nine parties and primary traverse by one of the same parties. This work was distributed over portions of nine States and Territories: Arizona, California, Colorado, Montana, Oregon, Texas, Utah, Washington, and Wyoming. The total area covered by this primary control was 27,600 square miles, of which 1,100 square miles were controlled by primary traverse. The result of this control was to make available forty-four 15-minute quadrangles and twenty-two 30-minute quadrangles in which to prosecute future topographic surveys. In the progress of this work 280 new triangulation stations were selected, permanently marked, and their geodetic positions determined, and 255 miles of primary traverse were run.

California.—Three 15-minute quadrangles in Kern County were controlled by Mr. C. F. Urquhart, topographer, who extended triangulation westward from stations Oldtown and Breckenridge. Besides reoccupying these, 8 new stations were built and occupied.

Five 15-minute quadrangles in the Sacramento Valley, between Arbuckle and Red Bluff, were controlled by 255 miles of primary traverse, run by Mr. Urquhart in the spring of 1903. This area lies partly within the counties of Colusa, Tehama, and Yolo. In the spring of 1904 Mr. Urquhart, in connection with the reclamation service, extended a belt of triangulation westward from the vicinity of Yuma, Ariz., through San Diego County, connecting with stations Tecate and Cuyamaca of the United States Coast and Geodetic Survey. In the prosecution of this work Mr. Urquhart occupied 25 stations.

Colorado.—Mr. J. F. McBeth, assistant topographer, occupied 4 stations and located 4 points by intersections, in the counties of Hinsdale and Ouray, during the months of June and July, 1903. During the early part of the season of 1903 Mr. H. L. Baldwin, jr., controlled two 15-minute quadrangles in Boulder, Clear Creek, Gilpin, and Jefferson counties, by reoccupying 3 old triangulation stations, occupying 9 new stations, and locating 10 points by intersections.

Montana.—An area of approximately 2,000 square miles in Choteau and Valley counties was controlled by Mr. H. L. Baldwin, jr., assisted by Messrs. Pearson Chapman and Fred. McLaughlin. These observers, besides reoccupying 5 old stations, built and occupied 35 new stations and located 22 points by intersections.

Texas.—Mr. Arthur Stiles, topographer, in July, 1903, completed triangulation control of four 30-minute quadrangles in Brewster and Presidio counties, the field work of which had been begun in 1902. Mr. Stiles built and occupied 8 stations and located 13 points by intersections.

Utah.—Secondary triangulation for the control of the Cottonwood Special district was extended from stations Bald, Clayton, and Saddle, in June, 1903, by Mr. R. H. Sargent, topographer. Eight stations were occupied and numerous points were cut in.

Washington.—During the season of 1903 Mr. R. B. Robertson, field assistant, extended triangulation from stations Moses, Salt Lake, and Kellar, previously located from the Spokane base and astronomic station, southward and westward, connecting with stations Cooper, Chelan, Atanum, and Wenas, established from the Ellensburg base and astronomic station, the area controlled lying within the counties of Adams, Douglas, Franklin, Kittitas, Okanogan, and Yakima, the net results of this work being the locating and monumenting of 62 stations for the control of an area of 6,500 square miles.

Wyoming.—During the field season of 1903 Mr. Sledge Tatum, topographer, extended triangulation from stations County Road and Gale, in Albany County, northwestward, connecting with stations dependent upon the Wheeler astronomic station at Fort Steele and upon the base line measured by Mr. Frank Tweedy in 1901 west of that place. The work was then extended due north to the vicinity of Buffalo and connected with the stations McKinney and Buffalo, located from the Ranchester base and Sheridan astronomic station. The area controlled lies within the counties of Albany, Carbon, Natrona, and Johnson, the southern portion being within the Medicine Bow Forest Reserve and the northern portion within the Bighorn Reserve. The total number of stations occupied during the season was 35, and 1 point was located by intersections.

SURVEYS OF FOREST RESERVES, WESTERN SECTION.

Oregon.—Proposed forest reserve: During the latter part of the season of 1903 Mr. C. F. Urquhart, topographer, extended triangulation south and east from stations Fields and Strawberry, previously developed from the Baker City base. In the progress of this work Mr. Urquhart occupied 18 stations, which furnish control for eight 30-minute quadrangles lying within the counties of Grant, Harney, and Malheur.

Wyoming: Bighorn Reserve.—As previously noted, triangulation was extended over a portion of this reserve by Mr. Sledge Tatum, topographer.

Medicine Bow Reserve.—As stated above, triangulation was extended over the greater portion of this reserve by Mr. Sledge Tatum, topographer, in the prosecution of his field work in 1903.

OFFICE WORK.

The office computations of triangulation, primary traverse, and adjustment of level circuits were continued, in charge of Mr. S. S. Gannett, geographer. Mr. D. H. Baldwin acted as permanent office assistant and Mr. Joseph W. Kreuttner as clerk.

To assist in computing, there were assigned to this work from time to time the following employees of the division of topography: H. L. Baldwin, jr., R. H. Chapman, L. C. Fletcher, George T. Hawkins, C. F. Urquhart, Sledge Tatum, Frank Tweedy, E. L. McNair, J. R. Ellis, C. B. Kendall, J. F. McBeth, A. P. Meade, L. Scott Smith, R. H. Sargent, and Arthur Stiles. The results of primary triangulation and primary traverse were summarized in form for publication as a bulletin. Triangulation plats for many of the States were made and a card catalogue of several thousand triangulation and primary traverse stations was compiled. The first edition of Geographic Tables and Formulas (Bulletin No. 214) having become exhausted, a second edition, with corrections and additions to the first, was prepared and will be published as Bulletin No. 234. The principal additions consist of a projection table (scale 1:12,000, latitudes 25° to 50°), a table giving the azimuths of Polaris at any hour angle, and a new table for converting wheel revolutions into decimals of a mile.

The 1903 adjustment of the precise-level net in the United States east of the one hundredth meridian by the United States Coast and Geodetic Survey necessitated the readjustment of nearly all level circuits and the correction of nearly all bench-mark elevations of the United States Geological Survey lying within the same area. This work was done chiefly by Mr. D. H. Baldwin, under the supervision of Mr. S. S. Gannett, and a manuscript list of standard bench marks was prepared for publication as a bulletin.

A considerable proportion of the office duties consisted of the preparation of triangulation and leveling data for chiefs of field parties, and of replies to requests from persons not connected with the Survey.

A summary of the office computing during the year follows:

Summary of office work in computing, July 1, 1903, to April 30, 1904.

Topographic section, State, and county.	Triangulation.	Primary traverse.	Level adjustment: Quadrangle.	Computer.
EASTERN.				
Alabama:				
Chambers			Dadeville	D. H. Baldwin.
Elmore			Opelika	
Lee				
Tallapoosa				
Arkansas:				
Benton			Eureka Springs	A. P. Meade.
Boone			Fayetteville	
Carroll			Harrison	
			Silvan Springs	
Georgia:				
Bartow			Cartersville	C. B. Kendall.
Butts			Crawfordville	D. H. Baldwin.
Taliaferro			Eaton	
			Jackson	
			Madison	
			Wilkes	
River surveys:				
Elbert			Alcovy River	D. H. Baldwin.
Fannin			Broad River	C. B. Kendall.
Franklin			Chattahoochee River.	
Habersham			Chattooga River	
Harris			Chestatee River	
Hart			Hiwassee River	
Jackson			Nottely River	
Jasper			Ocmulgee River	
Lincoln			Savannah River	
McDuffie			Soquee River	
Morgan			Tallulah River	
Rabun			Toccoa River	
Union			Towilega River	
Warren			Tugaloo River	
Wilkes			Yellow River	

Summary of office work in computing, July 1, 1903, to April 30, 1904—Continued.

Topographic section, State, and county.	Triangulation.	Primary traverse.	Level adjustment: Quadrangle.	Computer.
EASTERN—cont'd.				
Illinois: Gallatin, Hamilton, Saline, White; Indiana: Posey	....	Computation of 319 latitudes and departures and 80 geographic positions.	....	G. T. Hawkins. J. R. Ellis.
Illinois: Madison, St. Clair	....	Computation of 270 latitudes and departures and 80 geographic positions.	....	G. T. Hawkins. L. Scott Smith.
Missouri: St. Louis	....	....	St. Louis, East and West.	A. P. Meade.
Kansas: Montgomery, Neosho, Wilson	....	Computation of 357 latitudes and departures and 153 geographic positions.	Independence	G. T. Hawkins. L. Scott Smith. D. H. Baldwin.
Kentucky: Bell, Harlan, Mercer	....	....	Harlan, Harrodsburg, Maynardsville, Middlesboro, Pineville	C. B. Kendall.
Daviess, Henderson	....	Computation of 219 latitudes and departures and 17 geographic positions.	....	G. T. Hawkins. L. Scott Smith.
Louisiana: East Baton Rouge, West Baton Rouge, East Feliciana, West Feliciana	....	Computation of 410 latitudes and departures and 40 geographic positions.	....	G. T. Hawkins. J. R. Ellis.
Maine: Kennebec, Somerset	....	....	Bingham, Kennebec River survey	D. H. Baldwin.
Maryland: Anne Arundel, Caroline, Howard, Montgomery, Queen Anne, Talbot	....	Computation of 807 latitudes and departures and 139 geographic positions.	....	G. T. Hawkins. J. R. Ellis.
Allegany, Carroll, Garrett, Washington	....	....	Accident, Flintstone, Frostburg, Grantsville, Oakland, Westminster, Westernport	C. B. Kendall. D. H. Baldwin.

Summary of office work in computing, July 1, 1903, to April 30, 1904—Continued.

Topographic section, State, and county.	Triangulation.	Primary traverse.	Level adjustment: Quadrangle.	Computer.
EASTERN—cont'd.				
Michigan: Macomb, Oakland		Computation of 146 latitudes and departures and 34 geographic positions.	Detroit	G. T. Hawkins. J. R. Ellis. D. H. Baldwin.
Minnesota: Norman; North Dakota: Cass, Traill		Computation of 350 latitudes and departures and 127 geographic positions.		G. T. Hawkins. J. R. Ellis.
Missouri: Jefferson, St. Francois, Ste. Genevieve, Washington		Computation of 926 latitudes and departures and 88 geographic positions.		G. T. Hawkins. L. Scott Smith.
St. Louis (See Ill.-Mo.).			Bonneterre, Farmington	A. P. Meade.
Clark, Knox			Edina, Kahoka	J. R. Ellis.
New Hampshire: Hillsboro, Rockingham			Auburn, Dover, Manchester, Nottingham, Peterboro	D. H. Baldwin.
New York: Allegany	Reduction to center, station and figure adjustment, final computation of distances and positions.			E. L. McNair.
Erie, Genesee, Oneida, Oswego, Wyoming		Computation of 1,245 latitudes and departures and 137 geographic positions.		G. T. Hawkins. E. L. McNair.
Allegany, Columbia, Erie, Orange, Schoharie, Suffolk, Sullivan, Ulster, Wyomimg			Attica, Belfast, Copake, Depew, Moriches, Mount Morris, Richmondville, Riverhead, Schoharie, Warsaw	C. B. Kendall.
			Revision and readjustment of the level net throughout the State (field work 1896 to 1903) reducing all elevations to the 1903 adjustment of the precise level net.	D. H. Baldwin.

Summary of office work in computing, July 1, 1903, to April 30, 1904—Continued.

Topographic section, State, and county.	Triangulation.	Primary traverse.	Level adjustment: Quadrangle.	Computer.
EASTERN—cont'd.				
North Carolina:				
Buncombe				
Henderson			Asheville	
Madison			Morganton	
McDonald	....	....	Mount Mitchell	S. S. Gannett.
Mitchell			Pisgah	C. B. Kendall.
Transylvania			Roan Mountain	
Yancy				
North Dakota:				
Richland (See Minn.).	....	....	Wahpeton	D. H. Baldwin.
Ohio:				
Allen				
Ashtabula				
Auglaize				
Butler				
Clark				
Clinton				S. S. Gannett.
Darke				G. T. Hawkins.
Franklin				E. L. McNair.
Greene	....	Computation of 2,282 latitudes and departures and 630 geographic positions.	....	J. R. Ellis.
Madison				C. B. Kendall.
Mercer				
Miami				
Montgomery				
Preble				
Van Wert				
Warren				
			Akron	
			Ashtabula	
			Athens	
			Berea	
Allen			Canton	
Athens			Cleveland	
Lake			Cutler	
Lorain			Dayton	
Madison			Hamilton	
Marion			Kent	
Monroe	....	....	Lima	D. H. Baldwin.
Portage			Madison	A. P. Meade.
Seneca			Massillon	
Stark			Mentor	
Summit			Mount Sterling	
Washington			Oberlin	
Wyandot			Painesville	
			Springfield	
			Sycamore	
			Tiffin	
			Union	
			Woodsfield	

Summary of office work in computing, July 1, 1903, to April 30, 1904—Continued.

Topographic section, State, and county.	Triangulation.	Primary traverse.	Level adjustment: Quadrangle.	Computer.
EASTERN—cont'd.				
Ohio—Continued	....	....	Revision and readjustment of the level net throughout the State (field work 1897–1902), reducing all elevations to the 1903 adjustment of the precise level net.	S. S. Gannett. D. H. Baldwin.
Pennsylvania:				
Allegheny Westmoreland	Station and figure adjustments, final computation of distances and positions.	....	....	G. T. Hawkins.
Chester Crawford	....	Computation of 490 latitudes and departures and 94 geographic positions.	....	E. L. McNair. C. B. Kendall.
Allegheny Beaver Chester Lawrence Westmoreland Washington	....	....	Amity Beaver Carnegie Coatesville Freeport Greensburg McKeesport Newcastle Phoenixville Sewickly Sharpsburg Suplee	A. P. Meade.
South Carolina:				
Abbeville Anderson Oconee	....	....	Chattooga River flying levels.	D. H. Baldwin.
Tennessee:				
Union Wayne	....	....	Buffalo River survey. Waynesboro	C. B. Kendall.
Vermont:				
Chittenden	Reduction to center, station and figure adjustments, final computation of distances and positions.	....	....	E. L. McNair.
Addison Rutland	....	....	Brandon Middlebury Ticonderoga	D. H. Baldwin.
West Virginia:				
Jackson Mason Putnam Tyler Wirt Wood	Reduction to center, station and figure adjustments, final computation of distances and geodetic positions.	....	....	S. S. Gannett. G. T. Hawkins. E. L. McNair.

Summary of office work in computing, July 1, 1903, to April 30, 1904—Continued.

Topographic section, State, and county.	Triangulation.	Primary traverse.	Level adjustment: Quadrangle.	Computer.
EASTERN—cont'd.				
West Virginia—Continued.				
			Blacksville	
Doddridge			Cameron	
Gilmer			Fairmont	
Harrison			Glenville	
Marshall			Holbrook	
Marion	...	...	Littleton	D. H. Baldwin.
Monongalia			New Martinsville	A. P. Meade.
Morgan			Pawpaw	
Pleasant			Salem	
Ritchie			St. Marys	
Wetzel			West Union	
			Wheeling	
Wisconsin:				
Columbia	...	Computation of 300 latitudes and departures and 74 geographic positions.	...	G. T. Hawkins.
Dodge				J. R. Ellis.
Rock	...	...	Koshkonong	D. H. Baldwin.
WESTERN.				
Arizona:				
Cochise	Reduction to center, station and figure adjustments, final computation of distances and geodetic positions.	...	...	S. S. Gannett.
Coconino				R. H. Chapman.
Mohave				D. L. Reaburn.
Pima				J. F. McBeth.
Pinal				
Santa Cruz				
			Nogales	S. S. Gannett.
			Patagonia	
			Tombstone	L. C. Fletcher.
			Tucson	
California:				
Kern	Reduction to center, station and figure adjustments, final computation of distances and geodetic positions.	...	...	C. F. Urquhart.
San Diego				
Colusa	...	Computation of 1,100 latitudes and departures and 113 geographic positions.	...	Do.
Tehama				
Yolo				
			Bakersfield	
			Kaiser	
Alameda			Kaweah	
Colusa			Oil Center	
Kern			Pleasanton	S. S. Gannett.
Santa Barbara	...	...	Santa Maria	L. C. Fletcher.
Tehama			Tehama	
Tulare			Tehipiti	
Yolo			Vina	
			Willows	

Summary of office work in computing, July 1, 1903, to April 30, 1904—Continued.

Topographic section, State, and county.	Triangulation.	Primary traverse.	Level adjustment: Quadrangle.	Computer.
WESTERN—cont'd.				
Colorado: Hinsdale, Ouray	Reduction to center, station adjustments, computation of final distances and geodetic positions.	....	....	J. F. McBeth.
Boulder, Clear Creek, Gilpin, Jefferson	Station and figure adjustments, final computation of distances and geodetic positions.	....	....	R. H. Chapman. Sledge Tatum. J. F. McBeth.
			Boulder, Black Hawk, Central, Cripple Creek, Georgetown, Lake City	S. S. Gannett. L. C. Fletcher.
Montana: Choteau, Flathead, Valley	Reduction to center, station and figure adjustments, computation of final distances and geodetic positions.	....	....	H. L. Baldwin, jr. R. H. Chapman. Sledge Tatum. J. F. McBeth.
Choteau Valley	....	....	Bowdoin, Coburg, Fort Belknap, Harlem, Hinsdale, Malta, Saco	D. H. Baldwin.
Oregon: Baker, Grant, Harney, Malheur	Reduction to center, station and figure adjustments, computation of final distances and geodetic positions.	....	....	S. S. Gannett. C. F. Urquhart.
South Dakota: Butte	....	....	Belle Fourche	L. C. Fletcher.
Texas: Brewster, Presidio	Reduction to center, station adjustments, computation of final distances and positions.	....	....	Arthur Stiles.
El Paso, Fannin, Lamar	....	....	Bonham, Chisos, Paris, Vanhorn	D. H. Baldwin.
Utah: Salt Lake, Summit, Wasatch	Reduction to center, final computation of distances between, and positions of secondary points.	....	Revision and readjustment of level circuits reducing all elevations to the 1903 adjustment of the precise level net.	R. H. Sargent. S. S. Gannett. D. H. Baldwin.

Summary of office work in computing, July 1, 1903, to April 30, 1904—Continued.

Topographic section, State, and county.	Triangulation.	Primary traverse.	Level adjustment: Quadrangle.	Computer.
WESTERN—cont'd.				
Washington:			Chapaca; Mount Adams; Oakesdale; Pullman; Columbia River; Spokane River	R. H. Chapman. Sledge Tatum. L. C. Fletcher.
Adams; Douglas; Franklin; Kittitas; Okanogan	Reduction to center, station and figure adjustments, computation of final distances and positions.	....	Revision and readjustment of the level net in the northern central part of State.	L. C. Fletcher.
Wyoming:				
Albany; Carbon; Johnson; Natrona	Reduction to center, station and figure adjustments, computation of final distances and positions.	....	....	R. H. Chapman. Sledge Tatum.
Uinta	....	....	Revision and readjustment of level circuits.	S. S. Gannett. D. H. Baldwin.

SECTION OF INSPECTION OF TOPOGRAPHIC SURVEYING AND MAPPING.

Coincident with the reorganization of the topographic branch on July 1, 1903, provision was made for the inspection of topographic surveying and mapping, and Mr. John H. Renshawe, geographer, was placed in charge of that section. His duties are not administrative, but are general in character, and are carried on through consultation and collaboration with the chiefs of the eastern and western sections of topography. He keeps in touch with the topographers in the field, criticises their expressions of topographic forms and their choice of essential details, and eliminates, as far as possible, their mannerisms and individualities in contour sketching, with a view to gaining uniformity of style and expression for similar features throughout the country.

Mr. Renshawe left Washington on July 3 for the purpose of visiting all the districts in which field work was being carried on and of gaining a general knowledge of the characteristics and capabilities of the various topographers, to serve as a basis for discrimination later. This trip was completed in the latter part of October, with satisfactory results, when he returned to the Washington office.

To the chief of this section is also assigned the duty of preparing such base maps as may be required. Immediately upon his return to the office Mr. Renshawe began work on a complete and systematic revision of the three-sheet wall map of the United States. The map is on a scale of 40 miles to the inch, with a contour interval of 1,000 feet, and is based on the detailed topographic maps of this Survey. The map shows all State and county boundary lines, the names and location of county seats, all railroads, and principal drainage. The relief is treated somewhat broadly, as prescribed by the horizontal and vertical scale, but an effort has been made to preserve the character of all topographic features. During the office season work on this map progressed without interruption, with the result that all material for its completion has been prepared, and the final drawing of more than four-fifths of the area of the United States has been finished. Throughout the year Mr. Renshawe was assisted in this work by Mr. Vladimir Sournin, and during a portion of the time by Messrs. L. Scott Smith, W. O. Tufts, and J. I. Gayetty, of the eastern section, and R. A. Farmer, of the western section of topography. Miss M. E. Mitchell acted as clerk.

Special attention is given by this section to a classification of the physiographic types illustrated by the topography of the United States and their relations to the geologic structure. For this purpose there has been prepared for publication as a bulletin a paper on topographic expression, with pictorial illustrations of types and appropriate contouring of them, and such discussion of the subject as will enable the topographer to understand the origin and development of forms and to better express them.

SECTION OF INSTRUMENTS AND TOPOGRAPHIC RECORDS.

Mr. S. A. Aplin, assisted by Mr. Powell P. Withers, continued in charge of instruments and topographic records. The general overhauling of all instruments in use was attempted this year, the work being done principally by Mr. Ernest Kübel, mechanician. Other repairs, more economically handled by large shops, were made by Mr. George N. Saegmüller, of Washington, and Messrs. W. and L. E. Gurley, of Troy, N. Y.

The purchases of new instruments during the year were confined to regular types and to such quantities as to provide for loss by wear and tear and natural increase of field operations.

The filing of the original records under the existing card system was continued. The number of pieces filed was about 1,900, comprising triangulation, level, and topographic notebooks and plane-table sheets. In addition there were about 350 pieces of miscellaneous material. The material relating strictly to the various quadrangles was filed separately.

Division of Geography and Forestry.

During the summer of 1903 the work of this division was temporarily in charge of Mr. F. H. Newell, hydrographer, owing to the absence of Mr. Henry Gannett, geographer, in the Philippines. On Mr. Gannett's return, late in September, he resumed charge of the work.

The examination of the Gila River Forest Reserve, in New Mexico, commenced by Mr. T. F. Rixon in the spring of 1903, was completed during the summer, and a report on the forest conditions of this area, with recommendations, was prepared.

An examination of the Lincoln Forest Reserve, commenced toward the end of the last fiscal year by Messrs. F. G. Plummer and M. G. Gowsell, was completed and a report thereon was prepared.

An examination was made by Mr. J. B. Leiberg of that portion of the Yellowstone Forest Reserve which lies within Montana, and also of the Little Belt Mountain Reserve in that State. The examination included, in addition, all the lands within the Livingstone, Little Belt Mountain, Big Timber, and Granite Mountain quadrangles, and parts of the Fort Benton and Red Lodge quadrangles. A report on this area was completed.

During the winter Messrs. Plummer and Gowsell made an examination of a large area of country east of San Diego, Cal., with a view to creating a forest reserve for the protection of the water supply. The land, however, was found to be so largely in private hands that it was deemed inexpedient to create a reserve.

During the spring of 1904 Messrs. Plummer and Gowsell made an examination of the Santa Barbara Forest Reserve, in southern California, and also of the mountains in the neighborhood of San Luis Obispo, with a view to the possibility of creating a forest reserve in that region.

Early in the spring Mr. Rixon was engaged in the examination of the mountains lying southeast of Albuquerque, N. Mex., with a similar purpose in view.

The total area examined by these parties during the year is estimated to be in the neighborhood of 17,500 square miles.

During the year there were prepared gazetteers for the States of Delaware, Maryland, Virginia, and West Virginia; a second edition of the bulletin on the Origin of Certain Place Names in the United States; a third edition of the bulletin on Boundaries of States and Territories, and a second edition of the Gazetteer of Texas.

Maps in contours, on a scale of 12 miles to the inch, compiled mainly by reduction from atlas sheets of the Survey, were prepared for Colorado, New Mexico, Arizona, Wyoming, Delaware, Maryland, Virginia, and West Virginia.

HYDROGRAPHIC BRANCH.

Organization.

The hydrographic branch continued its investigation during the year on the general plans adopted in 1902, as described in the last annual report, pages 180–182. The work was divided among four divisions—hydrography, hydrology, hydro-economics, and the reclamation service, and was under the immediate charge of Mr. Frederick H. Newell, who was assisted by an executive staff consisting of the heads of various divisions and sections, and also by a consulting staff composed of experts who devote their time to the consideration of special features of the work. Among these were Messrs. Arthur P. Davis, J. B. Lippincott, and Charles H. Fitch, supervising engineers; George Y. Wisner, J. H. Quinton, B. M. Hall, H. N. Savage, and W. H. Sanders, consulting engineers; Mr. H. A. Storrs, electrical engineer; Mr. Morris Bien, legal expert; Mr. T. H. Means, engineer of soils, and others.

As during the preceding year, the Civil Service Commission held several examinations for the purpose of securing a list of eligibles to the various divisions of the work. These examinations were adapted to the requirements of the various grades, ranging from consulting and constructing engineers to engineering and hydrographic aids, and from the list thus obtained new men for the service were selected. The services of temporary field employees were practically dispensed with, their places being filled by regular civil-service employees, trained men who hold the positions wholly through merit and ability.

Division of Hydrography.

The extension of the work of the division of hydrography, which was started in 1902, was continued during 1903–4, under the immediate charge of Mr. Frederick H. Newell, assisted by various men in field and office.

The work at the Washington office was divided among six sections, as follows: Executive, which looks after the general conduct of the affairs of both the office and the field, under the direction of Mr. George B. Hollister; computing, which has charge of all records coming into the office, and prepares the same for publication, under Mr. John C. Hoyt, assisted by Messrs. Frank H. Brundage and R. H. Bolster; drafting, which cares for all maps, under the direction of Mr. H. V. Leménager, assisted by Mr. N. S. Hamilton and Miss Florence Wieser; instruments and equipments, which has general supervision of the purchase, care, and distribution of all instruments and supplies, under the direction of Mr. E. G. Paul; publicity, which was organized within the year and which gives out for general publication to the press of the country such facts in regard to the work as may be of special interest to the public, and also receives visitors and directs them to the sections which will give them the information they ask, under the direction of Mr. C. J. Blanchard. General filing and indexing was carried on by Mrs. Mary E. Coffin. Bookkeeping and accounts were in charge of Mrs. J. T. Davis. Disbursements for a considerable part of the year were made by Mr. J. W. Spencer.

The field work was divided into two sections—the eastern, which includes the humid States, most of which lie east of the Mississippi River, and the western, which is made up of the arid and semihumid States west of the Mississippi. For convenience in organization these sections have been divided into hydrographic districts, each of which is in charge of a district hydrographer or engineer, to whom all the employees in the district report, and who is responsible to the chief hydrographer for the work in his district. The inspection of the stations and methods was carried on by Mr. E. C. Murphy, who spent the larger part of his time in traveling through the various districts in company with the district hydrographers or their assistants.

Complete descriptions of the river stations, together with the data and the results obtained by discussion of these data, will be published in Water-Supply Papers Nos. 97 to 100, inclusive. The data for the various sections of the country are divided in these papers, as follows: No. 97, Great Lakes and northern Atlantic Ocean drainage; No. 98, southern Atlantic Ocean, eastern Gulf of Mexico, and eastern Mississippi River drainages; No. 99, western Gulf of Mexico and western Mississippi River drainages; No. 100, Interior Basin, Pacific coast, and Hudson Bay drainages.

EASTERN SECTION.

The eastern section of hydrography is divided into five hydrographic districts, as follows:

New England: Resident hydrographer, Mr. N. C. Grover, assisted by Messrs. F. E. Pressey, Sidney Clapp, and H. K. Barrows, with headquarters at Bangor, Me.

New York and Michigan: Resident hydrographer, Mr. R. E. Horton, assisted by Messrs. C. C. Covert and F. H. Tillinghast, with headquarters at Utica, N. Y.

Northern Atlantic States (including New Jersey, Pennsylvania, Maryland, West Virginia, and Virginia): Resident hydrographer, Mr E. G. Paul, assisted by Messrs. W. C. Sawyer and F. H. Tillinghast, with headquarters at Washington, D. C.

Southern Atlantic and Eastern Gulf States: Resident hydrographer, Mr. M. R. Hall, assisted by Messrs. J. M. Giles, B. S. Drane, W. E. Hall, and others, with headquarters at Atlanta, Ga.

Mississippi Valley: Resident hydrographer, Mr. Edward Johnson, jr., assisted by Messrs. F. W. Hanna, L. R. Stockman, E. H. Heilbron, and others, with headquarters at Chicago, Ill.

This district includes that portion of Wisconsin, northern Michigan, and Minnesota which drains into the Great Lakes, and the humid States west of the Mississippi River—namely, Iowa and Missouri.

The following paragraphs give, in geographic order, descriptions of the operations in the various States included in the eastern section of hydrography, and also the names of those who have assisted in the work.

Maine.—Measurements of the rivers at various points were continued through cooperation with the State survey.

New Hampshire.—The work in this State was extended to cover the more important streams.

Vermont.—The systematic measurement of the streams, which was started the preceding year, was continued and extended to cover the principal portions of the State.

Massachusetts.—During the latter part of the year systematic measurements were started on several streams in this State. As in former years, the Metropolitan Water and Sewage Board supplied the measurements of the flow of streams in the drainage areas which furnish the Boston water supply. Mr. R. A. Hale, assistant engineer, Lawrence, Mass., continued his determinations of the flow of Merrimac River.

Rhode Island.—Only a small amount of reconnaissance work was done in this State during the year.

Connecticut.—Measurements were continued on a few small streams in this State, in connection with the study of the water supply for New York City, by Mr. R. E. Horton, and systematic studies were begun of the more important streams in the State by Mr. N. C. Grover.

New York.—Measurements of streams for the purpose of water supply for New York City were continued during a part of the year, and investigations of the flow of water over dams were continued, in cooperation with Prof. G. S. Williams, at the hydraulic laboratory of Cornell University.

New Jersey.—Stream-measurement work in this State was extended during the year to the more important streams in the northern part. In establishing the stations special effort was made to choose localities that would give data for the study of the flood conditions which have been so disastrous during the last two years.

Pennsylvania.—As in previous years, the measurements in this State were confined to the Susquehanna River and Delaware River drainages.

Maryland.—The work in this State was continued, as in previous years, in cooperation with Prof. William B. Clark, director of the Maryland geological survey.

Virginia and West Virginia.—Measurements of the more important rivers in these States were continued.

North Carolina and South Carolina.—The work in these States was continued and largely increased during the year.

Georgia, Alabama, and Tennessee.—Measurements of the more important streams were continued, and the work was extended to many of the less important localities. During the year river profiles and surveys were made of several of the more important power streams of these States.

Ohio, Indiana, and Illinois.—The work which was started the preceding year in these States was continued and largely extended.

Michigan.—The work in the southern peninsula was under the direction of Mr. R. E. Horton and that in the northern peninsula under the direction of Mr. Edward Johnson, jr. Measurements were made of the more important streams in both sections.

Wisconsin, Minnesota, Iowa, and Missouri.—The work started in these States the preceding year was continued and was extended to cover the more important streams in each State. A river profile and survey was made of the Chippewa River.

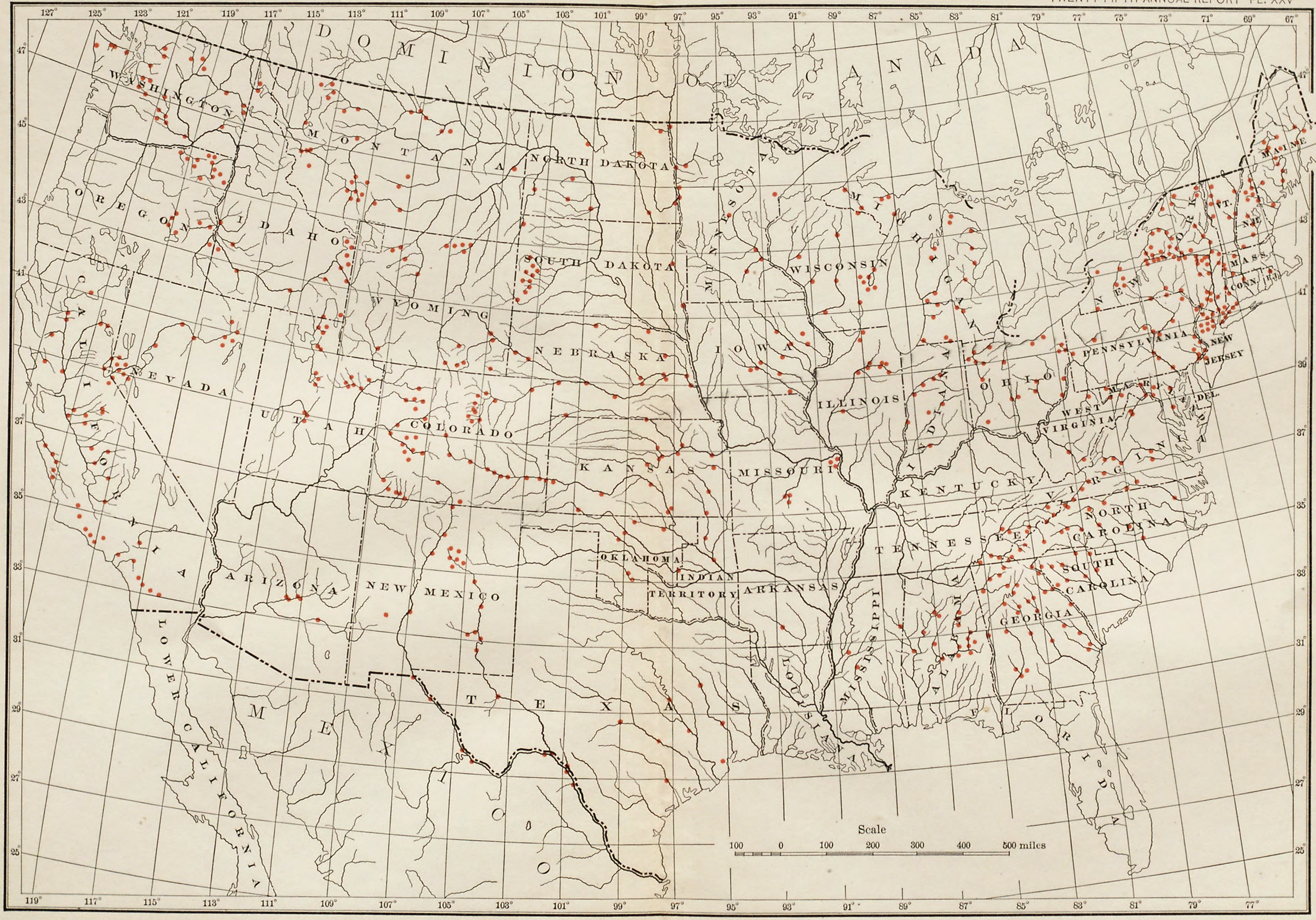
WESTERN SECTION.

The western section of hydrography, which includes the State of Texas and those States and Territories enumerated in the reclamation law, is divided into three principal hydrographic districts, and the remainder of the work is carried on in connection with the various irrigation investigations. These districts are (1) the central West, which includes the whole or portions of the States of Colorado, Kansas, Nebraska, South Dakota, Wyoming, and Utah and the Territories of New Mexico and Oklahoma, in which work was carried on under the general direction of Mr. A. L. Fellows, aided by Mr. M. C. Hinderlider, who was assisted by Messrs. Fillmore Cogswell, G. B. Monk, and F. L. Meeker; (2) California, in which the work was under the general supervision of Mr. J. B. Lippincott, assisted by Mr. S. G. Bennett, with headquarters at San Francisco, and Mr. W. B. Clapp, with headquarters at Los Angeles; and (3) Texas, in which the work is under the direction of Prof. Thomas U. Taylor, of Austin.

The following paragraphs give, in alphabetic order, descriptions of the operations in the various States and Territories included in the western section of hydrography, and also the names of the engineers and others who have either had charge of the work or have assisted in its prosecution:

Arizona.—Measurements in this Territory were confined to such localities on the Verde, Salt, and other rivers as are being investigated for irrigation purposes. Mr. Arthur P. Davis had general supervision, and owing to the limited transportation facilities in this region the work at the various stations was done mainly by resident observers. In the western part of Arizona, along the Colorado River, investigations were carried on, under the direction of Mr. J. B. Lippincott, by Mr. D. W. Smith.

California.—Owing to the great commercial value of water in this State, the measurements have here been more widely distributed than in most localities in the West. Special investigations were carried on in various portions of the State by



MAP OF UNITED STATES, SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1903-04

Mr. Homer Hamlin and others, and measurements were made to determine the effect of irrigation upon the water supply.

Colorado.—The work in Colorado was carried on by the employees of the Denver office. The principal localities under investigation were in the drainages of the Platte, Arkansas, Rio Grande, and Uncompahgre rivers.

Idaho.—Stream measurements in this State were continued under the direction of Mr. D. W. Ross, assisted by Mr. Fred Stockton.

Kansas.—Mr. G. W. Russell carried on the field work in this State, as in former years. Many data were collected in regard to the floods of the Kansas River.

Montana.—Measurements in this State were under the direction of Mr. Cyrus C. Babb, district engineer, assisted by Messrs. A. E. Place, W. B. Freeman, and others. The work was confined chiefly to those localities in which irrigation is being practiced, namely, the drainage basins of the St. Marys, Missouri, and Yellowstone rivers.

Nebraska.—The field operations in this State were continued by Mr. J. C. Stevens.

Nevada.—Work in Nevada was continued last year in cooperation with the State engineer, Mr. A. E. Chandler, who had direct supervision of the work.

New Mexico.—Several stations were maintained on the Rio Grande by Mr. W. W. Follett, consulting engineer of the International (Water) Boundary Commission, and the results were furnished to the Survey for publication. During the year systematic measurements were started in the northern part of the State, on the Gallina and Mora rivers, under the direction of Mr. M. C. Hinderlider, and in the southern portion of the State, on the Sapello, Hondo, and Pecos rivers, under the direction of Mr. W. M. Reed.

North Dakota.—The stations in this State were maintained under the direction of Mr. F. E. Weymouth, who was assisted by Prof. E. F. Chandler, of the University of North Dakota.

Oklahoma.—Mr. G. H. Matthes had general supervision of the work in this Territory.

Oregon.—The work in this State was largely extended during the year by Mr. J. T. Whistler, who has charge of the irrigation investigations in this locality. The principal drainage areas under investigation are those of Wallowa, Malheur, Grande Ronde, Umatilla, and Silvies rivers.

South Dakota.—A large amount of stream-measurement work was done in the southern portion of this State, under the direction of Mr. C. H. Fitch, who has carried on irrigation surveys in that locality.

Texas.—Measurements of the more important rivers were continued by Prof. Thomas U. Taylor, of the University of Texas. During the year Professor Taylor prepared a paper bringing together all available information concerning the water powers of this State. Measurements at various points along the Rio Grande were made by the engineers of the International (Water) Boundary Commission, under the direction of Mr. W. W. Follett.

Utah.—With the exception of the work in the vicinity of the Uinta Reservation, which was carried on, under the direction of Mr. M. C. Hinderlider, by Mr. H. S. Reed, the work in this State was under the direction of Mr. George L. Swendsen.

Washington.—The hydrographic work in this State was continued and largely extended during the year, under the direction of Mr. T. A. Noble, district engineer for this State.

Wyoming.—Mr. A. J. Parshall continued the measurements on several of the streams in this State, under the direction of Mr. M. C. Hinderlider. The work in the northwestern portion of the State was done under the direction of Mr. Jeremiah Ahern, in connection with irrigation surveys.

LOCATION OF RIVER MEASUREMENTS.

The locations of the principal river stations maintained during 1903, as enumerated in the following list, are shown on Pl. XXV. Acknowledgments should be made to the United States Weather Bureau, United States Army Engineers, and various municipalities, corporations, and individuals, as noted in Water-Supply Papers Nos. 97 to 100, for their cooperation in carrying on this work.

Gaging stations, by States, maintained in 1903.

River.	Station.	River.	Station.
ALABAMA.		CALIFORNIA—cont'd.	
Alabama	Montgomery.	East Side canal	Citrus.
Do	Selma.	Farmers canal	Bishop.
Black Warrior	Cordova.	Feather	Oroville.
Do	Tuscaloosa.	Independence Creek	Independence Lake, Overton.
Black Warrior (Locust Fork).	Palos.	Kaweah	Three Rivers.
Cahaba	Centerville.	King	Red Mountain, near Sanger.
Choccolocco	Jenifer.	Malibo Creek	Calabasas.
Coosa	Riverside.	Merced	Merced Falls.
Hillabee Creek	Alexander.	Modesto canal	Indian Hill flume.
Talladega Creek	Nottingham.	Mohave	Victorville.
Tallapoosa	Milstead.	Mokelumne	Electra.
Do	Sturdevant.	Mono Creek	Dam site (Cable station).
ARIZONA.			
Colorado	Bulls Head	Morgan flume	Lagrange.
Do	Yuma.	Owens	Independence.
Gila	San Carlos.	Do	Round Valley.
Do	Yuma.	Owens River canal	Bishop.
Salt	McDowell.	Pine Creek	Round Valley.
Do	Reservoir site below Tonto Creek, Livingstone.	Prosser Creek	Below Prosser Creek Ice Company's dam, Boca.
Tonto Creek	Livingstone.	Do	Prosser Creek Road House, Hobart Mills.
Verde	McDowell.		
ARKANSAS.			
Washita	Malvern.	Rock Creek	Round Valley.
CALIFORNIA.		Sacramento	Iron Canyon, Red Bluff.
Arroya Seco	Pettitt's ranch, Soledad.	San Gabriel River and canals.	Azuza.
Bishop Creek	Round Valley.	San Lorenzo Creek	Kings City.
Cache Creek	Lower Lake.	Sanger canal	Alvord.
Do	Yolo.	Santa Ana	Warmsprings.
Carson (West Fork)	Woodfords.	Santa Ynez	Cable Station.
Collins (A. O.) canal.	Bishop.	Stanislaus	Knights Ferry.
Collins (George) canal.	Bishop.	Stevens canal	Citrus.
Donner Creek, Donner.	Donner Ice Company's dam, Truckee.	Stony Creek	Julian's ranch, Fruto.
		Susan	Susanville.
		Triumpho Creek	Calabasas.

Gaging stations, by States, maintained in 1903—Continued.

River.	Station.	River.	Station.
CALIFORNIA—cont'd.		COLORADO—cont'd.	
Truckee	Nevada-California State Line, Mystic.	Marvine Creek	Buford.
Do	Tahoe.	Oxford Farmers canal.	Nepesta.
Truckee (Little)	Boca.	Rio Grande	Cenicero.
Tule	Portersville.	Do	Del Norte.
Tuolumne River and Turlock canal.	Lagrange.	St. Vrain Creek	Lyons.
Turlock canal	Morgan flume.	South Platte	Denver.
Do	Snake River flume.	Do	Julesburg.
Walker (West Fork)	Coleville.	Do	Kersey.
Yuba	Smartsville.	Do	South Platte.
COLORADO.		Supply ditch	Lyons.
Animas	Durango.	Uncompahgre	Colona.
Do	Silverton.	Do	Delta.
Arkansas	Canyon.	Do	Montrose.
Do	Granada.	White	Meeker.
Do	Nepesta.	White (North Fork)	Buford.
Do	La Junta.	White (South Fork)	Do.
Do	Prowers.	CONNECTICUT.	
Do	Pueblo.	Byram	Glenville.
Do	Rockyford.	Byram (East Branch).	Greenwich.
Do	Salida.	Do	Jones.
Big Thompson Creek.	Arkins.	Housatonic	Gaylordsville.
Cache la Poudre	Greeley.	Mianus	Sedgwicks.
Cimarron	Cimarron.	Do	Stamford.
Clear Creek	Forkscreek.	GEORGIA.	
Conejos	Magote.	Alcovy	Covington.
Dolores	Dolores.	Apalachee	Buckhead.
Florida	Durango.	Broad (of Georgia)	Carlton.
Grand	Glenwood Springs.	Cannoochee	Groveland.
Do	Palisades.	Chattahoochee	Gainesville.
Gunnison	Cimarron.	Do	Oakdale.
Do	Hotchkiss.	Do	West Point.
Do	Cory.	Do	Norcross.
Do	Iola.	Coosa	Rome.
Do	Whitewater.	Coosawattee	Carters.
Handy ditch	Arkins.	Etowah	Canton.
Los Pinos	Ignacio.	Do	Rome.
		Flint	Albany.
		Do	Woodbury.

Gaging stations, by States, maintained in 1903—Continued.

River.	Station.
GEORGIA—cont'd.	
Kinchafoonee Creek	Albany.
Muckalee Creek	Do.
Oconee	Dublin.
Do	Greensboro.
Do	Milledgeville.
Ocmulgee	Flovilla.
Do	Macon.
Ogeechee	Millen.
Ohoopee	Redisville.
Savannah	Augusta.
South	Lithonia.
Williamson Swamp Creek.	Davisboro.
IDAHO.	
Bear	Preston.
Do	Montpelier, near Dingle.
Blackfoot	Presto.
Boise	Boise.
Bruneau	Grandview.
Fall	Head of Harringfeld canal, Marysville.
Pend Oreille	Priest River.
Priest	Do.
Snake	Montgomery, near Minidoka.
Snake (North Fork)	Ora.
Snake (South Fork)	Wedekin Ferry, near Lyon.
Succor Creek	Homedale.
Teton	St. Anthony.
Weiser	Weiser.
Willow Creek	Prospect.
ILLINOIS.	
Desplaines	Above mouth of Kankakee, Channahon.
Do	Above mouth of Jackson Creek, Channahon.
Fox	Ottawa.
ILLINOIS—cont'd.	
Illinois	Peoria.
Do	Lasalle.
Do	Ottawa.
Do	Seneca.
Do	Minooka.
Rock	Above mouth of Pecatonica Creek, Rockton.
Do	Below mouth of Pecatonica Creek, Rockton.
Sangamon	Springfield.
INDIANA.	
Eel (Lower)	Cataract.
Eel (Upper)	Logansport.
Tippecanoe (Springboro Branch).	Delphi.
Wabash	Lafayette.
Do	Logansport.
Do	Terre Haute.
White (East Branch).	Shoals.
White (West Branch).	Indianapolis.
INDIAN TERRITORY.	
Verdigris	Catoosa.
IOWA.	
Cedar	Cedar Rapids.
Des Moines	Des Moines.
Do	Keosauqua.
Iowa	Iowa City.
Do	Marshalltown.
Maquoketa	Manchester.
Raccoon	Des Moines.
Wapsepinicon	Stone City.
KANSAS.	
Arkansas	Arkansas City.
Do	Coldridge.
Do	Dodge.
Do	Hutchinson.

Gaging stations, by States, maintained in 1903—Continued.

River.	Station.
KANSAS—continued.	
Arkansas	Syracuse.
Blue	Manhattan.
Cimarron	Arkalon.
Kansas	Lecompton.
Osage	Ottawa.
Neosho	Iola.
Republican	Junction.
Saline	Salina.
Smoky Hill	Ellsworth.
Solomon	Niles.
Verdigris	Liberty.
Walnut	Arkansas City.
MAINE.	
Androscoggin	Dixfield.
Aroostook	Fort Fairfield.
Carrabassett	North Anson.
Dead	The Forks.
Fish	Wallagrass.
Kennebec	North Anson.
Do	The Forks.
Mattawamkeag	Mattawamkeag.
Messalonskee	Waterville.
Moose	Rockford.
Penobscot	Montague.
Penobscot (East Branch).	Grindstone.
Piscataquis	Low's bridge, Foxcroft.
Roach	Roach River.
St. Croix	Spragues Falls, near Baring.
MARYLAND.	
Antietam Creek	Sharpsburg.
Monocacy	Frederick.
Patapsco	Woodstock.
Potomac	Point of Rocks.
Youghiogheny	Friendsville.
MICHIGAN.	
Au Sable	Bamfield.
Black	Cheboygan.
MICHIGAN—cont'd.	
Boardman	Traverse City.
Carp	Marquette.
Crockery Creek	Ravenna.
Dead	The Hoist, near Negaunee.
Escanaba	Escanaba.
Fawn	Sturgis.
Grand	Grand Rapids.
Do	North Lansing.
Iron	Riverton Mine.
Kalamazoo	Allegan.
Manistee	Sherman.
Menominee	Iron Mountain.
Muskegon	Newaygo.
Ontonagon	Rockland.
Ontonagon (West Branch)	Do.
Red Cedar	Agricultural College.
Do	Okemos.
Rifle	Omer.
St. Joseph	Buchannan.
Do	Mendon.
Tittabawassee	Freeland.
Thunder Bay	Alpena.
White Pigeon	Sturgis.
MINNESOTA.	
Crow Wing	Pillager.
Minnesota	Mankato.
Mississippi	Sauk Rapids.
Red	Moorhead.
Red Lake River	Crookston.
Rum	St. Francis.
St. Croix	Taylors Falls.
St. Louis	Cloquet.
MISSISSIPPI.	
Pearl	Jackson.
Tombigbee	Columbus.
Yazoo	Yazoo City.

Gaging stations, by States, maintained in 1903—Continued.

River.	Station.	River.	Station.
MONTANA.		NEBRASKA—cont'd.	
Beaver Creek	Ashfield.	Loup (North)	St. Paul.
Beaver Creek overflow.	Bowdoin.	Mill Race	Superior.
Big Blackfoot	Bonner.	Niobrara	Niobrara.
Bitterroot	Grantsdale.	Do	Valentine.
Do	Missoula.	North Platte	Bridgeport.
Cherry Creek	Red Bluff.	Do	Mitchell.
Fort Belknap canal.	Chinook.	Do	North Platte.
Gallatin	Logan.	Platte	Columbus.
Gallatin (West)	Salesville.	Do	Lexington.
Harlem canal (head of).	Zurich.	Do	South Bend.
Jefferson	Sappington.	Republican	Superior.
Madison	Morris, near Red Bluff.	Do	Benkelman.
Marias	Shelby.	Republican (South Fork.)	Do.
Middle Creek	Bozeman.	South Platte	Big Spring.
Milk	Havre.	NEVADA.	
Do	Malta.	Carson	Empire.
Missoula	Missoula.	Carson (East Fork).	Rodenbah's Ranch, Gardnerville.
Missouri	Cascade.	Humboldt (North Fork).	Near Elburz, near Halleck.
Do	Townsend.	Humboldt	Golconda.
Musselshell	Shawmut.	Do	Oreana.
Paradise Valley canal.	Chinook.	Do	Palisade.
St. Mary	Dam site.	Humboldt (South Fork).	Pattanni's ranch.
Do	International Line, near Cardston, Alberta.	Marys	Bradley's home ranch, Deeth.
Do	Main.	Pine Creek	Palisade.
Swift Current Creek.	Henkel's ranch, St. Mary.	Pyramid Lake	
Two Medicine Creek.	Midvale.	Slough to Mud Lake	Wadsworth.
Yellowstone	Carter's bridge, Livingstone.	Truckee	Pyramid Lake, Indian Agency, Wadsworth.
Do	Glendine.	Do	Vista.
NEBRASKA.		Walker	Wabuska.
Elkhorn	Arlington.	Walker (East Fork)	Ross Ranch, near Yerington.
Do	Norfolk.	NEW HAMPSHIRE.	
Loup	Columbus.	Ammonoosuc	Bretton Woods.
Loup (Middle)	St. Paul.	Androscoggin	Errol dam.

Gaging stations, by States, maintained in 1903—Continued.

River.	Station.
NEW HAMPSHIRE—continued.	
Androscoggin	Shelburne.
Ashuelot	Winchester.
Connecticut	Orford.
Contoocook	West Hopkinton.
Israel	Above South Branch, Jefferson Highlands.
Do	Below South Branch, Jefferson Highlands.
Merrimac	Franklin Junction.
Pemigewasset	Plymouth.
Zealand	Twin Mountain.
Saco	Conway Center.
NEW JERSEY.	
Delaware	Lambertville.
Millstone	East Millstone.
Musconetcong	Asbury.
Neshanie	Finderne.
Passaic	Two Bridges, near Mountain View.
Pompton	Do.
Raritan (North Branch).	Far Hills.
Raritan (South Branch).	Sunnyside.
NEW MEXICO.	
Hondo	Reservoir site.
Do	Roswell.
Gallinas	Las Vegas Spa, near Hot Spa.
Manuelitos	Sapello.
Mill tail race	Do.
Mora	Lacueva.
Do	Weber.
Pecos	Carlsbad.
Do	Roswell.
Do	Santa Rosa.
Rio Grande	Embudo.
Do	San Marcial.
NEW MEXICO—con.	
Rio Grande	Water tank, near Rio Grande.
Sapello	Los Alamos.
Do	Above mouth of Manuelitos, Sapello.
NEW YORK.	
Beaver	Croghan.
Black	Felts Mills.
Byram (main)	Pemberwick.
Do	Port Chester.
Byram (West Branch).	Do.
Canada Creek (East).	Dolgeville.
Canada Creek (West).	Twin Rock bridge.
Carlls (East Branch)	Babylon.
Carlls (West Branch).	Do.
Catskill (West Branch).	South Cairo.
Chenango	Binghamton.
Chittenango	Chittenango.
Connecticut	South Haven.
Connectquot (East Branch).	East Islip.
Connectquot (West Branch).	Do.
Darrell	Ithaca.
Delaware	Port Jervis.
Do	Hancock.
Delaware (East Branch).	Do.
D. and H. canal	Creek locks.
Doxsee	Islip.
Esopus Creek	Kingston.
Do	Skokan.
Fishkill	Glenham.
Foundry Brook	Cold Spring.
Genesee	Geneseo.
Do	Mount Morris.

Gaging stations, by States, maintained in 1903—Continued.

River.	Station.	River.	Station.
NEW YORK—cont'd.		NEW YORK—cont'd.	
Genesee	Rochester.	Starch Factory Creek.	Utica.
Graefenburg	Utica.	Susquehanna	Binghamton.
Hartford	Utica.	Wallkill	New Paltz.
Honeoye	East Rush.	Wappinger	Wappinger Falls.
Hudson	Fort Edward.	NORTH CAROLINA.	
Do	Mechanicville.	Cape Fear	Fayetteville.
Indian	Indiana Lake dam.	Catawba	Morgantown.
Johnson	Utica.	Dan	Madison.
Lennuta	Dover Plains.	Hiwassee	Murphy.
Massapequa Creek	Long Island.	Little Tenneesee	Judson.
Mianus	Bedford.	Nottely	Ranger.
Mohawk	Dunsbach Ferry.	Roanoke	Neal, near Kelford.
Do	Little Falls.	Rockfish Creek	Brunt.
Do	Utica.	Tuckasegee	Bryson.
Moose	Moose River.	Yadkin	North Wilkesboro.
Navesink	Point Jervis.	Do	Salisbury.
Oak Orchard	Medina.	NORTH DAKOTA.	
Oak Orchard feeder	Do	Cannon Ball	Stevenson.
Oneida	Oak Orchard.	Heart	Richardson.
Oriskany Creek	Oriskany.	James	Lamoure.
Orowoc	East Islip.	Little Missouri	Medora.
Oswegatchie	Ogdensburg.	Mouse	Minot.
Oswego, at Fulton	Fulton.	Pembina	Neche.
Oswego	High Dam.	Red River of the North.	Manitoba.
Do	Minetto.	Do	Grand Forks.
Peconic	Calverton.	Sheyenne	Haggart.
Raquette	Hannawa.	Knife	Broncho.
Reels Creek	Utica.	OHIO.	
Richelieu	Fort Montgomery.	Auglaize	Defiance.
Rondout	Honk Falls.	Blanchard	Ottawa.
Do	Rosendale.	Black	Elyria.
Salmon	Pulaski.	Cross Creek	Mingo Junction.
Sampawams Creek	Babylon.	Cuyahoga	Cleveland.
Saranac	Plattsburg.	Jonathan Creek	Powells.
Do	Saranac Lake.	Licking	Pleasant Valley.
Schoharie	Mill Point.	Little Miami	Morrow.
Do	Prattsburg.	Mahoning	Youngstown.
Schroon	Warrensburg.		
Seneca	Baldwinsville.		
Skaneateles outlet	Willow Glen.		

Gaging stations, by States, maintained in 1903—Continued.

River.	Station.
OHIO—continued.	
Maumee	Sherwood.
McMahon	Steel.
Olentangy	Columbus.
Ottawa	Lima.
Scioto	Columbus.
Tiffin	Defiance.
OKLAHOMA.	
Canadian (North Fork).	Elreno.
Otter Creek	Mountain Park.
Red (North Fork)	Granite.
Washita	Anadarko.
OREGON.	
Bully Creek	O'Neill's ranch, 13 miles above Vale.
Grande Ronde	Elgin.
Do	Hilgard.
Malheur	Vale.
Malheur Lake	The Narrows.
McCay Creek	Pendleton.
Owyhee	Owyhee.
Silvies	Proposed dam, Silvies.
Do	Parkers, near Burns.
Umatilla	Gibbon.
Do	Pendleton.
Do	Yoakum.
Do	Umatilla.
Wallowa	Wallowa.
Do	Joseph.
Do	12 miles above Elgin.
Walla Walla	Milton.
Walla Walla (South Fork).	Do.
PENNSYLVANIA.	
Juniata	Newport.
Lehigh	South Bethlehem.
Susquehanna	Harrisburg.
PENNSYLVANIA—con.	
Susquehanna	Wilkesbarre.
Do	Danville.
Susquehanna (West Branch).	Williamsport.
Susquehanna	McCall Ferry.
SOUTH CAROLINA.	
Broad (of the Carolinas).	Alston.
Catawba	Catawba.
Do	Rockhill.
Saluda	Waterloo.
Savannah	Calhoun Falls.
Seneca	Clemson College.
Tugaloo	Madison.
Wateree	Camden.
SOUTH DAKOTA.	
Battle Creek	Hermosa.
Belle Fourche	Belle Fourche.
Big Sioux	Watertown.
Box Elder Creek	Black Hawk.
Cheyenne	Edgemont.
Elk Creek	Tockler's ranch, Piedmont.
Little Missouri	Camp Crook.
Rapid	Rapid.
Red Water	Menesela.
Do	Belle Fourche.
Spearfish	Toomey's ranch.
Spring Creek	Blair ranch.
TENNESSEE.	
Cumberland	Nashville.
French Broad	Oldtown.
Hiwassee	Charleston.
Do	Reliance.
Holston (South Fork).	Bluff City.
Nolichucky	Greeneville.
Okoee	McCays.
Pigeon	Newport.

Gaging stations, by States, maintained in 1903—Continued.

River.	Station.	River.	Station.
TENNESSEE—con.		UTAH—continued.	
Tennessee	Chattanooga.	Uinta	Fort Duchesne.
Do	Knoxville.	Do	Ouray School, near Leland.
Watauga	Elizabethton.	Do	White Rocks.
TEXAS.		Weber	Uinta.
Brazos	Richmond.	White Rocks	White Rocks.
Do	Waco.	VERMONT.	
Colorado (of Texas)	Austin.	Lamoille	West Milton.
Do	Columbus.	Missisquoi	Swanton.
Devils	Devils River.	Otter Creek	Middlebury.
Guadalupe	Cuero.	Passumpsic	St. Johnsbury Center.
Pecos	Moorhead.	White	Sharon.
Do	Pecos.	Winooski	Richmond.
Rio Grande	Eagle Pass.	Do	Winooski.
Do	El Paso.	VIRGINIA.	
Do	Fort Hancock.	Appomattox	Mattoax.
Do	Below mouth of Devils River.	Dan	South Boston.
Do	Langtry.	James	Buchanan.
Do	Moorhead.	Do	Cartersville.
Do	Above Presidio.	James (North Fork)	Glasgow.
Do	Below Presidio.	James	Holcombs Rock.
Trinity	Riverside.	New	Oldtown.
UTAH.		Do	Radford.
American Fork	American Fork.	Roanoke	Roanoke.
Ashley	Vernal.	Shenandoah (North Branch).	Riverton.
Bear	Collinston.	Shenandoah (South Branch).	Front Royal.
Blacksmith Fork	Hyrum.	Smith	Waller.
Duchesne	Price road bridge.	Staunton	Randolph.
Green	Jansen.	WASHINGTON.	
Lake Creek	Wagon bridge, near mouth.	Cedar	Near Cedar Lake, near North Bend.
Logan	Logan.	Do	Maple Valley.
Provo	Provo.	Do	Renton.
Do	Near Provo.	Chelan	Chelan.
San Pitch	Gunnison.	Clealum	Roslyn.
Sevier	Do.	Johnson	Riverside.
Spanish Fork (in canyon).	Mapleton.		
Strawberry	Strawberry Valley, near Thistle.		

Gaging stations, by States, maintained in 1903.

River.	Station.	River.	Station.
WASHINGTON—con.		WISCONSIN—cont'd.	
Kachess	Easton.	Fond du Lac (East Branch).	Fond du Lac.
Little Spokane	Spokane.	Fond du Lac (West Branch).	Do.
Methow	Peteros.	Fox	Omro.
Naches	North Yakima.	Do	Wrightstown.
Palouse	Hooper.	Lake Mendota	Madison.
Rock Creek	Saint John.	Wisconsin	Merrill.
Salmon	Malott.	Do	Muscoda.
Snoqualmie	Above Snoqualmie Falls, Snoqualmie.	Do	Necedah.
Sinlahekin Creek	Loomis.	Wolf	Winneconne.
Spokane	Spokane.	WYOMING.	
Skykomish (South Fork).	Index.	Bighorn	Thermopolis.
Stillaquamish	Robe.	Clear Creek	Buffalo.
Tieton	North Yakima.	Cruze ditch	Story.
White	Buckley.	Green	Greenriver.
Yakima	Kiona.	Grey Bull	Meeteetsee.
Do	Martin.	Laramie	Uva.
Do	Union Gap.	Little Laramie	Haley's ranch, Laramie.
WEST VIRGINIA.		Do	May's ranch, Hatton.
Cheat	Uneva, near Morgantown.	Middle Crow Creek	Hecla.
Greenbrier	Alderson.	North Platte	Guernsey.
New	Fayette.	Do	Saratoga.
Potomac (North Fork).	Piedmont.	Piney Creek	Kearney.
Potomac (South Fork).	Springfield.	Prairie Dog ditch	Sand's ranch.
Shenandoah	Millville.	Shoshone	Cody.
WISCONSIN.		Do	Marquette.
Black	Melrose.	Shoshone (South Fork).	Do.
Catfish or Yahara	Madison.	Snake (South Fork)	Moran.
Chippewa	Eau Claire.	Sweetwater	Devil's Gate.
Flambeau	Ladysmith.	Do	Splitrock.
		Tongue	Dayton.

Division of Hydrology.

Since 1894 the appropriation acts have contained authority for investigations relating to underground waters, and many facts concerning artesian and other deep wells have been collected and published in the annual reports, bulletins, and water-supply papers of the Survey. The work relating to this subject reached such proportions that it became desirable to segregate it from the general hydrographic work, and in January, 1903, the division of hydro-geology or hydrology was organized.

The work of the division of hydrology includes the gathering, filing, and preparing for publication of data relating to underground water and its uses, as developed by springs and wells, for irrigation, city water supplies, and other important purposes.

For administrative reasons the division was divided into two sections, the eastern and the western, the field of the first embracing the States east of the Mississippi and those bordering that river on the west, and that of the second including the so-called reclamation States and Territories together with Texas. The chief engineer acted as chief of division until July 1, 1903, when the western section was placed in charge of Mr. N. H. Darton, geologist, and the eastern section was assigned to Mr. M. L. Fuller, geologist.

EASTERN SECTION.

At the beginning of the fiscal year work was in progress in twenty-one States, namely, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Georgia, Florida, Minnesota, Michigan, Wisconsin, Iowa, Missouri, Arkansas, Kentucky, Tennessee, Louisiana, Mississippi, and Alabama, and in most of these the work was continued during the whole or a portion of the summer. Plans for the preparation of reports or for cooperation in work on underground waters were made in a number of instances.

OFFICE WORK AND GENERAL INVESTIGATIONS.

In connection with hydrologic investigations there has grown up a large correspondence, the handling of which makes considerable demands on the time of the members of this section. Among the notable requests received were those from the colonial secretary of Bermuda, for information as to the methods of obtaining water supply for that island; from the

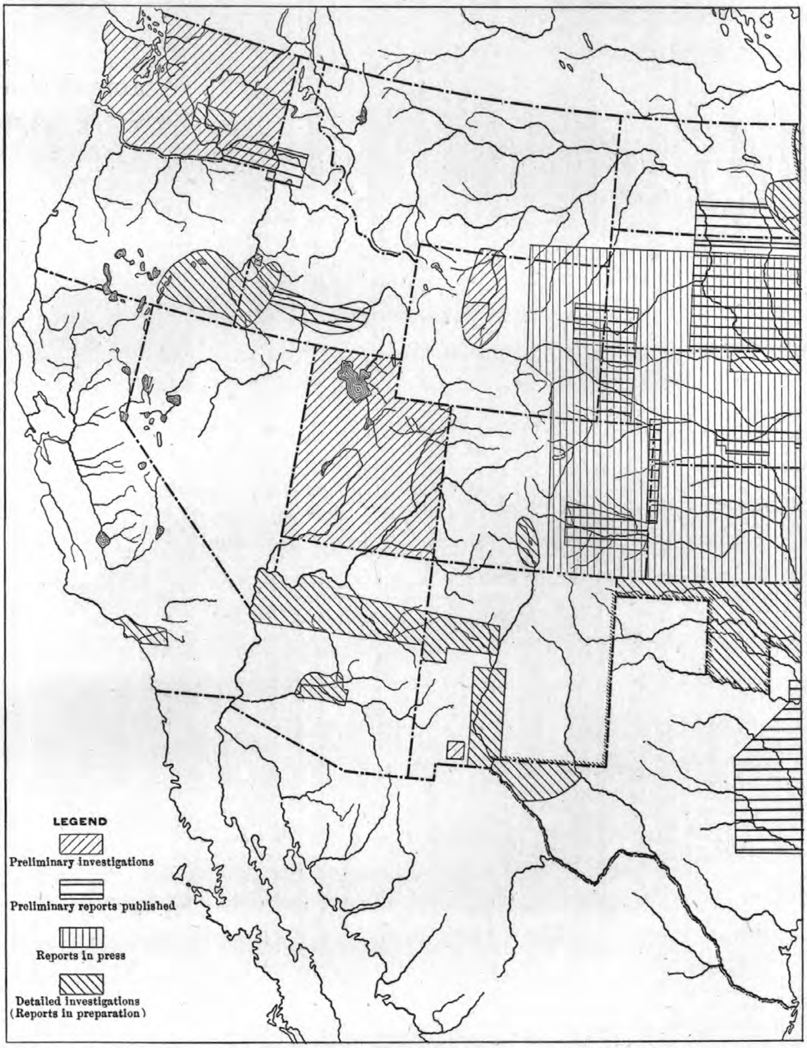


FIG. 1.—Map showing progress of work on underground waters in western half of United States in 1903–4.

Peruvian Government, for the recommendation of a hydrologist to organize and take charge of a bureau of hydrology in that country similar to the hydrographic branch of the Survey, and from the secretary of the Eleventh International Congress of Hygiene and Demography, held in Berlin in 1903, in regard to the pollution of limestone waters.

The information requested in each case was furnished, and a member of the Survey, Mr. George I. Adams, was recommended to the Peruvian Government for the service required.

FIG. 2.—Map showing progress of work on underground waters in eastern half of United States in 1903–4.

Mr. Adams entered on his duties in May. Estimates for boring a deep artesian well at the American legation in

Peking, China, were also obtained and submitted, at the request of the Secretary of State.

In addition to answering requests from corporations and private parties in this country, the eastern section furnished information to the War Department in regard to water conditions at forts in the District of Columbia, South Carolina, Michigan, and New Hampshire. In New Hampshire a special field investigation was made, with promising results. Requests were received for the investigation of the water supply of a number of cities and towns afflicted with typhoid epidemics, and the requests were complied with as far as possible.

A number of general reports, hereafter referred to, were prepared, wholly or in part, within the fiscal year; among them papers entitled "Contributions to the Hydrology of Eastern United States, 1903" (Water Supply and Irrigation Paper No. 102), "Contributions to the Hydrology of Eastern United States, 1904" (Water Supply and Irrigation Paper No. 110), and "Underground Waters of Eastern United States" (Water-Supply and Irrigation Paper No. 114).

In planning the series of Contributions to Hydrology of Eastern United States, which it is proposed to issue annually, the aim has been to present (1) a summary of the work of the division for the preceding year, including reviews of the survey publications relating to underground waters; (2) miscellaneous information from scattered localities not under special investigation, which would not be made available in other reports; and (3) more or less detailed descriptions of areas or problems of importance which are not of sufficient length to warrant publication as separate papers. The paper on Underground Waters of Eastern United States presents a brief summary of the underground water conditions by States, and was prepared to meet the demand of drillers and others for general information relating to the broader features of the occurrence of ground waters in the various States and districts. A large number of geologists contributed to each of the general papers.

The general report for 1903 embraces several thousand records of wells and springs, water analyses, etc., collected by the geologists connected with the section. The compilation, however, was done in the office by Mr. Fuller, assisted by Mr. F. G. Clapp, assistant geologist, and Miss Edna T. Pollard, who, in addition to her regular stenographic work, recomputed a large number of analyses.

The results of some of the work of this section will be used also by the geologic branch, namely, records and samples from oil, gas, brine, and water wells collected by Mr. A. C. Veatch; certain investigations of the geology and water resources of Mississippi; and the investigation of the geology of Long Island. Part of the month of May and the whole of June were devoted by Mr. Fuller to work on Long Island and in adjacent territory, for the geologic branch. A week's time was also devoted by Mr. Veatch to the search for Pleistocene fossils.

A considerable number of geologists, as indicated in the discussion of the work by States, contributed during the year reports on the underground-water conditions in the areas in which they have worked.

Work of Mr. M. L. Fuller.—From the close of the field season, September 1, 1903, to the opening of the next field season, May 11, 1904, Mr. Fuller was occupied in the office with administrative work as chief of the section and with scientific work. The larger part of his time was devoted to executive work, to correspondence as outlined above, and to editorial work on the various reports prepared in the section. Mr. Fuller also read the proofs of the Patoka folio and of a portion of the Brownsville-Connellsville folio, and prepared a short report on the Hyner gas pool of Pennsylvania. Assisted by Mr. Cleveland Abbe, jr., and Miss Pollard, he prepared a large number of well records and additional bibliographic data for a new edition of the list of deep borings of the United States. The preparation of a bibliography and index of such publications of the United States Geological Survey as touch on underground waters was undertaken, and the manuscript was nearly completed at the close of the year. During the winter Mr. Fuller served on the committee having in charge the preparation and correction of papers for the examination for assistant geologists held March 9 and 10. The following papers were published or submitted for publication by Mr. Fuller within the year:

Gaines folio, Pennsylvania (with William C. Alden): Geol. Atlas U. S., Folio No. 92.

Elkland-Tioga folio, Pennsylvania (with William C. Alden): Geol. Atlas U. S., Folio No. 93.

Probable pre-Kansan and Iowan deposits of Long Island, New York: Am. Geologist, vol. 32, pp. 308–312.

Natural gas (Brownsville-Connellsville quadrangles): Geol. Atlas U. S., Folio No. 94.

Results of resurvey of Long Island (with A. C. Veatch): Science, n. s., vol. 18, No. 466, pp. 29–31.

Patoka folio, Indiana-Illinois (with F. G. Clapp): Geol. Atlas U. S., Folio No. 105.

Hyner gas pool, Clinton County, Pa.: Bull. U. S. Geol. Survey No. 225, pp. 392–395.

Ice retreat in glacial Lake Neponset and in southeastern Massachusetts: Jour. Geol., vol. 12, pp. 181–197.

Underground waters of southern Louisiana, with discussion of their uses for water supplies and for rice irrigation (with G. D. Harris): Water-Sup. and Irr. Paper No. 101.

Contributions to the hydrology of eastern United States, 1903 (with others): Water-Sup. and Irr. Paper No. 102.

Contributions to the hydrology of eastern United States, 1904 (with others): Water-Sup. and Irr. Paper No. 110.

Underground waters of eastern United States (with others): Water-Sup. and Irr. Paper No. 114.

Work of Mr. A. C. Veatch.—Mr. Veatch returned to the office about October 1, 1903, and with the exception of a few days spent in the field on Long Island in May, 1904, remained in office until the end of the fiscal year. The larger part of his time was devoted to the preparation of reports on the geology and water resources of Long Island, but incidentally he devoted considerable attention to the nomenclature of geologic formations of the Gulf States, to the editing or reviewing of reports on Louisiana and Arkansas, to referred correspondence, and to the development of a system for the collection of records and samples of oil, gas, brine, and water wells throughout the United States.

This latter work, which was planned in great detail by Mr. Veatch, was begun on July 1, 1904. Arrangements for procuring the effective aid of drillers will be made, and it is anticipated that a large amount of economic and stratigraphic data, much of which would otherwise soon be lost, will thus be preserved. It is proposed to publish the accumulated data promptly each year, making it quickly available to drillers and others interested in underground waters.

Work of Mr. D. W. Johnson.—During the year Mr. Johnson was engaged in preparing a paper on the legal decisions relating to underground waters. This paper is now nearly completed and will give a summary of the legal decisions on the various phases of the subject. The object is to put into the hands of those interested in underground waters a report which will present the general principles on which legal decisions relating to water rights are based, and which will give a general idea of the rights and obligations of well owners.

Work of Prof. Charles S. Slichter.—Besides the field work in the State of New York, which will be noted on a later page, Professor Slichter was engaged on several lines of laboratory investigations relating to the movements of underground water. This work was conducted largely at private expense, but arrangements have been made for the preparation of a paper covering certain features of the investigations for publication in the reports of the section. Professor Slichter during the year contributed to these reports the following papers:

Description of the underflow meter used in measuring the velocity and direction of movement of underground water.

California or "stovepipe" method of well construction.

Approximate method of measuring yield of flowing wells.

Professor Slichter also furnished the section with information in regard to several underground-water problems, and outlined plans for testing deep wells at Quitman, Ga., in relation to problems of well contamination.

WORK BY STATES.

Maine.—The investigations in this State were in charge of Prof. W. S. Bayley, assistant geologist, who was assisted by Messrs. W. C. Washburn and L. G. Lord. The work of collecting well and spring data was continued during the early part of the year, and a large number of well and spring records and analyses were obtained. Lists of wells over 100 feet in depth, of the sources of water supply of the principal cities and towns, and of springs of commercial value, etc., were submitted for publication, and a summary report on the underground-water conditions of the State was prepared.

During the month of July, 1903, a special canvass of the wells and an investigation of the underground-water conditions in the vicinity of Belfast and Deer Island were undertaken, the work being done by Mr. W. C. Washburn, under the supervision of Mr. G. O. Smith. Considerable light was thrown on the occurrence of underground waters in this region, problems relating to which are of great importance to the owners' estates in the region.

New Hampshire.—The work in this State was continued under the direction of Mr. J. M. Boutwell, assistant geologist. From the records of wells and springs collected by Mr. Boutwell a brief report was prepared for publication. A summary of the underground-water conditions was also prepared by Mr. M. L. Fuller, from data collected by Mr. Boutwell. In March, 1904, Mr. Boutwell visited New Hampshire and investigated the underground-water conditions in the vicinity of the Government forts at the mouth of Portsmouth Harbor, the work being done in response to a request received from the Quartermaster-General. Owing to the pressure of his regular mining work, Mr. Boutwell was unable to continue the work in New Hampshire, and the services of Mr. G. O. Smith, geologist, were obtained to complete the investigations at Portsmouth. Both Mr. Boutwell and Mr. Smith give favorable reports as to the possibility of obtaining underground supplies at the forts.

Mr. Boutwell conferred with the State authorities regarding cooperation in the investigation of underground water, especially in the chemical composition of the waters of the State. It is hoped that some arrangement for cooperation can be made.

Vermont.—Prof. George H. Perkins, State geologist, voluntarily cooperated with the Survey in obtaining information relating to the wells and springs of the State, and prepared a statistical report giving well and spring records, source of town water supplies, analyses, etc., and a summary report on the underground-water conditions in the State.

Short reports on the water resources of the Brandon and Taconic quadrangles were prepared by Mr. T. Nelson Dale and Mr. F. B. Taylor, respectively, for publication in the paper entitled "Contributions to the Hydrology of Eastern United States, 1904" (Water-Supply and Irrigation Paper No. 110).

Massachusetts and Rhode Island.—This district was in charge of Prof. W. O. Crosby, of Boston, who was assisted by Mr. Laurence La Forge, of Cambridge, and Mr. G. F. Loughlin, of Boston. A report giving a summary of the underground-water conditions of the two States was prepared by Professor Crosby, and a list of well and spring records was compiled in the Washington office from data collected by Professor Crosby and his assistants. A large number of well records, in addition to those obtained by Professor Crosby, were furnished by Mr. F. A. Champlin.

Papers entitled "Drilled Wells of the Triassic Area of the Connecticut Valley," by Mr. W. H. C. Pynchon, and "Triassic Rocks of the Connecticut Valley as a Source of Water Supply," by Mr. M. L. Fuller, were also prepared during the year. These papers will be published in Water-Supply and Irrigation Paper No. 110.

The report on the Taconic quadrangle by F. B. Taylor, mentioned under Vermont, deals with the water conditions in a portion of western Massachusetts.

Connecticut.—The work in this State remained in charge of Prof. H. E. Gregory, assistant geologist, who collected a large number of records from drillers and from well and spring owners, the results of which were compiled in tables and published in the paper entitled "Contributions to the Hydrology of Eastern United States, 1903" (Water-Supply and Irrigation Paper No. 102). Professor Gregory also prepared a summary of underground-water conditions in the State, for publication in the paper entitled "Underground Waters of Eastern United States" (Water-Supply and Irrigation Paper No. 114).

In addition to the work of Professor Gregory Mr. W. H. C. Pynchon prepared, at his own expense, a report on the wells of the Triassic area, noted under Massachusetts. The paper by Mr. Fuller on the waters of the Triassic rocks, also noted above, includes a considerable area in Connecticut. Many additional well records were furnished by Messrs. F. A. Champlin and C. L. Grant.

New York.—The principal work conducted by this section in New York included a study of the geology and water resources of Long Island, and an investigation of the spring waters of the State. Reports on the water resources of the Brandon, Taconic, and Watkins Glen quadrangles were prepared by Messrs. T. Nelson Dale, F. B. Taylor, and R. S. Tarr, respectively. A brief report on the artesian-well supply at Ithaca developed to replace the reservoir supply, which had become polluted, giving rise to a typhoid epidemic, was prepared by Mr. Francis L. Whitney.

The Long Island work was in charge of Mr. M. L. Fuller, who was assisted by Mr. A. C. Veatch, to whom was given the immediate supervision of the water-supply investigations. The temporary office which had been opened at Jamaica early in 1903 was maintained, under the charge of Mr. Veatch, until the close of the field work in September. Mr. Veatch was assisted by Messrs. Isaiah Bowman, Francis L. Whitney, F. D. Rathbun, and others. Mr. Fuller, assisted by Mr. D. W. Johnson, devoted the month of July and a portion of August to the investigation of the areal geology of the island and to correlation studies in New Jersey, in the latter of which he was associated with Mr. G. N. Knapp, of the New Jersey State geological survey. A report on the geology and water resources of the island was prepared by Messrs. Fuller and Veatch in September and submitted to the New York commission on additional water supply, which had cooperated with the Survey in the work on the island. During the winter Mr. Veatch prepared a more elaborate report on the geology and water resources of Long Island, in which many new features were brought out.

During the month of May Mr. Veatch devoted several days to a study of certain bluff sections and to search for Pleistocene fossils, while a part of May and the whole of June were devoted by Mr. Fuller to a detailed examination of the shoreline outcrops in the eastern half of the island and to correlation studies on Plum and Fishers islands, New York; on Block

Island, Rhode Island; and on Marthas Vineyard, Nantucket, and Elizabeth islands, and Cape Cod, Massachusetts.

The more important geologic results of the Long Island work include the recognition and interpretation of a complex glacial history, the correlation of the Cretaceous deposits with those of New Jersey by direct structural evidence, the recognition in Long Island and the accompanying depression of Long Island Sound of the normal continuation of the Coastal Plain topography developed in New Jersey, and proof of the probable absence of Tertiary on Long Island.

The results of the greatest economic importance, because of their bearing on the question of the water supply, are proofs (1) that the island is composed of relatively porous sand beds with only irregular and discontinuous clay masses, and that the rain water is therefore relatively free to penetrate to any parts of these beds without regard to dip, and (2) that the flowing wells obtained along the shores depend not on the dip of the strata, but on the height of the main ground-water table above the landward edge of the local clay layer which happens to confine the water.

In connection with the water-supply investigation Prof. Charles S. Slichter conducted for the section an investigation, by means of an electrical apparatus invented by him for measuring the direction and rate of underflow, of the movement of the ground waters of the island. The studies resulted in the determination of the amount of underflow available for municipal supply in the localities examined. The measurements were made in conjunction with the commission on additional water supply for Greater New York, and apparatus for the continuation of the investigation was placed in the hands of the water department of the city of Brooklyn, which proposes to extend the work eastward into Suffolk County.

Mr. F. B. Weeks, in addition to his work as librarian of the Survey, devoted considerable time to the investigation of the springs of New York State and the collection of well and spring records. A large number of these records were compiled for publication in the paper entitled "Contributions to the Hydrology of Eastern United States, 1903" (Water-

Supply and Irrigation Paper No. 102), while a summary of the underground-water conditions was prepared for publication in the same report for 1904 (Water-Supply and Irrigation Paper No. 110).

New Jersey.—During the summer Mr. G. N. Knapp, working under the direction of Mr. H. B. Kümmel, State geologist, continued his studies on the occurrence of underground waters. The field investigations were completed in December, 1903, and considerable time was devoted during the winter to the preparation of a report, which is now nearly completed and will appear shortly as a water-supply paper. A short report, giving a summary of the underground-water conditions of the State, was also prepared by Mr. Knapp. The work was conducted in cooperation with the State survey, through the courtesy of which large amounts of material gathered in previous years are made available.

Mr. Knapp's recent field work and the examination of the many thousands of well samples, which he for the first time systematically studied and arranged, have resulted in clearing up to a great extent the confusion in stratigraphic correlations which has long existed. Seven well-defined water horizons have been differentiated, and a series of maps is in preparation that will show the outcrop of each of these horizons and the location and depths of the wells. It is expected that these maps will be of great value as a means of forecasting the depths to artesian waters and in predicting supplies in regions yet untested. A laboratory study of the size and texture of the grains of the samples from the various water horizons has been made for the purpose of aiding well drillers to recognize the horizons and of indicating to some extent the fineness of the strainers needed for well points. The report will cover the deep-seated waters of the entire State, but will deal more specifically with those of the Coastal Plain, special attention, in addition to the points already mentioned, being given to the strike and dip of the various beds, lateral variations in texture and composition, and the occurrence of fossils.

The New Jersey Highlands, a region which in the future may become of importance as a source of water supply for certain New Jersey cities, or even for Greater New York, was the subject of a report prepared by Mr. Laurence La Forge, of the geologic branch.

Pennsylvania.—No field work was conducted during the year by this section in the State of Pennsylvania, but reports on the water supplies of a number of areas were prepared by members of the geologic branch. These include the following papers:

Water resources of the Philadelphia district, by Florence Bascom: Water-Sup. and Irr. Paper No. 106.

Water resources of the Chambersburg and Mercersburg quadrangles, by G. W. Stose.

Water resources of the Curwensville, Patton, Ebensburg, and Barnesboro quadrangles, by F. G. Clapp.

Water resources of the Elders Ridge quadrangle, by R. W. Stone.

Water resources of the Waynesburg quadrangle, by R. W. Stone.

A brief summary of the underground-water conditions in the State was also prepared by Mr. M. L. Fuller.

Maryland.—Reports on the water resources of the Accident, Grantville, Frostburg, and Flintstone quadrangles were prepared by Mr. G. C. Martin, and a short summary report of the underground conditions of the entire State was prepared by Messrs. N. H. Darton and M. L. Fuller.

Virginia.—A brief summary of the underground-water conditions was prepared by Messrs. Darton and Fuller.

West Virginia.—A small area in this State is covered by the reports of Mr. G. C. Martin on the water resources of the Frostburg and Flintstone quadrangles, mentioned under Maryland. A summary statement of the underground-water conditions was prepared by Mr. M. L. Fuller.

North Carolina.—A report was prepared by Mr. H. S. Gale on the water resources of the Cowee and Pisgah quadrangles, in the western portion of the State, and a summary report of the underground-water conditions was prepared by Messrs. M. L. Fuller and J. A. Holmes.

South Carolina.—The investigations in this State were in charge of Mr. L. C. Glenn, who collected many well records and prepared a brief report on the geology and water resources of the State.

Georgia.—During the year Mr. S. W. McCallie, assistant State geologist, continued his work on the underground waters and springs and the related geology, especially that of the Coastal Plain, work being conducted in cooperation with the State geological survey. A statistical report containing well, spring, and city water-supply data, a summary report of the underground-water conditions, and a report on a well-contamination experiment at Quitman, were submitted by Mr. S. W. McCallie during the year.

The investigation at Quitman was undertaken to prove or disprove the possibility of contamination of the wells in the town by a proposed method of disposing of the city sewage through an underground channel. A large quantity of salt was inserted in a well leading to the underground channel in question, and the neighboring wells were tested at short intervals for chlorine. It was found that every well in the vicinity showed traces of salt, indicating clearly the danger of the proposed method of sewage disposal, as the sewage would penetrate wherever the salt would. The results of this experiment, which was conducted by the United States Geological Survey in cooperation with the geological survey of Georgia and the town of Quitman, has attracted wide attention throughout the country and is quoted as a practical demonstration of the Survey's methods of work.

The knowledge of the geology of the Coastal Plain proved to be insufficient for the complete understanding of the occurrence of underground waters, and arrangements were therefore made for a somewhat detailed examination of this portion of the State. A very large number of fossils have been collected by Mr. McCallie and identified by Mr. T. W. Vaughan, with the result that much more definite correlations can now be made.

In addition to the investigations of the occurrence of underground waters, much attention was paid by Mr. McCallie and the State chemist to the composition of well and spring waters, especially of the peculiar phosphate waters of certain wells, which have been shown to contain phosphorus in such amounts that where used for irrigation artificial fertilizers can be dispensed with. Mr. Titus Ulke, under the direction of Mr. M. O. Leighton, chief of the hydro-economic division of this Survey, took part in the investigation of the composition of the waters.

Florida.—In addition to administrative and editorial work, Mr. M. L. Fuller carried on an extensive correspondence with drillers, well and spring owners, etc., in this State, and obtained a large amount of information as to the distribution, depth, quality, and value of underground waters. A statistical report on wells, giving, in connection with other data, the height of the wells in relation to sea level, the depth at which water is found, and the height to which it will rise, was prepared. A short report on the underground-water conditions was also compiled.

Minnesota.—Prof. C. W. Hall, in connection with his work at the University of Minnesota, continued to collect data relating to springs and underground waters for this Survey. A considerable amount of time was devoted during the year to the preparation of a report on the geology and water resources of this State, which it is expected will soon be submitted. A number of well records in Lyon County were also submitted by Mr. J. E. Todd.

Wisconsin.—During the summer Mr. Alfred R. Shultz, assisted a portion of the time by Mr. G. W. Crane, continued the investigations of the water resources of the Wisconsin district, including Wisconsin and adjacent portions of northern Michigan and northern Illinois. The investigation resulted in locating several new artesian basins, including one in the crystalline Huronian rocks, and clearly pointed out the areas within which artesian waters may be obtained. In a report which was prepared during the winter attention is called to the economic value of the water of the various artesian horizons, to its medicinal properties, and to its importance as a source of supply of cities and villages.

Michigan.—The work in Michigan included the systematic collection of data relating to deep wells and springs and the field investigation of a number of counties along the southern border of the lower peninsula. The work was carried on by

Mr. W. F. Cooper, under the supervision of Mr. A. C. Lane, State geologist.

A statistical report on the wells and springs of the State and a special report on the counties examined were prepared by Mr. W. F. Cooper.

The work conducted during the year is preliminary to a more elaborate survey of the water resources of the State, which will be undertaken at the beginning of the new fiscal year. Mr. Frank Leverett, geologist, will have charge of the work, which will include a careful investigation of the waters of the drift, and will be assisted by Messrs. John Udden, W. M. Gregory, and Isaiah Bowman.

Iowa.—The work in Iowa continued in charge of Prof. W. H. Norton. Owing to engagements with the State geological survey, Professor Norton was unable to take up the preparation of the final report on the water resources of that State, which is to be prepared in cooperation with the State geological survey. A brief summary report on the underground-water conditions was, however, submitted for publication. The office was consulted regarding artesian waters by the officials at Keokuk, Mount Pleasant, Waterloo, Fort Dodge, and Belle Plaine, and reports as to the depth of the artesian horizons, the character of rocks to be encountered, and the quality and quantity of the artesian water were furnished. At Waterloo, which had been visited by a severe typhoid epidemic, field investigations were made at the request of the city authorities, and a full report, with recommendations, in regard to the underground waters as a possible source of a city supply was made.

Missouri.—The work in Missouri was continued in charge of Prof. E. M. Shepard, who collected a large amount of data relating to deep wells and springs. These data have been compiled for publication. Besides information obtained by Professor Shepard, additional records in the Joplin district were furnished by Mr. W. S. T. Smith, and in Livingston County by Mr. R. Hawkins.

The field work which Professor Shepard began in the previous fiscal year was continued through July, August, and

September, and parts of October and November. Special attention was given to the composition of the waters as dependent on their geologic horizon. Systematic work was also begun on the great springs of the State, some of which yield flows of over 100,000,000 gallons a day. A report on the spring system of the Decaturville dome, in Camden County, was submitted, as was also a summary report on the underground-water conditions in the State. Studies on the relation of ore horizons and springs, the relationship between the composition of water and the geologic horizons, the modifications of topography due to underground drainage, and the causes of the intermittent brine springs, the variation of temperature, and the escape of sulphuretted hydrogen in Saline County were continued.

Arkansas.—During the year Prof. A. H. Purdue continued to collect well and spring records in the northern half of the State. These have been compiled for publication and a summary report on the underground-water conditions in the northern half of the State has been prepared.

A month was also devoted to field work on the contact between the Paleozoic rocks and the embayment deposits in northern Arkansas. This work included the determination of the relation of the embayment deposits to the Paleozoic rocks, the mapping of the contact, the study of the unconformity, the determination of the water horizons and their catchment areas, the investigation of the sources of the water in horizons not outcropping, and the problems of depth, amount, character, and permanency of the water supplies. It was found that the ground-water supply is practically inexhaustible and within easy reach of the surface. While in many wells the water is strongly charged with iron and organic matter, water of fairly good quality can easily be procured by sinking a well at some other point but a short distance away. The results of the work have been presented in a report.

Mr. A. C. Veatch, who during the previous fiscal year, investigated the artesian waters of the southern half of the State, prepared a brief report on the same during the year, and some progress was made on a detailed report in the same area. Mr. George I. Adams also prepared a summary report on the water supply of the Ozark region, in the northern portion of the State.

Louisiana.—Prof. G. D. Harris, State geologist, completed his field investigations on the artesian waters of the southern portion of the State early in the beginning of the fiscal year and prepared and submitted a detailed report in October, 1903. A summary report of the conditions in the northern half of the State, based on the investigations made during the previous fiscal year, was also prepared by Mr. A. C. Veatch. Short reports on the water supplies from wells and on rice irrigation in southern Louisiana were also compiled by Mr. M. L. Fuller.

Kentucky and Tennessee.—The work in these States remained in charge of Mr. L. C. Glenn, who collected well and spring data from which a statistical report was prepared for publication. In August and September, 1903, Mr. Glenn investigated the underground waters of the embayment deposits of the Jackson Purchase region west of the Tennessee River. The work involved the study of the general stratigraphy and structure of the region and resulted in the discovery of new points of importance in the geology of the region. The surface-water supplies were found to be of only fair quality, and in many cases were very poor. It was ascertained that deep waters could be obtained at moderate cost over almost the entire region, and that these deep waters are generally of good quality and in large quantity, and suitable for all purposes for which water is demanded in the region, both for domestic and for industrial uses. The results of the field study are being compiled in a detailed report on the region.

A brief report on the water resources of the Middlesboro-Harlan region of southeastern Kentucky was also prepared by Mr. George H. Ashley, of the geologic branch.

Mississippi.—During the year Mr. L. C. Johnson voluntarily continued to collect well and spring data in the State, a considerable correspondence being conducted and a number of field trips made. As a result of this and previous work the probable depth to artesian water and the height to which it will rise can be predicted with reasonable certainty for any locality in the State. Statistical reports and a summary of the underground-water conditions, including a geologic map of the State, were prepared by Mr. Johnson. Messrs. E. C. Eckel and A. F. Crider also contributed notes and maps relating to the geology of the State.

Alabama.—The investigations in this State remained in charge of Mr. Eugene A. Smith, State geologist, who was assisted by Mr. B. F. Lovelace, Mr. R. S. Hodges, and Mr. James A. Anderson. Some work was conducted at the Survey's expense during July, and voluntary investigations were continued into the fall. Arrangements have been made for the completion of the work during the next fiscal year, and for the preparation of a report on the water resources of the State. Artesian waters have until recently been utilized less than in the adjacent State of Mississippi, but the recent increase in knowledge of the conditions has led to the sinking of many wells in regions where it has heretofore been thought impossible to find satisfactory underground supplies. Artesian wells are constantly increasing in importance as a source of town supplies, the use of the water being generally attended with improvement in the health of the people.

WESTERN SECTION.

The work of this section was continued under the direction of Mr. N. H. Darton, geologist in charge, who was assisted by Mr. W. C. Mendenhall, geologist, and Messrs. G. B. Richardson and C. E. Siebenthal, assistant geologists. Messrs. Willis T. Lee and C. A. Fisher served throughout the year as field assistants, but having become eligible through civil-service examination, they have recently been appointed assistant geologists. Several special assistants were engaged during the field season, mainly professors of geology in western colleges, who devoted a portion of their time to the work. Part of their services was rendered in connection with cooperation between the Federal Survey and State surveys.

Work already began was carried forward and a number of new areas were investigated. There is great demand for information relating to underground waters in all portions of the West, but the area is so vast that, with limited means, it is not practicable to obtain quickly the desired data for all the districts. So far as possible, work has been done where the information would serve the interests of the largest number of people, or where the problems are such that investigation would probably throw light on the principles governing the occurrence of underground water, or on the geologic relations of the district. During the last season considerable attention was paid to the geology of dam sites and of regions in which reservoirs are contemplated.

OFFICE WORK.

Work was continued on the catalogue of deep wells of the United States, which will soon be ready for publication. The preliminary list, which appeared in Water-Supply Papers Nos. 57 and 61, proved to be useful, and the new list will be similar in scope, but will have many additions, bringing it as nearly to date as practicable.

Considerable additional work was done on the report on the central Great Plains, incorporating the results of investigations made during the field season of 1903. This report is now in the hands of the printers.

WORK BY STATES AND TERRITORIES.

Arizona.—The investigation of underground water supplies in southern and central Arizona was continued by Mr. Willis T. Lee. Mr. Lee has made a detailed investigation to ascertain the extent of the area in which underground waters are available, the geologic conditions under which they occur, the volume of water obtainable, and the conditions under which the waters can be utilized to the best advantage. A report on the Gila Indian Reservation area has been prepared and is now in course of publication (Water-Supply and Irrigation Paper No. 104), and another on the Salt River Valley south and east of Phoenix is ready for publication.

Mr. Lee also made an investigation of the geology along the Colorado River, in relation to dam sites and the utilization of underflow. During the early part of the year he examined the geology of the northwest corner of the Territory, to determine the prospects for obtaining underground waters by deep borings in the western margin of the plateau region. Considerable progress was made in the preparation of a report on the geology and underground water resources of the plateau region, by Messrs. Darton and Lee.

California.—On July 1 Mr. W. C. Mendenhall was transferred to the division of hydrology and assigned to the work of investigating the underground water resources of the valley of southern California. He entered the field about the middle of August, with Mr. Charles H. White, of Harvard University, as assistant. The first work done was a reconnaissance through the San Joaquin Hills and the southern flanks of the Santa Ana Mountains, where the Tertiary and Cretaceous rocks are well developed. This work was planned in order to give familiarity with the stratigraphic succession in this part of the State, so that favorable structures for artesian basins could be more easily recognized later.

Regular hydrologic work was then undertaken in the upper part of the valley, in the neighborhood of Redlands and San Bernardino, where there is one of the most important artesian basins of the State. In order to determine the origin of this and similar basins, supplementary studies were carried out in the San Bernardino, San Antonio, and San Jacinto mountains.

About the 1st of January the mapping of irrigated lands and the collection of well data, heretofore in the hands of Messrs. J. B. Lippincott and Homer Hamlin, were turned over to Mr. Mendenhall, the reclamation service demanding all the time of the engineers. The force then engaged on this work was increased by the addition of two field assistants, and the task of visiting each of the 10,000 wells in the area shown on the California sheet No. 1, measuring their depth, determining the position of the water plane, testing the purity of the water, and mapping the lands on which this water is used for irrigation, was pressed with energy. By May 20 the greater part of the field work had been completed, and two of the field assistants had been transferred back to the reclamation service.

While continuing the supervision of this work Mr. Mendenhall brought the hydrologic field work in the Redlands and San Bernardino areas to a conclusion, made substantial progress in the areal mapping of the bed-rock portions of the San Bernardino quadrangle, and in addition spent a month, in the latter part of January and the early part of February, in a special investigation of the Carriso Mountain region, for the division of geology.

Soon after the 1st of April office work was begun in Los Angeles, at the office of the reclamation service. Immediately the work of preparing water-supply papers was taken up, and was continued until the end of the fiscal year, while, at the same time, close supervision was exercised over the assistants who are mapping irrigated lands, collecting well data, and compiling these data for publication.

Colorado.—In order to ascertain the underground water conditions in the portion of the Arkansas Valley between Rocky Ford and La Junta, Mr. C. A. Fisher made a detailed investigation of the geologic structure and examined numerous borings of various kinds which throw light on the problems. The principal area examined is comprised in the Napesta quadrangle, and Mr. Fisher has prepared the results for publication as a geologic folio of the Survey. One sheet of this folio will show the depth to the artesian waters in the Dakota sandstone, the area in which flows may be expected, and the height to which the water will rise in the area of flow.

Considerable progress was made in the preparation of a report on the underground waters of the entire Arkansas basin in Colorado east of the mountains, but additional field work will be required before this can be completed. The underground waters of the Arkansas basin have proved very useful and much interest is manifested concerning the area in which artesian flows are available.

On July 1, 1903, Mr. C. E. Siebenthal was assigned to the division of hydrology and sent to the San Luis Valley for an investigation of the artesian basin which underlies that region.

He examined the greater portion of the area, but additional field work will be required before a report can be prepared. This work will be done in July and August, 1904.

Kansas.—Attention was given, mainly by correspondence, to obtaining additional information regarding the underground waters of Kansas and to experience with various deep wells. It was intended to sink an experimental deep well in northwestern Kansas, but some enterprising oil prospectors were found in the field and their borings were sufficiently deep to afford all necessary information regarding the underground water prospects. Unfortunately, the results were not encouraging, either for oil or for water. Water in the Dakota sandstone undoubtedly underlies all of the western portion of the State, but it is almost certain that no useful flows will be obtainable in areas in which additional water supplies are needed.

Nebraska.—Mr. G. E. Condra completed an investigation of the geologic structure and underground waters of the northeastern portion of the State and submitted a report, which is now ready for publication. This report describes the geologic structure, gives all available data regarding the artesian wells, and is illustrated by maps showing the areas to which the artesian flows are limited.

New Mexico.—Prof. C. R. Keyes, of the school of mines at Socorro, made an investigation of the geology and underground waters of the Jornado del Muerto, which is now ready for publication. In this report considerable encouragement is given as to waters available for deep wells in this desert area.

During the latter part of 1903 Mr. N. H. Darton continued his examination of the plateau region of the northwestern portion of the Territory, to obtain additional data for a report now in preparation on western New Mexico and northern Arizona. Mr. Darton also visited the district about Deming, to ascertain the extent of the water-bearing gravels underlying the broad valleys of that region.

In the spring of 1904 Mr. C. A. Fisher was assigned to an investigation of the Roswell artesian area, in the Pecos Valley. He made a detailed investigation of the entire artesian basin and is now engaged in the preparation of a report. A large amount of water appears to be available, but as numerous wells are being sunk it is feared that finally the "head" may be so lowered that flows will cease. With a view to ascertaining the effect of new wells on the flow, special provision has been made for taking pressures of representative wells at intervals during the coming year.

North Dakota.—Prof. D. E. Willard, of the State Agricultural College, continued field work in the Red River Valley, to investigate the artesian water conditions. He has completed the manuscripts of the Casselton and Fargo folios, which were begun by the late Prof. C. M. Hall.

During the summer Prof. F. A. Wilder, former State geologist, made an examination of the lignite deposits in the western portion of the State, which may serve for fuel for pumping surface waters into reservoirs and ditches, for irrigation. A résumé of the results of this investigation was published in the First Annual Report of the Reclamation Service, and a more detailed report is now ready for publication as a water-supply paper.

Oklahoma.—Prof. C. N. Gould, professor of geology at the State University, continued his investigation of the underground waters of the Territory and submitted a report on the geology and waters, which is now ready for publication. Special attention was given to the conditions in a wide area underlain by the "Red Beds," a region in which water is greatly needed, but in which borings usually have been unsuccessful in obtaining satisfactory water supplies.

Oregon.—Prof. I. C. Russell, of the University of Michigan, conducted an expedition through south-central Oregon, to investigate the geology and water resources. Much of the region traversed was found to present very little encouragement for artesian flows, or even for water available in deep pump wells. The results of the investigation are now ready for publication as a professional paper.

South Dakota.—The report by Prof. J. E. Todd and the late Prof. C. M. Hall, on the geology and underground waters of a portion of the James River Valley, was finally completed and has been published as Water-Supply Paper No. 90. Other products of the investigation are folios 97, 98, 99, and 100, which were published during the year, and the Huron and De Smet folios, now in course of publication.

During the season Professor Todd continued his investigation by making an examination of the southeast corner of the State.

Texas.—During the summer and autumn of 1903, Mr. G. B. Richardson made an investigation of the geology of El Paso County and a portion of Reeves County. The work was done jointly with the State mineral survey, under the direction of Prof. W. B. Phillips, to ascertain the prospects for water for deep wells, especially in the areas of school lands which the State holds in these counties. During the winter Mr. Richardson prepared his report, and this was recently transmitted to Professor Phillips for publication by the State of Texas, the State having paid the expenses of the investigation.

Utah.—Considerable progress was made in canvassing the entire State for data relating to underground waters. Large numbers of schedules were sent out and numerous important data secured. Plans were perfected for an investigation of the artesian basin in the north-central portion of the State, by Mr. G. B. Richardson.

Washington.—Mr. Henry Landes, State geologist, prepared a review of all available data relating to the underground waters of the State, which has been transmitted for publication as a water-supply paper.

A report has been transmitted by Mr. F. C. Calkins, assistant geologist of the Survey, on the geology and water resources of the Yakima district, in Washington, which will soon be submitted for publication.

Wyoming.—During the summer Mr. N. H. Darton, assisted by Mr. C. A. Fisher, continued his investigations of the geology on the western side of the Bighorn Range, with a view to determining the geologic structure of the Bighorn basin. Later in the season Mr. Fisher extended this work around the rim of the basin, in various directions, remaining in the field until the weather became unfavorable. The investigation will be continued during the coming season, with a view of preparing a report on the geology and underground waters and other resources of the entire Bighorn basin.

Division of Hydro-Economics.

This division has for its object the investigation of the various features of economic value in the water supplies of the United States. The quality of water, the changes which take place in its composition, the damages arising from abuse of one kind or another, and the methods by which it may be made commercially valuable, are all subjects of investigation. The work is based largely on a consideration of physical, chemical, and biological evidence.

The division is in charge of Mr. Marshall O. Leighton, hydrographer, who was assisted throughout the year by Mr. Richard B. Dole, engineering aid, and during the latter part of the fiscal year by Messrs. Herman Stabler and Sheldon K. Baker, hydrographic aids.

To make the work of this division of immediate practical value, investigations have been confined to conditions and problems concerning which there is a present demand for information. The work is organized under three heads: (1) Hydro-economic investigations, by members of the staff; (2) investigations in cooperation with State or private bodies under joint appropriations; (3) cooperative arrangements with laboratory officials whereby the chemical work is done by the laboratories, while the expenses of collection, transportation of samples, etc., are defrayed from Survey appropriations.

The most important work under the first heading has been the devising of field methods of water assay, by which satisfactory knowledge of the condition of the water can be obtained without recourse to a laboratory. The demand for such a system has been apparent for many years, as the process usually followed is long, tedious, and expensive.

The field methods which have been devised are not intended to be strictly accurate, errors to a maximum of 1 per cent being involved; but for the purposes in view the data furnished are as valuable as they would be were they determined by refined methods. By a few simple tests, made with apparatus which can be carried into the field and used on the spot, the engineer is able to cover large areas in a short time; and even if it is necessary for any reason to make periodical determinations, the cost of the work will still be small in comparison with the large sums heretofore spent in such investigations.

Methods have been devised for field determination of the following qualities: Turbidity, color, total hardness, alkalinity or carbonates, total sulphates, chlorine, and iron; and there are under consideration methods for the field determination of calcium, magnesium, sodium, free carbon dioxide, and hydrogen sulphide. The work which has been carried on during the latter part of the year with the methods already provided afforded results of great value and of greater accuracy than was expected.

Field determinations of the principal constituents of ground and surface waters were made by members of the staff in Georgia, Indiana, and Iowa, and preparation has already been made to extend the investigations into other States. From the results of this work it is possible to prepare reports clearly outlining the availability of the waters for use in various lines of industrial and economic development.

Of practical importance is the investigation of the effects of sewage and industrial pollution on the waters of Lake Champlain, which has been a fruitful cause of discussion and complaint among the residents and property owners along the border of that lake, both in Vermont and in New York. This investigation is the direct result of a request made by the governor of the State of Vermont.

Cooperative investigations.—One of the most important studies made during the last fiscal year is that of the ground and surface waters of Minnesota, made in cooperation with the State board of health. The object of the Geological Survey in determining the character of water is to secure information respecting its economic value and to show how it has been damaged by abuse. The steps leading up to such results are practically those involved in a sanitary survey. Therefore the work easily lends itself to cooperation with sanitary bodies.

In the case of the Minnesota board of health, arrangements were made for the joint prosecution of the work according to an agreement duly executed and on file in the office of the Survey.

The work which has been carried on in cooperation with chemical laboratories covers portions of Maine, Kentucky, Kansas, Pennsylvania, New York, and Indiana.

Under an agreement with Prof. William P. Mason, of Rensselaer Polytechnic Institute, Troy, N. Y., examinations were made of the character of the water in Hoosic River, in Massachusetts, Vermont, and New York. The work is important by reason of the fact that this river possesses many valuable resources which are at present considerably damaged by sewage and industrial pollution from cities and manufacturing plants located in New England. The interstate features of the question are of especial significance. The work consisted of periodical examinations of the water in the river, taken from chosen points along the stream from source to mouth, together with a detailed examination of the sources of pollution and the natural advantages possessed by the system.

Periodical examinations of the water of the Susquehanna River for the purpose of determining the effect of coal-mine wastes which are discharged into the stream, especially in the northern anthracite basin, were continued under a cooperative arrangement between the Survey and Mr. W. H. Dean, of Wilkesbarre, until January 1, 1904, and the results have been used, together with other analytical data taken from the records of railroads crossing the drainage area, to form the basis of a paper entitled "Quality of Water in the Susquehanna Drainage Basin" (Water-Supply Paper No. 108). This paper will soon be ready for distribution.

In the State of Kentucky examinations of the water at chosen points along the Kentucky, Salt, Green, and Cumberland rivers were made by Prof. Chase Palmer, of the Central University of Kentucky. This work is not yet completed.

Under an agreement with Prof. Edward Bartow, of the University of Kansas, periodical examinations of water taken from chosen points along the Neosho, Verdigris, and Osage rivers, in southeastern Kansas, were made at the laboratory of the University of Kansas. The object of these investigations is to determine the character of waters available for manufacturing and municipal uses in that part of the State, which under the impetus of recent mining developments has increased considerably in importance; and the problems incident thereto, in respect to municipal water supplies and the damage to sources of such supply by mine wastes, warrant an investigation of the possibilities of the future.

Under an arrangement with Mr. D. D. Jackson, of Mount Prospect Laboratory, Brooklyn, N. Y., samples of normal water in Maine and New Hampshire were collected for the determination of normal chlorine, the data to be used in the completion of a normal chlorine map covering New York and the New England States. This work was completed and the map is ready for publication.

Special acknowledgment is due the following corporations and individuals for assistance in this work or for the contribution of valuable analytical data: State board of health of Vermont; Pennsylvania Railroad Company; Baltimore and Ohio Railroad Company; Pere Marquette Railroad; Central Railway of Georgia; Chicago, Milwaukee and St. Paul Railroad Company; Chicago and Northwestern Railroad Company; Atchison, Topeka and Santa Fe Railroad Company; Pittsburg Testing Laboratory (Limited), Pittsburg; the Robert W. Hunt Company, Chicago; Prof. E. M. Chamot, Cornell University; Mr. George W. Fuller, New York; Kennicott Water Softener Company, Chicago, and others.

In addition to the work falling regularly under the appropriation for this division, the members of the staff participated in the work of the reclamation service by making preliminary field determinations of the character of water available in projects under discussion, consideration of which is important in connection with the establishment of irrigation systems. This work will be continued during a part of the next fiscal year.

Reclamation Service.

Work was continued under the reclamation law of June 17, 1902, general instructions being given to all engineers in the field to push the work as rapidly and economically as possible. Actual construction was begun and is now in progress on the Salt River project in Arizona and on the Truckee-Carson project in Nevada.

The general conduct of the work was continued under the charge of Mr. F. H. Newell, as head of the hydrographic branch and chief engineer of the reclamation service. Various consulting engineers and specialists were added to the organization and the services of others are being obtained from time to time. At the close of the year the general staff included the following: Arthur P. Davis, J. B. Lippincott, and C. H. Fitch, supervising engineers; G. Y. Wisner, H. N. Savage, J. H. Quinton, B. M. Hall, W. H. Sanders, A. J. Wiley, and C. S. Slichter, consulting engineers; Morris Bien, engineer in charge of investigations of land titles; N. H. Darton, hydrographer in charge of western section of hydrology; H. A. Storrs, electrical engineer; G. A. Hammond, superintendent of borings; G. B. Hollister, hydrographer, executive officer; T. H. Means, engineer of soils.

In the following paragraphs brief mention is made of the personnel and operations in the various States and Territories. More complete information will be found in the First and Second Annual Reports of the Reclamation Service, transmitted to Congress in 1902 and 1903, respectively.

ARIZONA.

In this Territory attention was given first, under the reclamation law, to the consideration of the relative merits of the two large reservoir sites which had been previously known and widely discussed. These are the San Carlos site on the Gila River and the Salt River site, on the stream of that name, the principal tributary of Gila River. The former was examined in connection with the surveys of The Buttes reservoir site, authorized by act of Congress, approved July 1, 1898, appropriating $20,000 for ascertaining the depth to bed rock at The Buttes and estimating the cost of construction of a dam across the river.

In addition a general examination was made of opportunities of storing water in various parts of the Territory, and a study of the underground waters of the Salt River Valley which may be made available by pumping. The work was in charge of Mr. Louis C. Hill, engineer, who was assisted by Messrs. W. A. Farish, C. R. Olberg, Andrew Weiss, A. M. Sprigg, R. P. Dillon, A. L. Harris, O. T. Reedy, and C. R. Steiner, assistant engineers; E. Duryee, cement expert; M. T. Turner, topographer; Hugh Redmond and M. H. Brinkley, engineering aids, and others.

Salt River project.—The Salt River project involves the construction of a dam 220 feet high, at an estimated cost of about $3,000,000, for the storage of 1,200,000 acre-feet of water. The dam site is on the Salt River, about 60 miles above Phoenix, and immediately below the mouth of Tonto Creek. Water stored at this point will be turned down the Salt River and utilized on 160,000 to 200,000 acres of land in the vicinity of Phoenix. Most of the land is in private ownership, but all the surrounding public land has been withdrawn pending survey. In addition to this, it is estimated that by developing the flow available along the Salt River and using it for pumping, an area amounting to nearly 100,000 acres can be added to the irrigated district in the Salt River Valley. The power developed along the river would be transmitted to substations properly located, and there distributed at a lower voltage to various pumping stations so situated as to furnish water for irrigation.

An association of the water users has been formed for the purpose of dealing with the Government and guaranteeing the carrying out of the purpose of the law and the repayment of the cost of reclamation. In February, 1904, the Secretary of the Interior approved a form of contract which it was proposed to enter into with this association. This form was submitted to the association and was accepted by vote on May 10, 1904.

On December 22, 1903, bids were opened for the excavation of the outlet tunnel in the canyon of the Salt River below the mouth of Tonto Creek. The tunnel is to be cut through hard sandstone and shale, and will be 500 feet long, 10 feet high by 13 feet wide. The contract was let to John Tuttle, of San Francisco.

On January 7, 1904, bids were opened for the excavation and lining of about 9,000 feet of tunnel along the line of the power canal, and for the excavation of the rest of this canal. These contracts were awarded to John Tuttle, of San Francisco, and Robert Sherer, of Los Angeles.

On January 4, 1904, bids were opened for 1,000 barrels or more of first-class Portland cement delivered at Globe, Ariz. Only one formal bid was received. This was rejected and purchase was made in open market at $2.62 per barrel.

On February 29 bids were opened for 150,000 barrels or more of cement delivered at the dam. Three bids were received, at prices of $5.70, $5.49, and $4.81 per barrel. All these bids were rejected and authority was requested for the purchase of cement in the open market.

Sealed proposals were opened in Denver on September 21, 1903, and bids for the furnishing of machinery for a cement mill and the erection of a plant were received.

In addition to the contracts mentioned above contracts with the following firms have been signed:

Wilcox & Rose, Riverside, Cal., for erecting cement mill. Contract dated December 17, 1903.

Hendrie & Bolthoff, Denver, Colo., for electric motors. Contract dated January 6, 1904.

Bullock Electric Manufacturing Company, for generators for the temporary power plant. Contract dated January 8, 1904.

Stillwell-Bierce & Smith-Vaile Company, for water wheels for power plant. Contract dated February 18, 1904.

Allis-Chalmers Company, for machinery for manufacture of cement. Contract dated December 22, 1903.

James R. Thorpe, for telephone line from Arizona dam to Livingstone. Contract dated December 26, 1903.

Work is now in progress under these contracts.

A waterworks system was installed for the purpose of supplying potable water to the camp and town at Roosevelt.

The telephone line connecting the headworks of the upper power canal with the Arizona dam was completed. The tunnels along the line of the power canal are being rapidly pushed to completion. The contractors for the excavation of the power canal started work in April, 1904, and have been gradually increasing their force ever since. Part of the cement-mill machinery is on the ground. The refrigerating plant is in process of erection, and the temporary power plant and machine shop is nearly finished. The erection of the cement mill is well underway. Work is being pushed on the Phoenix-Roosevelt freight road, about 300 men being employed in seven camps.

The total number of men at work on this project at the close of the fiscal year, exclusive of those hired by the contractors, was about 500. The contractors had as many more.

Additional borings were being made at the dam site, along the line of the diversion dam at the head of the power canal, at a power location 8 miles below the dam, and at points still farther down on the Salt River.

The final survey for a power canal at the mouth of the Verde was practically complete at the end of the fiscal year.

The cadastral survey of the irrigable lands in the Phoenix Valley was completed.

Of the 4,475.08 acres of patented lands within the extreme high-water line of the reservoir, 1,134.14 acres had been purchased at a total cost of $29,775. Two other tracts, aggregating 191.14 acres, had been contracted for at $3,700, and it only remained to execute one deed, sign the necessary vouchers, and make payment to complete the transactions, thus bringing the land purchased up to 1,325.28 acres, at a cost of $33,475.

Of other patented lands in the reservoir site contracts of purchase were made or understandings as to price were arrived at, covering 779.64 acres at the aggregate price of $15,500, leaving 2,372.16 acres of said land in the reservoir site for which the Government had no agreements of purchase. With two or three exceptions the tracts for which no contracts of purchase exist are of comparatively small value.

San Carlos reservoir site.—The San Carlos reservoir site is on the White Mountain Indian Reservation, in Arizona, below

San Carlos, on the Gila River. A dam at this point will impound about 240,000 acre-feet of water, at a cost of little over $2,000,000. The stored water will be turned down Gila River and taken out for use in the broad valley in the vicinity of Florence and on the Gila Indian Reservation near Sacaton. Investigations were begun here in 1899 and deep borings for bed rock made during June of that year. The water supply is scanty, but the chief difficulty will be with the large amount of silt carried by the Gila River.

Investigations of the foundation problem were begun by the reclamation service in February, 1903. The steam diamond drill and the pipe apparatus were placed in charge of Mr. W. G. Steward, under the general direction of Mr. C. R. Olberg. The work was discontinued in August, 1903, fifteen holes having been sunk to bed rock and diamond-drill cores taken therefrom.

San Pedro project.—The San Pedro project is located in the southeastern part of Arizona, along the San Pedro River, in the vicinity of the town of Benson, in Cochise County.

The river is torrential in character and the project contemplates the construction of a dam below the station of Charleston on the El Paso and Southwestern Railroad, on the San Pedro River, for the storage of the flood waters of the river and the diversion by means of canals of the stored water for the irrigation of lands below.

No estimate can be made of the feasibility of this project until the amount of water supply has been settled. A gaging station has been established and an observer will continue his observations until enough data are collected upon which to base a reasonable estimate of the probable water supply.

Mr. Henry R. Evans, assistant engineer, was sent to make an investigation of this project for the purpose of determining its feasibility. Complete contour maps of the reservoir site were made; a canal line was located, and estimates of the cost of the canal, reservoir, and dam were made. It was found that it would be necessary to move the tracks of the El Paso and Southwestern Railroad about 10 miles. The proposed line of this railroad was located, and estimates were made of the cost of removal. The total cost of moving the railroad was placed at $124,132. The estimate for the cost of the dam was about $262,000, and the total cost of storage, including rights of way, dam, removal of railroad, etc., amounts to about $456,000. The total cost of the canal, including the headworks, amounts to $179,000, and the total cost of the project to about $735,000.

Sacaton Indian Reservation.—Mr. W. H. Code, for the Indian Department, has made some investigations and estimates for the supply of water for irrigating a portion of the Sacaton Indian Reservation. This contemplates the irrigation from wells of about 10,000 acres of land. The power for pumping this water is to be supplied from one of the power plants along the Salt River. It is estimated that the cost of this project will be about $30 or $35 per acre. There seems to be no question as to the amount of underflow. The investigations of Mr. Willis T. Lee and Mr. Code, as well as of others, seem to make certain that a large amount of very fair water is available for irrigation, by pumping, to the whole district southeast of Phoenix.

Reconnaissances.—Various reconnaissance surveys have been made in the southern part of the Territory, principally on streams tributary to the Gila River. In particular, an examination of underground waters in the Salt River Valley has been carried on, under the direction of Mr. N. H. Darton, by Mr. Willis T. Lee. Mr. Lee has found that there are definite ancient channels filled with gravel, from which water in considerable quantities may be pumped. Some of this water is alkaline, but a great portion may be utilized for the reclamation of arid land.

A reconnaissance of the Little Colorado has been completed. No good reservoir sites have been found. Mr. J. G. Camp, who made these surveys, also made an examination of Verde River with a view to finding a reservoir site for the purpose of storing some of the flood waters of the Verde. No better reservoir site was found along this river than the one near its junction with the Salt, where some investigations have already been made.

CALIFORNIA.

The work in this State was continued under the direction of Mr. J. B. Lippincott, supervising engineer, who was assisted by Messrs. Homer Hamlin, E. T. Perkins, S. G. Bennett, H. E. Green, and J. C. Clausen, engineers; W. B. Clapp, J. A. Sargent, Goyne Drummond, R. S. Hawley, and L. M. Lawson, assistant engineers; A. C. Hansen, F. W. Huber, T. H. Humphreys, O. W. Paterson, and W. D. Smith, engineering aids, and others.

Colorado River project.—Work on the Colorado River project was continued under the immediate charge of Mr. E. T. Perkins, and included surveys for the irrigation of the valley lands of the Colorado and Gila rivers in the immediate vicinity of Yuma, Ariz., and in the Yuma Indian Reservation, in California, looking toward the utilization of the Colorado River for their water supply.

In the Yuma Indian Reservation it is estimated that there will be, on the California side of the river, within the levees, 16,000 acres under the system, making a total of 107,000 acres. Of this area it is estimated that 5,000 acres next to the Mexican line in Arizona will be subject to overflow in such a way as to temporarily exclude them from the irrigable areas, and, in addition, a small percentage of the remaining lands are known to be in sand dunes that will be above the level of the canal lines. In all, it is estimated that on both sides of the river there will be a total of 86,700 acres of irrigable land, of which 73,100 acres are in Arizona. The water supply of the Colorado River is adequate for the irrigation of this area.

The whole project, as planned, contemplates the permanent reclamation of this district by means of irrigation, levee, and drainage works. All portions of the system will be made of steel, concrete, or earthwork.

The reports of the Department of Agriculture as well as past farming experience indicate that the soils of this valley are exceedingly fertile. The silt of Colorado River, all of which can not be removed at the headworks, has high fertilizing properties. Under these conditions, and with proper handling of the system, the valley should be perpetually fertile. According to the estimate, the entire cost of this enterprise, provided all the area indicated above is irrigated, will amount to about $35 per acre irrigated. It is entirely possible, however, that as construction work proceeds this cost will be somewhat increased or lessened, although an effort has been made to cover all contingencies, and the estimates of cost have been liberal.

The sum of $3,000,000 has been set aside from the reclamation fund for this project, contingent upon the landowners of this valley entering into contracts with the Department in accordance with the provisions of the reclamation act.

Owens Valley project.—In the summer of 1903 Mr. J. C. Clausen, engineer, investigated the possibilities of storing water in Owens Valley. Mr. R. S. Hawley, assistant engineer, has maintained a number of gaging stations in the valley. The water supply comes from the mountains on the west, and it is considered probable that there will be a large surplus over present use, to permit of the storage of a portion of the spring high water in addition to the winter discharge which is available. There is an abundance of irrigable land, both public and private, in this valley. The water supply is the controlling feature, and it is thought that this may be augmented by the construction of additional reservoirs on the small tributaries coming from the eastern slope of the mountains, in addition to the large reservoir which exists on the upper portion of the Owens River at Long Valley. The grade of the small streams on the eastern slope of the Sierras will be approximately 6,000 feet in a distance of 6 miles, and it is proposed that this available water power shall be utilized in part in pumping water in the valley for the combined purpose of draining the lands that are now water-logged from over irrigation and removing alkali, and thus increasing the available water supply.

Long Valley.—Mr. G. A. Hammond, superintendent of borings, will visit the Long Valley dam site with a view to exploring for bed rock at that point, in connection with an estimate on the feasibility and cost of constructing a masonry dam.

Mr. W. T. Lee, geologist, will make an examination for artesian and ground water in the valley and the regions to the south, with a view to supplementing the supply from storage with this ground water, particularly in connection with pumping plants which may be installed.

Sacramento Valley.—The investigations in the Sacramento Valley were continued. These contemplate a general reconnaissance of the entire basin of the river, a search for reservoir sites, the gaging of streams, and an approximate determination of the areas of irrigable land. The work is being carried on in cooperation with the State, in connection with the topographic mapping of the valley lands by the Survey, and in harmony with the work of the Bureau of Forestry of the Department of Agriculture, which is examining the conditions for forest reserves.

The western side of the drainage basin and the northern portion of the basin as far as the Pit River have been examined for reservoir sites. Sites have been found aggregating in estimated capacity 1,800,000 acre-feet. Gaging stations are being established at the desirable reservoir sites, eight of these having been maintained during the last winter. At the close of the year plans and estimates on the field work done by Mr. H. E. Green, engineer, were being prepared.

Klamath River basin.—During the last season a hurried reconnaissance of a part of the Klamath River drainage basin was made by Mr. H. E. Green, engineer. His report was generally unfavorable. In California the river flows mostly through canyons and mountainous districts, and there are few feasible irrigation projects near it. In Oregon, however, it occupies a high plateau region where irrigation is practised to advantage. It is also possible to divert the Klamath near the California State line, and to carry its waters southward into the Shasta Valley to an area immediately north of Mount Shasta. A thorough exploration of the drainage basin of this stream above the one hundred and twenty-second meridian was in progress at the close of the year, under Mr. T. H. Humphreys, with a view to determining the irrigation possibilities therefrom. It is expected that this reconnaissance will be followed by detailed surveys of such reservoir sites and irrigable areas as may be found.

Stream measurements.—Stream measurements in California were continued under the charge of Mr. S. G. Bennett, engineer. The State is cooperating in this work, $15,000 being available in the two years from July 1, 1903, to June 30, 1905.

COLORADO.

The reclamation work in this State was continued in charge of Mr. A. L. Fellows, with office at Denver, where he has been assisted by Messrs. R. S. Stockton and C. T. Pease, engineers. This office is used as the western headquarters and supply point, and also as a disbursing office, not only for Colorado, but for the adjacent States.

Uncompahgre Valley project.—Special attention was devoted to the Uncompahgre project, which contemplates the irrigation of lands in the Uncompahgre Valley, water being diverted from the Gunnison River and conveyed to the valley by means of a tunnel. Surveys were also conducted looking to the reclamation of lands in the northwestern part of the State by waters from the White River. An examination was made of the opportunities of reclamation of land near Grand Junction, and, in addition, reconnaissance was carried on in various parts of the State.

The Uncompahgre Valley project is located in Montrose and Delta counties, in western Colorado, on the western side of the main range of the Rocky Mountains. The source of water supply is the Gunnison River, from which it is expected that water will be taken by means of a tunnel about 6 miles long, beginning in the Grand Canyon of the Gunnison and delivering water in Uncompahgre Valley a few miles northeast of the town of Montrose. From the lower portion of the tunnel the water will be taken around the edge of the valley for the purpose of irrigating about 100,000 acres of land, a considerable portion of which is in private ownership in small tracts. It is estimated that this project will cost in the aggregate approximately $2,500,000, and that it will take about four years to complete it. The first segregation of land, comprising about 137,000 acres, was ordered January 31, 1902, before the passage of the reclamation act; but after the passage of that law these lands were brought under its provisions by special order. On October 24, 1902, an additional area of 238,000 acres was segregated. Since that date there have been returned to general entry about 46,000 acres, and the return to general entry of about 125,000 acres additional has been recommended. The lands to be irrigated are in the vicinity of the towns of Montrose and Delta, and are traversed by the narrow-gage branch of the Denver and Rio Grande Railroad. The principal crops raised are fruits, grains, alfalfa, and vegetables.

Preliminary examination was begun by the United States Geological Survey in 1901, and in the same year an appropriation of $25,000 was made by the State of Colorado for the commencement of construction. This amount was expended in excavating the lower portion of the State tunnel before the surveys had been concluded. Surveys were continued after the passage of the reclamation act in 1902, and a preliminary report was made on March 7, 1903. This was submitted to a board of engineers consisting of Messrs. A. P. Davis, J. H. Quinton, and Morris Bien, and was favorably indorsed by them, further examination being ordered. Accordingly, topographic surveys of the land affected have been made on a scale of 1,000 feet to the inch, and precise surveys for the purpose of definitely locating the tunnel and head works have been concluded.

A detailed report was submitted by Mr. A. L. Fellows to the chief engineer on January 25, 1904; and on May 8, 1904, a board consisting of Messrs. A. P. Davis, George Y. Wisner, and W. H. Sanders, accompanied by Morris Bien, engineer, and Prof. L. G. Carpenter, State engineer of Colorado, considered the report and went over the proposed tunnel locations and canal lines, and reported favorably concerning the construction of the project. In accordance with this report the sum of $2,500,000 was conditionally set apart by the Secretary on June 7, 1904. Final acceptance will, however, depend upon compliance with conditions regarding lands in private ownership imposed by the board of consulting engineers.

At the close of the year the topographic map of the irrigable lands of the valley, on a scale of 1 inch to 1,000 feet, with a contour interval of 10 feet, had been completed; definite location work was being carried on and final estimates were being prepared, and paper locations of tunnels and main canals had been completed.

Northwestern Colorado.—It is proposed to reclaim approximately 90,000 acres of land in northwestern Colorado, in Rio Blanco and Routt counties, the water to be taken from the White River about 30 miles above the town of Meeker. Preliminary examinations of this project were made by Mr. A. L. Fellows, first in 1898, and again in 1901. Investigations under the reclamation law were ordered by the chief engineer in May, 1903. In June of that year Mr. Robert S. Stockton was placed in charge of the work. On February 9, 1903, about 377,000 acres were segregated (exclusive of the White River Forest Reserve), and on August 13, 1903, after investigation by Mr. Stockton, 170,000 acres were returned to general entry as being unsuited for irrigation, and 99,000 acres were added to the former segregation. It is estimated that the cost of the project will be approximately $2,000,000.

During the season of 1903 reconnaissance surveys were carried on over the entire area and material was obtained for a preliminary report. Field work was brought to a close on November 16 and Mr. Stockton, engineer in charge, returned to Denver. He was employed throughout the winter in making preliminary estimates with reference to the project. The preliminary estimate is now completed and is ready for the consideration of a board of consulting engineers.

Other investigations.—In addition to the surveys and examinations which may lead to early construction, various projects of interest to the public have been investigated. Exploration has been made in western Colorado, and considerable time has been devoted to a thorough examination of several projects in other parts of the State, which have been popularly considered important.

Stream measurements.—The stream measurements have been under the direct supervision of Mr. M. C. Hinderlider, engineer, assisted by various assistant engineers and aids. Mr. Hinderlider also supervises hydrographic work in Wyoming, Nebraska, South Dakota, Kansas, northern Oklahoma, Indian Territory, northern New Mexico, and the Uinta Indian Reservation.

IDAHO.

Work was continued under the general direction of Mr. D. W. Ross, with headquarters at Boise.

In this State are a number of projects for the reclamation of arid land, both in public and in private ownership. The most important of these is the Minidoka project, on the Snake River, below American Falls. Mr. D. G. Martin, engineer, was appointed resident engineer in immediate charge of the project, and he was assisted by Messrs. J. T. Burke and T. B. White, assistant engineers; L. L. Gay, G. H. Hogue, R. J. Newell, A. M. Gilbert, engineering aids; and others. The Payette-Boise project is in the southwestern part of the State, where the lands are mainly in private ownership. They may be reclaimed by storage and control of the waters of the Payette and Boise rivers. In the work on this project Mr. Ross was assisted by Messrs. C. B. Smith and B. E. Hayden, assistant engineers; Mr. C. E. Slonaker, engineering aid; and others. A third project is the Dubois, in the southeastern part of the State, near the headwaters of the Snake River, where a vast extent of desert public land can be reclaimed by storage of flood waters if suitable reservoirs can be found. In the work on this project Mr. Ross was assisted by Mr. J. G. Camp, assistant engineer, and others.

Minidoka project.—The Minidoka project is located on the Snake River, in the southern part of Idaho. It is proposed to reclaim from 130,000 to 150,000 acres of desert land belonging to the United States. Water is to be taken from Snake River, the dam being located about 40 miles below American Falls and 6 miles south of Minidoka station, on the Oregon Short Line Railroad.

The lands to be reclaimed were segregated, pending a survey, by order of the Secretary of the Interior, dated November 17, 1902. Preliminary surveys were begun in March, 1903, and the preliminary estimates and report were filed with the chief engineer in October, 1903. All the trial surveys have been completed and a plane-table survey on a scale of 1,000 feet to the inch has been made of a tract on the south side of the river, covering in all 130 square miles. At the close of the year a classification had been made of the lands on both sides of the river, about 120,000 acres in all. A topographic survey had been made of the dam site on Snake River and of 7 miles of the upper portion of the north-side canal. This field work was brought to a close in the early part of December, 1903, and during that month plans of several of the different structures were made. Assistance in preparing these plans was given by Mr. J. H. Quinton, consulting engineer.

About February 1, 1904, a field party began surveys for the final location of the canal system covering the north-side lands. Many preliminary lines for this purpose were run and the control work for a topographic survey of the north-side tract, consisting of about 60,000 acres, was completed.

A board of consulting engineers, consisting of Messrs. A. P. Davis, George Y. Wisner, and H. N. Savage, visited this work from March 16 to 22, and on March 21 submitted a report to the chief engineer approving the project; the board also prepared specifications covering the dam and headworks, and recommended that the sum of $2,600,000 be set aside from the reclamation fund for the construction of the works proposed. This recommendation received favorable action by the Secretary, and shortly thereafter advertisements were inserted in leading engineering and construction journals of the country, inviting bids for the construction of the works to be covered by the first contract, the bids to be opened on July 2, 1904.

A great many preliminary lines have been run on the north side of the Snake River with a view to ascertaining the most feasible route for the location of the main canal. Owing to the level yet somewhat broken character of the country, and to the fact that a great deal of rock would be encountered in construction, many alternative lines had to be run and many estimates made before the cheapest and best route was found. This work has been finished and a definite route decided upon. At the close of the year from 800 to 900 feet of test pits had been dug in the vicinity of the dam site, on the ground from which material for backfilling for the dam will be taken, and along the line of the fore-bay canal and tailrace from the power house, and several alternative sites had been investigated for a power house and tailrace.

From April 10 to 14 Mr. H. A. Storrs, electrical engineer, visited Minidoka to look over the site of the proposed works, for the purpose of deciding upon the best plans for power development. It is now thought that these investigations have been carried to a point where the best and most feasible plans can be determined beyond question.

At the close of the year six plane-table parties were at work, making a survey of these lands on a scale of 1,000 feet to the inch, with a contour interval of 1 and 2 feet. This survey will serve as a basis for locating the distributing system over this area, and is being made with great precision, as there is but little latitude in the matter of grades, etc., the surface being very flat. It was thought that this topographic work would be completed by the end of July.

On April 15 a recommendation to the Secretary of the Interior was made by the Director of the Geological Survey to the effect that certain tracts near points selected for sidings on this proposed railroad by the Oregon Short Line officials be withdrawn from all entry and held for town-site purposes. In pursuance of this recommendation an order was sent to the local land office at Hailey, Idaho, temporarily withdrawing from entry the two townships embracing these subdivisions, until such time as a description of the lands could be sent to that office by mail. On May 2 a proclamation was issued by President Roosevelt confirming the action of the Secretary, and reserving these tracts, three in number, for town-site purposes.

Dubois project.—The Dubois project is located in the upper portion of the Snake River Valley, southwest of the town of

Dubois, in Blaine and Fremont counties. It is proposed to reclaim about 200,000 acres of desert public land by means of a large canal heading on the South Fork of Snake River near the town of St. Anthony. The land is nearly level, and is near the lower end of the sinks of the Big Lost and Little Lost rivers. It is traversed on the east side by the Utah and Northern Railroad.

The land was segregated, pending a survey, by orders of the Secretary of the Interior, dated June 11 and July 16, 1903. Reconnaissance and trial surveys were begun in June and ended on November 10, 1903. In all, 1,570 miles were covered by reconnaissance work, and 369 miles of canal line, and 116 miles in connection with reservoir surveys. The preliminary examination was not finished and will require another season.

The field parties were disbanded early in November, and in December the work was transferred to the Boise office, where maps of all the surveys made were prepared by Mr. James G. Camp, assistant engineer, and Mr. R. J. Newell, engineering aid.

The canal and reservoir surveys were platted on standard sheets, and all maps necessary in the further investigation of this project were prepared.

On May 26 Mr. James G. Camp, assistant engineer, left Boise for St. Anthony to begin reservoir investigations on the North Fork of Snake River and its tributaries, and it is hoped that by the end of this field season all information necessary to determine beyond question the feasibility of this project will be available.

Payette-Boise project.—The Payette-Boise project is designed to reclaim about 300,000 acres of land in the Boise and Payette valleys, in the southwestern portion of Idaho. Most of this acreage is in private ownership, in relatively small tracts, and about five-sixths of the area is at present without facilities for irrigation. The area is in or adjacent to the Snake River Valley, and is traversed by the Oregon Short Line, the Boise, Nampa, and Owyhee, and the Idaho Northern railroads.

Temporary segregation of public lands, pending survey, was made by order of the Secretary of the Interior dated March 5, 1903. Preliminary or trial surveys were begun in November, 1902, and brought to a close in September, 1903. Water for the proposed project will be obtained from the Boise River by utilizing the floods of that stream, the low-water flow being entirely appropriated. The supply will be reenforced from the Payette River by means of a canal carried along the bluffs on the north side of that stream and over or through the ridge dividing the two valleys. Considerable interest in this project has been shown by the landowners of these valleys, and meetings were held at many points in the vicinity during December and January. A delegate meeting was held at Nampa on January 10, when the chief engineer of the reclamation service outlined the policy of the Department regarding projects of this nature, and gave advice as to the necessity of perfecting some kind of an association through which to deal with the National Government. Steps were at once taken and an organization committee was formed, which has circulated petitions among the landowners, held several public meetings, and worked up a general interest in the undertaking.

Early in March petitions, lists of lands, and plats showing the location of irrigable land under the project were forwarded by the organization committee to the Secretary of the Interior, with a request that the preliminary examination of the project be extended and completed and funds set aside for the construction of the necessary works, said works to be begun upon the perfecting of such an organization of land owners as might be approved by the Secretary. This petition received the prompt attention of the Geological Survey, and a recommendation was made by the Director, which was approved by the Secretary of the Interior, to the effect that the landowners be encouraged in their efforts to perfect the necessary organization, and that surveys be continued with a view to ascertaining the feasibility of the project.

At the close of the year two field parties were engaged in making detailed surveys for the proposed canals of this system. One, under the direction of Mr. Charles B. Smith, was at work in the Payette and Boise valleys; the other, under the direction of Mr. Gilbert H. Hogue, was making a survey for a canal on the north side of the Boise Valley. The results from both of these surveys point to the entire feasibility of the project, and indicate that the cost will perhaps be very much less than was stated in the preliminary estimate.

During the latter part of the year several meetings were held by the organization committee of the landowners, and at one of the last meetings articles of incorporation were presented, and a board of directors, consisting of 11 members, was named to act for the first year.

Snake River.—Examination was made of possible reservoir sites on the headwaters of the Snake River in Idaho and western Wyoming, the cost being allotted to the Minidoka or Dubois projects. Considerable work was done after December 1, 1903, in the preparation of a general map showing the condition of the development of irrigation in Idaho. Investigations made by the reclamation service will be shown on this map, and the irrigation surveys now in progress under the direction of the State engineer will be indicated.

Malade tributaries.—During April Mr. Stockton made an investigation of the storage possibilities on the tributaries of the Malade River in the vicinity of Malade, in Oneida County.

Wood and Lost rivers.—During the latter part of May Mr. R. S. Stockton made a reconnaissance of the headwaters of the Big Wood and Little Wood rivers in the vicinity of Hailey, and laid out work which he thought should be done in greater detail by a field party. In the latter part of June a small field party was organized for this work, in charge of Mr. R. J. Newell, and not only made surveys of two or more reservoir sites on the Big Wood River, but investigated the storage possibilities of the Big Lost and Little Lost rivers.

KANSAS.

The work in Kansas during the last year was confined to the study of the water resources, both surface and underground, with the idea of determining the localities where it will be feasible to make irrigation investigations.

In June, 1904, Prof. C. S. Slichter and assistants began a special investigation of underground-water conditions in southwest Kansas, in the vicinity of the Arkansas and Cimarron rivers, an allotment having been made for the purpose.

MONTANA.

In this State principal attention was given to the possibilities of reclamation of lands along the Milk River in the northern part of the State. In addition a reconnaissance was made on the rivers to the south—the Marias, Sun, and Teton—and preliminary surveys were carried along some of the rivers between the Missouri and the Yellowstone. Examinations were also made of the opportunities for development on the lower Yellowstone, as described under the heading North Dakota.

A preliminary reconnaissance was made on the Crow Indian Reservation, and detailed surveys will be made this summer.

Milk River project.—Work in connection with the Milk River project was continued in charge of Mr. Cyrus C. Babb, engineer, assisted by Messrs. L. E. Granke, E. W. Myers, C. M. Pritchett, C. T. Prall, L. R. Stockman, C. K. Hosford, F. H. Tillinghast, Robert Follansbee, and A. E. Place, assistant engineers; W. B. Freeman and W. L. Gorton, engineering aids, and others.

The Milk River rises in the undulating foothills of the Rocky Mountains, near the boundary line between Montana and Canada, flows eastward about 100 miles, parallel with the international boundary, and then turns southeastward, passing through the northern part of Montana and emptying into the Missouri River. The valley through which the Milk River passes is broad and contains many thousand acres of excellent arid land. The summer flow of the stream is not sufficient for the irrigation of any considerable part of this area, and it has been proposed to reenforce the supply by turning into the headwaters of the Milk River some of the abundant waters from the Rocky Mountains—those of the St. Mary basin, lying immediately adjacent to the source of the Milk. In order to avoid passing through Canada, this can probably be done by an expensive line turning southward across the head of the Milk and emptying into Cutbank Creek, a tributary of the Marias River. From the latter the water may be taken into the Milk River Valley, being kept in Montana throughout its course. The Milk River project is divided into three sections—St. Mary subproject, Marias subproject, and lower Milk River project.

The St. Mary River rises on the eastern slope of the main range of the Rocky Mountains. It flows northward into Canada and empties into Hudson Bay. Owing to the heavy snowfall in the basin, the annual run-off is large. It is proposed to store this water in the St. Mary Lakes, in order that it may be used to reenforce the supply for the Milk River Valley, if it can be successfully diverted. The examinations made indicate that at a cost of approximately $2,000,000 the water could be stored and taken to Cutbank Creek, a tributary of the Marias.

Investigations were first started on this project in 1900, work around St. Marys Lakes being in charge of Mr. G. H. Matthes. In the year 1901 Mr. Cyrus C. Babb was placed in charge, and the investigations were continued under his direction. Work was continued during 1902 and 1903, and covered the investigation of water supply, canal surveys, detailed surveys of reservoir sites, and borings for bed rock at the St. Mary dam site.

Maps and estimates have been prepared for the location of the dam site and canal. These maps are on scales of from 50 to 400 feet to the inch. Plans of the dam have also been prepared.

The Marias project is the second principal link in reenforcing the water supply of the St. Mary Lakes. The water diverted into the Marias River must be taken out by means of a dam located in the canyon of that river and a large canal crossing the divide to the Milk River drainage.

A general reconnaissance of the upper basin of the river was made in 1902 for reservoir sites. A number of small sites were discovered, but no large ones. During the same year a topographic survey of a portion of the same river was made.

At the close of the year surveys were in progress at the dam site on the Marias River and along the north side of the canyon for location of the canal line. Two relatively low divides had been discovered between the Marias and the Milk drainages, which it was believed would prove feasible for canal locations. Two parties were at work on this problem.

It is proposed to utilize the stored waters of St. Mary Lakes, as brought down through the Marias River and supplemented by the natural flow of the Milk River, for irrigating arable lands along the latter stream. The general elevation of the country ranges from 2,150 to 2,400 feet, and it is better adapted to irrigation than the plateau region in the vicinity of St. Mary Lakes. Through the development of the broad scheme—the utilization of the stored waters of the St. Mary River—from 250,000 to 350,000 acres can be irrigated. By depending on the Milk River alone, and storing in Bowdoin reservoir the two years' minimum run-off of the Milk, sufficient water for irrigating 68,500 acres will be available.

In August, 1902, surveys were commenced in this section. The natural flow of the Milk River and the reenforced supply can be put to the best advantage by providing accessory storage. For this purpose a depression north of Lake Bowdoin, located about 8 miles east of Malta, on the south side of the Milk, has been examined. It is a broad, shallow lake of somewhat alkaline water. A survey of this locality, with a view to its possible use as a reservoir site, was made in 1902.

Lake Bowdoin has already been filed upon by private parties, and to utilize it arrangements must be made for its purchase or condemnation. It will also be necessary to move about 9 miles of the Great Northern Railroad.

During the field season of 1903 detailed engineering surveys were made extending from Chinook to Glasgow. The work comprised surveys of dam site, reservoir site, and canal lines, as well as diamond-drill borings at the Dodson dam site.

Plans and final estimates have been prepared for the lower Milk River diversion, with the idea of utilizing Milk River water only. It will be a feasible project at a cost not to exceed $21 an acre, even if waters of the St. Mary can not be brought down. With this restricted supply, as stated above, 68,500 acres can be reclaimed.

At the close of the year field work was in progress at various points. One party was located at the Dodson dam site, where borings for bed rock were being made. A second party was making the final location for the center line of the Malta south canal, and cross sectioning the same. The third party was at work on preliminary location of the Bowdoin north canal, which diverts from Lake Bowdoin and continues northeastward, crossing the Milk River, and thence continues eastward, irrigating lands north of Saco and Hinsdale, on the north side of the Milk.

Sun River project.—The Sun River receives the drainage from the eastern portion of the Rocky Mountain region south of the St. Mary River and north of Helena, Mont. An examination of this stream was made by Mr. H. M. Wilson in 1890 and 1891, the results being printed in the Twelfth Annual Report of the Geological Survey, Part II, pp. 120–133. The stream carries a considerable amount of water. There are known to be several reservoir sites, and there is a large body of irrigable land, much of it in public ownership. This was withdrawn, pending survey, by the Secretary's order dated October 17, 1903.

A reconnaissance was made in the fall of 1903 by Mr. C. H. Fitch, who examined the country to be irrigated and the Sun River in the localities where it may be diverted. In November, 1903, Mr. C. T. Prall established a gaging station on the Sun River at the mouth of the canyon, and systematic measurements of the river have been begun.

It is proposed to make preliminary surveys and investigations of this project during the present season, with Mr. S. B. Robbins, engineer, in charge, and Messrs. Gordon Edson, A. P. Porter, and A. E. Steere, aids, assisting.

Crow Reservation project.—The Crow Reservation project refers to the irrigation of certain bodies of land lying along the Yellowstone and Bighorn rivers in Montana. Most of the lands to be reclaimed are in the ceded portion of the Crow Indian Reservation.

By act of Congress approved April 27, 1904, it is provided that the reclamation service shall make surveys and investigations for the reclamation of the irrigable area within the ceded portion of the Crow Indian Reservation in Montana lying south of the Yellowstone River and extending along the Bighorn River as far south as the Fort Custer Military Reservation.

Soon after the passage of the above-mentioned act Mr. Goyne Drummond made a preliminary reconnaissance, and reported that on the Bighorn River, from Fort Custer Military Reservation to the mouth of the river, lies a fine body of land, comprising about 35,000 acres, and that there is also an area of about 10,000 acres inside the Fort Custer Military Reservation, but outside the ceded strip. All of this land could be covered by a canal diverting water from the Bighorn River. Another canal from the Bighorn, taking water from the mouth of the canyon, would cover approximately 17,000 acres on the ceded strip and 20,000 acres on the reserve, this land lying on the high bench west of the river and adjoining the lower tract of land previously mentioned.

There is a possibility that the high-line canal may cross the divide between the Bighorn and the Yellowstone rivers. By this perhaps 50,000 additional acres of land could be covered that could not be profitably irrigated from the Yellowstone. A survey is necessary to determine the feasibility of crossing the divide with the high-line canal.

A tract of about 1,000 acres lies on the east side of the Bighorn, near its mouth. A survey will be necessary to determine whether or not this area is susceptible of irrigation.

If the above estimates are correct, there would be about 130,000 acres of land to be watered from the Bighorn River under the Crow Reservation project.

Yellowstone project.—On the Yellowstone is a fine body of irrigable land, comprising about 40,000 acres, extending from Huntley to the mouth of the Bighorn River. This land can be irrigated at a low cost per acre.

In addition to the large tracts already mentioned, there are approximately 30,000 acres lower down the Yellowstone, extending from Myers to Forsyth. Of this land about half is on the reserve, the rest being mostly in private ownership.

In the latter part of May, 1904, an examination was made by Messrs. A. P. Davis and C. H. Fitch, supervising engineers, and R. S. Stockton, engineer, as a result of which the immediate outfitting of field parties was recommended. Mr. Stockton was placed in charge of the project, with Messrs. G. E. Stratton, assistant engineer, and J. S. Swan, engineering aid, as assistants. The preliminary work on the canal lines has been begun, and the topographic work is well underway. Gaging stations will soon be established and stream measurements regularly made.

NEBRASKA.

The reclamation surveys in this State were continued under the direction of Mr. John E. Field, with headquarters at Denver, Colo. He was assisted by Messrs. L. V. Branch, J. D. Stannard, Andrew Weiss, and M. D. Williams, assistant engineers, and others. The stream measurements were carried on by Mr. J. C. Stevens, assistant engineer.

North Platte project.—The North Platte project is the most important reclamation work now under consideration in this State; it contemplates the watering of a large area in western Nebraska and southeastern Wyoming.

On July 1, 1903, the diamond drilling at the reservoir site at Devils Gate, on Sweetwater River in Wyoming, begun in 1902, was resumed and resulted in the discovery of excellent foundations of solid granite. The amount of water available for storage, however, was found to be insufficient, and the investigations on the Sweetwater were discontinued.

Upon determining that the Sweetwater reservoir could probably not be filled, owing to an inadequate water supply, search was made for other reservoir sites, and one was found, called the Pathfinder, on the North Platte, about 3 miles below the mouth of the Sweetwater. This is at the beginning of the canyon through the Rattlesnake Range. A dam constructed here will be 75 feet in length at the bottom, 200 feet high, and about 250 feet long at the top. Surveys show the surficial area of the reservoir thus created to be about 23,000 acres, and the capacity 1,080,000 acre-feet. It is probable that it will hold all of the flood and surplus waters flowing into the North Platte River at this point.

The survey of this reservoir site was begun on August 1 and completed about October 20, 1903. The resulting maps of the dam site are on a scale of 50 feet to the inch and those of the reservoir site are on a scale of 1,000 feet to the inch. In all, 36 square miles have been contoured.

Diamond-drill borings for bed rock were begun at the dam site on September 1 and completed on October 20, 1903. The foundations were found to be solid granite, and at a depth of only about 10 feet below low-water mark. Incomplete estimates indicate that the cost of the dam will approximate $1,000,000.

In accordance with the recommendation of the board of consulting engineers which visited the site during May, the sinking of test pits was begun on June 1, 1904, to ascertain the depth to granite on the saddle south of the main dam. It is proposed, if bed rock is found, to construct a wasteway on the south side, with a contemplated capacity for the reservoir of 500,000 acre-feet. The work will be so designed that the capacity may be increased, as necessity requires, to 1,000,000 acre-feet.

The waters stored in the Pathfinder reservoir can be used on lands in Goshen Hole. This is an area of undulating, nearly level land in southeastern Wyoming, lying south of North Platte River. Its name is derived from the fact that it is partly inclosed by abrupt mesas or bench lands. The area has been studied by Mr. George I. Adams, the results being given in Water-Supply Paper No. 70. Various surveys made by individuals and corporations show that much of the irrigable land in this region can be reached by canal from the North Platte River.

About 150,000 acres of good land in Goshen Hole can be irrigated, and there are two principal alternative canal lines by which water can be conducted to this land. In both cases a dam must be built in a narrow gorge on the North Platte at a point about 1 mile above the town of Guernsey. Heading at this point the canal can be taken out on either side of the river.

The canal line on the south side of the North Platte passes for the first 30 miles through a very broken country, where construction would be difficult and expensive. The canal on the north side can be taken out and the waters conducted across the North Platte by means of an inverted siphon, crossing the river about 3 miles below Fort Laramie; this line would, however, be much more expensive than the south-side line.

In either case the canal will be about 140 miles long, and will cover upwards of 10,000 acres of irrigable land in western Nebraska. There are several good reservoir sites in Goshen Hole, and by utilizing these the size of the canal can be reduced and the cost materially decreased.

The preliminary estimates show the cost of the Goshen Hole canal and the dam at Guernsey to be about $3,000,000, making the cost per acre about $25. This estimate did not include the cost of laterals, and contemplated a capacity of but 1,200 second-feet. Revised estimates were made at the suggestion of the board of consulting engineers, and $500,000 was allowed for the construction of laterals and $500,000 for increasing the capacity of the canal. The raising of the dam and the revised estimates of cost brought the total cost to nearly $5,000,000. The project is deemed by the board of consulting engineers to be unfeasible at this time, or until further investigations are made looking to securing a greater area to be irrigated.

An examination of the lands on the north side of the North Platte River, in eastern Wyoming and western Nebraska, indicates that a considerable body of land can be irrigated in Nebraska, amounting to possibly 1,000,000 acres, and about 25,000 acres in eastern Wyoming.

There are in both States uncompleted canals in private ownership, which were designed to extend much farther and cover much more land than is at present served by them, the completion of the work having been prevented by financial reverses and other difficulties. It is proposed that these canals be extended to cover the land as originally contemplated. It is doubtful, however, whether these extensions will be made. It is possible that an interstate canal for the irrigation of these lands could be constructed by the reclamation service. The results would be superior to those which could be expected from the construction of the extensions, for several reasons: First, the cost would perhaps be less per acre; second, the landowners would acquire an interest in an assured water supply from the Pathfinder reservoir; and third, questions of priority of use would be eliminated. It may therefore be possible to irrigate 50,000 acres in addition to the land already mentioned.

Sufficient level lines have been run on the north side to demonstrate the practicability of constructing a canal which will serve the lands mentioned, and a topographic survey is now under way which will show the amount and kind of irrigable land under the proposed line.

NEVADA.

The operations in Nevada were continued in charge of Mr. L. H. Taylor, with office at Reno. He was assisted by Messrs. W. E. Swift and William Sargeant, engineers; W. S. Russell, R. R. McGregor, A. V. Saph, F. A. Temple, C. V. Taylor, B. E. Forbes, D. W. Hays, and W. A. Keddie, assistant engineers; C. H. Southworth, F. W. Huber, E. P. Arnot, B. E. Corlett, I. W. Huffaker, A. H. Schadler, and B. B. Smith, engineering aids, and others.

The large amount of information available concerning the water resources made it possible to reach an early conclusion regarding the merits of various projects, and work was begun at an early date on the plans and estimates for utilizing the waters of the Truckee and Carson rivers. These streams converge toward the desert lands and disappear in sinks or lakes at an altitude of about 3,900 feet. Around these sinks are broad bodies of desert land, much of it of excellent quality when watered.

Truckee project.—The waters of the Truckee River are used for the irrigation of lands in the vicinity of Reno. Below these lands the river flows through a narrow canyon and then turns to the north, its waters being lost in Pyramid and Winnemucca lakes. In this lower canyon a canal is being constructed to take out the flood and excess waters of the Truckee, which would otherwise be lost in the lakes, and carry them southeastward to a reservoir on the lower part of the Carson River. In this same reservoir the excess waters of the latter stream can also be stored. From this reservoir distributing canals will be built to cover several hundred thousand acres of land near Carson Sink.

Plans and estimates made by Mr. Taylor were submitted to a board of consulting engineers consisting of Messrs. A. P. Davis, George Y. Wisner, and J. H. Quinton, and approved by them in May, 1903, and their recommendation was submitted to the Secretary and approved by him.

Bids were opened in July, 1903, and contracts were entered into for the construction of the canal from Truckee River, the work consisting of three divisions. A contract was entered into with C. A. Warren & Co., dated September 3, 1903, to construct divisions 1 and 2 of the main canal, and on August 28, 1903, with E. B. & A. L. Stone Company to construct division 3 of the canal.

Proposals were invited for furnishing cement for use in connection with this project, but on October 12, 1903, the Secretary of the Interior rejected all bids and authorized purchase to be made in open market. Contract was entered into on December 17, 1903.

Work on the three divisions of the canal is being pushed forward. In addition surveys are being made of the irrigable land on a scale of 1,320 feet to the inch, with contour intervals of 5 feet. An investigation of the character and quality of this land is in progress and nearing completion. Surveys of the distributing and lateral canal system are also being prosecuted.

Carson project.—Diamond drilling was carried on at the dam site on the Carson River, and is approaching completion. In the district proposed to be irrigated, section and township lines have been retraced and lost and obliterated corners reestablished.

Water is to be diverted from the Carson River at a point about 5 miles below the Lower Carson reservoir site, by means of two main canals. The canal on the south side of the river will have a capacity of 1,500 second-feet, and the one on the north side a capacity of about 300 second-feet. These canals, with their main branches, will traverse the Carson Sink Valley, and constitute the main distributing system for nearly 200,000 acres of land.

Plans and estimates made by Mr. L. H. Taylor were submitted to a board of consulting engineers consisting of Messrs. H. N. Savage, J. H. Quinton, and W. H. Sanders, and approved by them April 15, 1904, and the recommendation was submitted to the Secretary and approved by him. Proposals for the construction of about 37 miles of the main distributing canals, with diverting dam, regulating gates, spillways, falls, weirs, and bridges, were advertised for, to be opened at Reno on July 15, 1904.

Reconnaissances.—Reconnaissance surveys were carried on along important streams in Nevada, largely in cooperation with the State engineer.

NEW MEXICO.

The reclamation investigations in New Mexico are in charge of Mr. B. M. Hall, consulting engineer, assisted by Messrs. W. M. Reed, district engineer; James A. French, engineer; F. S. Dobson, W. R. Ewing, E. D. Hendricks, H. C. Hurd, S. G. Porter, and others. The work in this Territory consisted of the preliminary surveys of a number of projects selected from many suggested by citizens and public men. These projects are the lower Rio Grande, Pecos, Hondo, Las Vegas, Canadian, and Urton Lake.

Hondo project.—That portion of the Hondo River Valley which is tributary to the Pecos River in southeastern New Mexico, about 12 miles southwest of the town of Roswell, appears to offer suitable opportunities for reclamation. A reservoir site, the area and capacity of which have been determined, was found and surveyed, and a complete topographic map was made of the lands susceptible of irrigation under it.

The land that can be most easily and economically irrigated under this project has passed from Government ownership by patent and the people have formed an organization similar to that in the Salt River Valley, Arizona, for the purpose of dealing with the Government and administering the affairs of the water users.

On November 10, 1903, authority was given by the Secretary of the Interior to proceed with the project, if, on continuation of the surveys, it was found to be feasible. Examinations of the whole project, but particularly of the reservoir site, were made by the board of consulting engineers, Messrs. George Y. Wisner, J. H. Quinton, and B. M. Hall, accompanied by Mr. A. P. Davis, supervising engineer. Diamond-drill borings were made at various points within the reservoir site to determine the nature of the underlying strata, and especially to determine their degree of imperviousness. Borings were also made at points where the most important structures will be located. On June 6 the construction of this project was recommended by the consulting engineers, Messrs. George Y. Wisner, W. H. Sanders, and H. N. Savage.

The plans and estimates for the project were completed and a full report was made of the diamond-drill borings in the reservoir site.

Before construction can be undertaken title to the site must be acquired by the United States, and contracts between the Water Users' Association and individual owners of land, sufficient in number to assure the return of the money expended by the Government, must be executed.

The area to be irrigated under this project is estimated to embrace about 12,000 acres, and the cost will probably be about $250,000.

Urton project.—This project is on the Pecos River, in eastern New Mexico, about 60 miles north of Roswell, near old Fort Sumner. It contemplates the diversion of waters from the Pecos by means of a dam and a canal about 35 miles long, storing the flood waters in a large natural basin or reservoir, provided with an outlet tunnel and distributing canals. The irrigable lands are nearly all in public ownership, and are excellent in quality, the center of the tract being about 100 miles from Santa Rosa, on the Rock Island Railway, and 25 miles from Kenna, on the Southeastern, a branch of the Santa Fe system. Work was begun on this project in May, 1903. The inlet canal was definitely located and test pits were dug along its entire length. The district susceptible of irrigation was surveyed topographically. The feature of this project in greatest doubt at present is the water supply, and river gagings and daily gage-height records to determine the amount of water available are being made. Borings to determine the cost and the stability of the proposed structures will be carried on during the coming fall and winter, when drilling operations in the Northern States must be suspended, and the plans and estimates for the project will then be completed. Under this project 60,000 acres can be reclaimed, the cost being estimated at $1,000,000.

Las Vegas project.—It is proposed under this project to conduct water from the Gallinas and Sapello rivers to a point about 5 miles north of the town of Las Vegas and there impound it by means of a dam constructed across a narrow point in an arroya. The regular flow of these streams has been appropriated and it is contemplated to store their flood waters, coming from the high mountains to the west, which are claimed to be large in amount. Gaging stations have been established on both streams to determine the amount of the available supply. A topographic map is now being made of the reservoir sites and the land susceptible of irrigation, and legal matters pertaining to the transfer of lands are being investigated by the representatives of the Las Vegas grant. The topographic work will be completed and plans and estimates prepared, and borings to determine the underlying strata within the reservoir sites and at points of proposed structures will be made as soon as drilling machinery is available. In the meantime the investigations of the water supply will continue.

Rio Grande project.—Under this project it is proposed to store flood waters of the Rio Grande at some point in New Mexico for the development of the open valleys along the course of the river. Surveys already made show that water may be held at a number of localities along the stream, notably at Mesilla Valley and above El Paso. In August, 1903, a survey of the Elephant Butte reservoir site and of the dam site was completed; a survey of the irrigable lands was begun and continued through Mesilla Valley to El Paso, Tex. Borings for this dam site were carried on, and borings at Fort Selden, N. Mex., for a diverting dam, have also been begun. Owing to the shorter season available for field work in the Northern States, work on this project was suspended during the summer season, but it will be resumed in the fall.

Reconnaissance surveys.—In April, 1904, the Canadian watershed was visited by Mr. Frank S. Dobson, engineering aid, and a reconnaissance is being made from Springer, N. Mex., to the Texas line. Preliminary investigations will be continued in this region.

Silt investigations.—Owing to the long-continued drought in New Mexico the McMillan storage reservoir of the Texas Irrigation Company, situated 15 miles north of Carlsbad, N. Mex., was nearly empty on June 1, 1904, thus offering an unusual opportunity to study the accumulation of silt in reservoirs in New Mexico, where the silt problem is of great importance. An investigation was therefore begun on June 1 to determine the amount of silt filling in the McMillan reservoir. It is expected that this investigation will be productive of valuable results, which will throw light on similar conditions in the Pecos River region, where reclamation possibilities are under investigation.

NORTH DAKOTA.

The reclamation work in North Dakota has been conducted under the general supervision of Mr. Charles H. Fitch. As the result of an examination of this State for reclamation possibilities attention has been concentrated on land in the extreme western portion of the State. A general field study has been made of the occurrence of lignite and the possibility of using this material as fuel for pumping engines. Stream measurements have been made by Mr. E. F. Chandler, assistant engineer.

Fort Buford project.—The Fort Buford project involves the reclamation of land on the west bank of the Yellowstone River, with a proposed canal heading about 20 miles below Glendive. The survey begun in 1903 resulted in the location of the proposed high-line canal, to run for 82 miles and cover about 66,000 acres of land in Montana and northern Dakota. Topographic maps of the strip of country along this canal were completed, and a preliminary location of the canal line was plotted on these maps. The high-line canal, however, on further examination by the board of consulting engineers, was not found to be entirely satisfactory, and the location of what is known as the low-line canal, heading about 20 miles below Glendive, was undertaken. This line is being run with a fall less than that of the high-line canal, and will probably cover between 40,000 and 50,000 acres. Active work on the new location is in progress. Mr. F. E. Weymouth, engineer, has been in immediate charge of this project, and has been assisted by Messrs. E. C. Bebb, J. N. Kerr, C. K. Hosford, and Paul McGeehan, assistant engineers; Mr. H. S. Morse, aid, and others. Stream measurements have been made by Mr. E. F. Chandler, assistant engineer.

Mouse River project.—An investigation is being made under the charge of Mr. James A. French, assistant engineer, to determine the possibilities of irrigation along the Mouse River, which heads in Canada near Qu'Appelle and enters North Dakota near the one hundred and second meridian. Along its course in this State it enters the basin of the old glacial Lake Souris, and, turning northward, reenters Canada a few miles east of the one hundred and first meridian. Its valley in North Dakota is about 180 miles long. In its southerly course the river runs through a flat valley flanked by hills, which disappear as it enters Lake Souris and turns northward. The district within this bend is cut by the Great Northern Railway and is bisected by branch lines of the same road. As the location seems to offer excellent opportunities for reclamation, investigations are being pushed to determine the feasibility of irrigation.

OKLAHOMA.

Investigations for the location of irrigation projects in this Territory are in charge of Mr. Gerard H. Matthes, with headquarters at Lawton. Attention was particularly given to the opportunities for water storage in the country east of the Wichita Mountains and in Beaver County, the work being executed by Mr. Ferdinand Bonstedt, engineer. Various reservoir sites were surveyed and water supply and storage facilities examined along numerous streams. Search was also continued for possible reservoir sites and for opportunities for the development of surface and underground waters.

OREGON.

Mr. John T. Whistler, district engineer, with headquarters at Pendleton, was in charge of reclamation investigations in Oregon. He was assisted by Messrs. H. D. Newell, J. S. Voorhees, J. G. Camp, W. C. Sawyer, J. H. Lewis, and E. I. Davis, assistant engineers; L. D. Brainerd and H. S. Williams, aids, and others. As the result of reconnaissance surveys certain definite projects were selected for further examination on the Umatilla and Malheur rivers and in Harney County. In October, 1903, a reconnaissance was also made in Lake and Klamath counties.

Umatilla project.—In the north-central part of Oregon, near the Columbia River and west of the Umatilla, its tributary, is an area of rolling bench lands lying at an elevation of 300 to 600 feet above sea level. Most of this land is unpatented and has been withdrawn, pending surveys, from all except homestead entry. The Umatilla project proposes to reclaim approximately 60,000 acres.

An attempt was first made to ascertain the possibility of diverting the waters of the Snake River, near Riparia, Wash., for use in this district, but the line of levels run by Mr. J. G. Camp showed that this was impracticable. It, however, developed the fact that waters from the Umatilla River could be used and impounded in a shallow reservoir site. Examinations and surveys of this and other reservoir sites on the upper waters of the Umatilla were made, and the discharge of the river was obtained by means of a number of gaging stations established along its course. It next became necessary to determine the nature of the material underlying the reservoir sites, embankment line, and canal line. This work was undertaken at the suggestion of the board of consulting engineers.

Additional reservoir sites will also be sought for on the headwaters of the stream.

Malheur project.—This project contemplates the reclamation of lands of the Malheur Valley from above the town of Vale to the Snake River. The irrigable tract includes about 45,000 acres of bench lands and an equal amount of bottom lands, lying on both sides of the Malheur River. Reservoir sites of sufficient capacity to retain all of the flood waters of the stream in ordinary years were found, and other reservoir sites on tributaries of the Malheur are under consideration. At the close of the year these sites had all been surveyed and mapped, and surveys of over 70 miles of canal line had been completed. The water supply has been studied and the records of discharge measurements for the last five years have been compared. To obtain topographic control of the irrigable lands under this project, triangulation and leveling have been carried on, and the topographic work will be rapidly pushed.

Harney project.—The Harney Valley, in the east-central part of the State and north of Malheur Lake, appears to offer an opportunity for successful irrigation. The valley has an area of 700 square miles and an altitude of approximately 4,000 feet. Land in the vicinity of the two shallow lakes, Harney and Malheur, which occupy the center of the valley, is as a rule level. Into this valley the Silvies River flows from the north, inundating vast areas in the spring; in the summer season the stream becomes small. Approximately one-half of the flood water entering the valley can be stored at small cost in a reservoir site about 20 miles north of Harney Valley, known as Silvies Valley.

During the season of 1903 the reservoir site at Silvies Valley was mapped, as was also about 350 square miles of irrigable land in Harney Valley. It was found that 40,000 acres can be reclaimed at a cost not to exceed $20 per acre.

Klamath project.—The possibilities of reclamation from Klamath River are being investigated, and gaging stations are being established in Klamath County for the determination of the water supply from this stream. Preliminary investigations are also under way, or have been completed, in Baker, Wallowa, Union, and Lake counties, and it appears desirable to continue these investigations by making a study of the use of appropriated water and the water supply available from Powder, Walla Walla, Grande Ronde, Sprague, Klamath, and Lost rivers and Silver Creek.

SOUTH DAKOTA.

In this State attention was given particularly to reclamation possibilities west of the Missouri River. The work is in charge of Mr. Charles H. Fitch, supervising engineer, assisted by Mr. Raymond F. Walter, engineer; Mr. Thomas B. White, assistant engineer; Messrs. O. L. Bridgham, F. C. Magruder, A. P. Morris, F. M. Madden, and J. T. Swan, aids, and others, with headquarters at Belle Fourche. Any reclamation attempted on the streams of this region must be founded on storm water of spring and winter flow. With this in view the country around the Black Hills has been carefully investigated for storage possibilities, and the north side has been selected as the most promising. Here the Belle Fourche project has been located and has received the principal attention of the engineers in the State.

Belle Fourche project.—This project involves the reclamation of land northeast of the Black Hills, in Butte and Meade counties, by the diversion of water from the Belle Fourche and Redwater rivers into basins near the town of Belle Fourche. These basins are to be converted into storage reservoirs by damming the outlets. From the reservoirs the water will be distributed to lands in the valley on both sides of the Belle Fourche River, where between 60,000 and 100,000 acres may be reclaimed, depending upon the available water supply. In connection with this project canal lines to reservoir sites and elsewhere were located and the reservoir sites were topographically mapped. Maps and plans were prepared of all structures in connection with the project, showing the reservoir sites, canal lines, and irrigable areas, and preliminary estimates of cost were made. A careful estimate of the water supply was obtained from previous measurements, the organization of the landowners was begun and the project was favorably passed upon by the board of consulting engineers. Detailed surveys are now being made of all dam sites, main canals, and laterals, and borings are being carried on for foundations of masonry structures. In addition to this work, investigations are on foot to determine additional storage facilities on the headwaters of the tributary streams, in order that the available water supply may be increased to the greatest extent.

Other projects in the Black Hills region.—In addition to the Belle Fourche project there are a number of other projects in the Black Hills district which are receiving attention with reference to future reclamation, particularly those on Rapid Creek and the Little Missouri River, where preliminary surveys have been made and the water supply is being investigated. New work is also being taken up on the Grand, Moreau, and White rivers.

UTAH.

Mr. G. L. Swendsen, engineer in general charge of operations in this State, gave particular attention during the last year to the development of surveys to determine the feasibility of the Utah Lake and Bear Lake projects. He has been assisted by Mr. W. T. Turner, topographer; Mr. A. H. Horton, engineer; Messrs. W. P. Hardesty, E. F. Tabor, Caleb Tanner, and W. D. Beers, assistant engineers; L. L. Hunter, H. S. Kleinschmidt, W. T. Carpenter, and A. I. Stiles, aids, and others.

Utah Lake project.—Work on this project was commenced in the last fiscal year and was continued during the present year. Several parties were in the field, engaged in topographic surveys of the shore line of Utah Lake and the Jordan River, in examining materials and conditions that will be encountered in the construction through the lake, in making reconnaissance to determine the possibilities for the extension of irrigated areas, and in detailed studies of hydrographic conditions.

This work will be continued, and a reconnaissance of the possibilities for diversion from Duchesne branches of the Utah Lake basin will be made. Preliminary steps have been taken to form an association of those who will use water under the project.

Bear Lake project.—This project contemplates the use of water from various streams in northwestern Utah in connection with Bear Lake as a possible reservoir for the reclamation of lands in the Jordan Valley. Surveys have been in progress for some months, and a thorough study of the water supply of the region has been carried on. Particular difficulty has been found in locating suitable points for the diversion of water, surveys to determine which are still in progress. In connection with this project, reconnaissance of storage possibilities on branches of the Bear in Cache Valley and an examination of possibilities relative to the use of the Bear River in Cache, Weber, Boxelder, and Salt Lake counties are being carried on.

Other reconnaissances.—In addition to the projects above named, reconnaissance surveys were carried on in other parts of the State to determine irrigation possibilities. In particular a general examination was made of the country lying east of the Wasatch Mountains and near the headwaters of the Price River. In eastern Utah, on the Uinta Indian Reservation, Mr. H. S. Reed made systematic measurements of the river flow and a general study of the opportunities for future reclamation in view of the possibility that these lands may be opened for settlement at an early date.

WASHINGTON.

In the State of Washington the reclamation work has been carried on under the charge of Mr. T. A. Noble, district engineer, assisted by Mr. Christian Andersen, engineer; Messrs. W. W. Schlecht, R. W. Hawley, G. H. Bliss, L. J. Charles, C. E. Hewitt, and W. G. Steward, assistant engineers; C. C. Fisher, Calvin Casteel, C. B. Cox, G. F. Harley, and Olaf Saurgaard, aids, and others. Work has been directed in particular to the Big Bend, Palouse, and Okanogan projects, these having been found to be the most feasible after a preliminary investigation of various suggested projects. Of these projects, that portion of the Big Bend area which can be irrigated from the Palouse River, designated the Palouse project, has received the most attention.

Big Bend project.—This project involves the irrigation of a large body of land in eastern Washington, bounded by the Columbia River on the west, the Snake River on the south, and the high wheat lands of the Palouse River on the north and east. The preliminary surveys show that the estimated cost of diverting sufficient water to irrigate this large area is so great that a careful and complete classification of all the irrigable lands and a study of the distribution system for irrigating them are necessary to determine whether there is sufficient land which can be irrigated to make the project feasible. This work will be carried on during the present season.

Palouse River project.—As has already been stated, work is being concentrated upon the Palouse River project for the irrigation of about 100,000 acres of land from that river. Preliminary surveys show this project to be worthy of a thorough investigation, and work to determine these facts is in progress. Several parties are at work surveying the irrigable lands, reservoir sites, canal lines, and dam sites, and it is believed that this work will be finished during the present season.

Okanogan project.—The irrigable lands now within the Okanogan project are on the west side of the Okanogan River, in the northern part of the State. They lie at an altitude of about 1,200 feet. Cultivation by irrigation under private enterprise has already commenced in this region, but urgent requests from the citizens of Okanogan County for the examination of the project have been followed by investigations by the reclamation service. During the last season two dam sites and reservoir sites were surveyed and about 30,000 acres of irrigable land were mapped. This work is being continued, and will probably be finished before fall, when the project will be ready for inspection by the board of consulting engineers.

Reconnaissances.—A number of other investigations to determine irrigation possibilities in Washington were undertaken within the year. One of these was an examination of the water supply of the Yakima Valley, to determine the amount of water appropriated, the amount of unirrigated land available, and other conditions affecting the feasibility of a Government irrigation project in this district. Work was commenced early in the spring of 1904 and will be carried on during the field season.

Priest Rapids pumping plant.—In the fall of 1903 a report was submitted to the Secretary of the Interior on the cost and feasibility of irrigating 73,000 acres of land on the left bank of the Columbia River near Priest Rapids. A preliminary reconnaissance was made of these lands and the general feasibility of the proposed plan was examined. As the plan seems feasible and the lands in question are of excellent quality, it is proposed to make a more systematic investigation of the best design and the cost of pumping machinery, and the nature and cost of headworks and a main diverting canal. This work will require a certain amount of topographic mapping along the main canal line and the sinking of test pits to determine the nature of excavation.

WYOMING.

Mr. Jeremiah Ahern, district engineer, is in charge of irrigation operations in the northern portion of this State, while investigations in the southern portion are being conducted by Mr. John E. Field, district engineer. Mr. Ahern has been assisted by Messrs. E. S. Ela, H. R. Evans, H. T. Paterson, G. E. Stratton, and W. E. Young, assistant engineers; H. J. Saunders and M. H. Brinkley, aids, and others. Investigations in the northern portion of the State have resulted in the concentration of work upon two main projects, the Shoshone and the Lake De Smet.

Shoshone project.—This project contemplates the utilization of a portion of the surplus water of the Shoshone River for the reclamation of land in the northern part of Bighorn County. The Shoshone River receives its waters from the high mountains adjacent to and east of the Yellowstone National Park, some of the tributaries rising within the eastern boundary of the Park. The river just below the junction of its north and south forks enters a canyon in which a good reservoir site has been found. A topographic map was made of this site, and also of about 200 square miles of irrigable land which it was thought possible to reclaim. A conduit in the canal, and canal lines covering the largest area of land that it is feasible to irrigate, were located and plans for a dam and headworks at the head of the canyon were made. These plans were passed upon by a board of consulting engineers in February, 1904, and $2,250,000 were set aside by the Secretary of the Interior for the construction of the project, should further work prove to be feasible. Sixty thousand acres of land included under this project, which had been segregated by the State under the provisions of the Carey Act, were released by the State and became available under the reclamation act. The right to appropriate water from the Shoshone River for this tract was also transferred by Col W. F. Cody to the Secretary of the Interior. The canal lines as located cover 103,000 acres, of which 93,000 acres are irrigable. By extending the main canal through the bad lands below Carlsbad it is estimated that 40,000 to 50,000 acres additional in the vicinity of Frannie may be reclaimed. There are also several thousand acres of irrigable land in the drainage basin of Clark Fork that may be reclaimed. The total area will probably exceed 150,000 acres. This land lies at an elevation of between 4,000 and 5,000 feet.

Early in the present year a board of consulting engineers consisting of Messrs. H. N. Savage and W. H. Sanders examined the preliminary plans on the ground and recommended that the construction of the project be begun at an early date, provided borings at the dam site show that the foundation is satisfactory. Work has been begun on structures preliminary to the building of the main dam, such as a wagon road into the canyon for the transportation of materials, a telephone line from Cody to the dam site, etc.

De Smet project.—Lake De Smet is a natural basin in Johnson County, east of the Bighorn Mountains. It has no visible outlet and seems to be maintained by inflow from a small catchment area. It is proposed to increase its inflow by the diversion of flood and unappropriated waters of Piney Creek through a canal 4 miles in length. Water thus stored in Lake De Smet may be taken out by canals heading at either end of the lake for the reclamation of approximately 3,000 acres of land along Clear Creek in the vicinity of Clearmont, and also along Prairie Dog Creek east of Sheridan, or all of the stored water may be used in reclaiming land along the lower stretches of Clear Creek and along the Powder River.

Preliminary surveys of this project were carried on in 1902 and plans and estimates of the probable cost were made. The question of greatest importance at present in connection with this project is that of water supply, and investigations are being carried on to determine its availability.

Wind River or Shoshone Indian Reservation.—No investigations have been made on the upper Bighorn River or the Wind River, its most important tributary, which heads in the Wind River Range in west-central Wyoming and carries considerable water. During the present season it is proposed to make a reconnaissance of this river, including the Bighorn River and its principal tributaries. The work will be under the charge of Mr. Goyne Drummond.

POWER DEVELOPMENT AND PUMPING.

In connection with many projects power development is contemplated. The power would usually be developed at the outlet from storage reservoirs, at diversion dams, or at drops in main canals, and transmitted electrically to pumping areas, where it could be utilized for supplying water for additional irrigation, sometimes by pumping from wells, sometimes from streams or low-line canals to high-line canals or storage reservoirs, for distribution to lands difficult to supply by gravity systems, and sometimes by pumping return or seepage water for the purpose of draining lands liable to be flooded or of returning the seepage water to lands to be irrigated.

Some projects are under investigation which depend wholly upon pumping the water for irrigation. One class of these projects contemplates developing power wherever natural water-power sites can be found in the vicinity of the proposed project, and utilizing the power to pump irrigating water to lands too high to be economically reached by gravity systems of canals. Another class contemplates installing steam power plants where cheap fuel in the form of coal or oil can be found, and pumping water from large systems of wells sunk in areas where the underground supply of water is abundant and reliable, or from storage reservoirs too low to supply lands by gravity systems. The power and pumping plants can sometimes be combined, but often the power will have to be electrically transmitted considerable distances.

Temporary power plants can often be erected, during or prior to construction of the permanent works, for furnishing power cheaply for the work of construction, thus effecting an appreciable saving of the first cost of the permanent works.

The study of power development and pumping features of the several projects is under the direction of Mr. H. A. Storrs, electrical engineer, Denver, Colo. His work consists of investigating the power and pumping possibilities, designing and estimating costs of power plants, transmission systems, wells and pumping plants, fuel supplies, etc. He has been assisted by Messrs. T. F. J. Maguire, P. M. Churchill, C. R. Steiner, C. P. Williams, and others.

PUBLICATION BRANCH.

Editorial Division.

TEXTS.

The textual section of the editorial division remained during the year in charge of Mr. Philip C. Warman. He was assisted by Messrs. George M. Wood, Laurence F. Schmeckebier, and Alfred C. Cosdon throughout the year; Mr. Ernest F. Burchard until April 1, when he was transferred to the section of geologic maps; Mr. Crittenden Marriott, after April 18; Mr. Allen H. Hughey, after May 31, and Mrs. Annie B. Wood, after April 13, under a temporary appointment. Mr. William

Taylor Thom, editorial clerk, is assigned to the division of mining and mineral resources, and does the principal part of the editorial work and the proof reading for the annual volume on mineral resources; and Mrs. Harriet Connor Brown, editorial clerk, devotes a large part of her time to the preparation of press bulletins, whereby authentic information concerning the work of the Survey is given to the people of the country.

The following tables exhibit the character and amount of the work:

Manuscripts edited during the year 1903–4.

Publication.	Pages (usually typewritten).
Twenty-fourth Annual Report	450
Second Annual Report of the Reclamation Service	991
Monograph XLVII	1,985
Professional Paper No. 20	215
Professional Paper No. 21	434
Professional Paper No. 22	160
Professional Paper No. 23	123
Professional Paper No. 24	228
Professional Paper No. 25	167
Professional Paper No. 26	456
Professional Paper No. 27	224
Professional Paper No. 28	61
Professional Paper No. 29	260
Professional Paper No. 30	118
Professional Paper No. 31	238
Professional Paper No. 32	989
Professional Paper No. 33	74
Professional Paper No. 34	156
Professional Paper No. 35	205
Professional Paper No. 37	628
Bulletin No. 219	58
Bulletin No. 220	254
Bulletin No. 221	410
Bulletin No. 222	329
Bulletin No. 223	227
Bulletin No. 224	130
Bulletin No. 225	937
Bulletin No. 226	140
Bulletin No. 227	311

Manuscripts edited during the year 1903–4—Continued.

Publication.	Pages (usually typewritten).
Bulletin No. 228	445
Bulletin No. 229	76
Bulletin No. 230	23
Bulletin No. 231	145
Bulletin No. 232	735
Bulletin No. 233	446
Bulletin No. 234	307
Bulletin No. 235	253
Bulletin No. 236	49
Bulletin No. 237	341
Bulletin No. 238	195
Bulletin No. 239	260
Bulletin No. 240	425
Bulletin No. 241	46
Bulletin No. 242	75
Bulletin No. 244	260
Bulletin No. 250	85
Bulletin No. —— (Dale: Taconic physiography)	70
Bulletin No. —— (Bagg)	76
Water-Supply Paper No. 89	122
Water-Supply Paper No. 90	68
Water-Supply Paper No. 91	178
Water-Supply Paper No. 92	61
Water-Supply Paper No. 93	769
Water-Supply Paper No. 94	99
Water-Supply Paper No. 95	139
Water-Supply Paper No. 96	124
Water-Supply Paper No. 97	945
Water-Supply Paper No. 98	682
Water-Supply Paper No. 99	932
Water-Supply Paper No. 100	1,052
Water-Supply Paper No. 101	144
Water-Supply Paper No. 102	862
Water-Supply Paper No. 103	214
Water-Supply Paper No. 104	106
Water-Supply Paper No. 105	136
Water-Supply Paper No. 106	111
Water-Supply Paper No. 107	313
Water-Supply Paper No. 108	121
Water-Supply Paper No. 109	319

Manuscripts edited during the year 1903–4—Continued.

Publication.	Pages (usually typewritten).
Water-Supply Paper No. 110	317
Water-Supply Paper No. 112	66
Water-Supply Paper No. 113	84
Water-Supply Paper No. 116	134
Geologic Folio No. 97	93
Geologic Folio No. 98	119
Geologic Folio No. 99	92
Geologic Folio No. 100	82
Geologic Folio No. 101	159
Geologic Folio No. 103	72
Geologic Folio No. 104	90
Geologic Folio No. 105	115
Geologic Folio No. 106	149
Geologic Folio No. 107	104
Geologic Folio No. 108	117
Geologic Folio No. 109	85
Geologic Folio No. 110	176
Geologic Folio No. 111	188
Mineral Resources for 1902 (in part)	1,573
Mineral Resources for 1903 (in part)	52
Field assignments for 1904	100
Report of gold deposits in Wichita Mountains (Bain)	24
Revision of "Explanation" on folio cover	19
Press bulletins	632
Total number of manuscript pages edited	27,409

Proof sheets read and corrected during the year 1903–4.

Publication.	Final printed pages.
Twenty-fourth Annual Report	330
Second Annual Report of the Reclamation Service	609
Monograph XLVI	560
Monograph XLVII	1,288
Professional Paper No. 15	85
Professional Paper No. 17	116
Professional Paper No. 18	110
Professional Paper No. 19	112
Professional Paper No. 20	160
Professional Paper No. 21	202

Proof sheets read and corrected during the year 1903–4—Continued.

Publication.	Final printed pages.
Professional Paper No. 22	105
Professional Paper No. 23	70
Professional Paper No. 24	150
Professional Paper No. 25	113
Professional Paper No. 26	245
Professional Paper No. 27	140
Professional Paper No. 28	71
Professional Paper No. 31	108
Bulletin No. 216	226
Bulletin No. 217	104
Bulletin No. 218	81
Bulletin No. 219	36
Bulletin No. 220	123
Bulletin No. 221	203
Bulletin No. 222	211
Bulletin No. 223	154
Bulletin No. 224	188
Bulletin No. 225	532
Bulletin No. 226	204
Bulletin No. 227	218
Bulletin No. 228	380
Bulletin No. 229	72
Bulletin No. 230	19
Bulletin No. 231	88
Bulletin No. 232	162
Water-Supply Paper No. 84	206
Water-Supply Paper No. 85	256
Water-Supply Paper No. 86	84
Water-Supply Paper No. 87	270
Water-Supply Paper No. 88	77
Water-Supply Paper No. 89	110
Water-Supply Paper No. 90	77
Water-Supply Paper No. 91	136
Water-Supply Paper No. 92	61
Water-Supply Paper No. 93	366
Water-Supply Paper No. 94	85
Water-Supply Paper No. 95	180
Water-Supply Paper No. 96	100
Water-Supply Paper No. 104	81
Geologic Folio No. 93	11
Geologic Folio No. 94	23

Proof sheets read and corrected during the year 1903–4—Continued.

Publication.	Final printed pages.
Geologic Folio No. 95	12
Geologic Folio No. 96	6
Geologic Folio No. 97	6
Geologic Folio No. 98	9
Geologic Folio No. 99	7
Geologic Folio No. 100	6
Geologic Folio No. 101	14
Geologic Folio No. 102	10
Geologic Folio No. 103	5
Geologic Folio No. 104	6
Geologic Folio No. 105	14
Geologic Folio No. 106	11
Geologic Folio No. 107	9
Geologic Folio No. 108	9
Geologic Folio No. 109	6
Mineral Resources for 1902 (in part; some chapters abridged in making up volume)	1,415
"Explanation" for folio cover	2
Field assignments for 1904	107
Press bulletins	146
Total number of pages of proof (including plates) read and corrected	11,498

The reading of the proof sheets of the publications tabulated above required the handling of 5,145 galleys and 23,410 page proofs.

Indexes prepared during the year 1903–4.

Publication.	Pages indexed.
Twenty-fourth Annual Report	302
Second Annual Report of the Reclamation Service	540
Monograph XLVI	513
Monograph XLVII	1,275
Professional Paper No. 15	71
Professional Paper No. 16	546
Professional Paper No. 17	69
Professional Paper No. 18	98
Professional Paper No. 19	101
Professional Paper No. 20	139
Professional Paper No. 21	168
Professional Paper No. 22	95

Indexes prepared during the year 1903–4—Continued.

Publication.	Pages indexed.
Professional Paper No. 23	62
Professional Paper No. 24	118
Professional Paper No. 25	107
Professional Paper No. 26	222
Professional Paper No. 27	122
Professional Paper No. 28	66
Professional Paper No. 31	97
Bulletin No. 214	284
Bulletin No. 215	234
Bulletin No. 216	222
Bulletin No. 217	83
Bulletin No. 218	71
Bulletin No. 219	31
Bulletin No. 220	119
Bulletin No. 221	200
Bulletin No. 222	208
Bulletin No. 223	129
Bulletin No. 225	527
Bulletin No. 226	145
Bulletin No. 227	205
Bulletin No. 228	375
Bulletin No. 229	61
Water-Supply Paper No. 84	200
Water-Supply Paper No. 85	250
Water-Supply Paper No. 86	62
Water-Supply Paper No. 87	238
Water-Supply Paper No. 88	56
Water-Supply Paper No. 89	91
Water-Supply Paper No. 90	47
Water-Supply Paper No. 91	130
Water-Supply Paper No. 92	48
Water-Supply Paper No. 93	361
Water-Supply Paper No. 94	76
Water-Supply Paper No. 95	169
Water-Supply Paper No. 96	81
Mineral Resources for 1902	1,038
Total number of pages indexed	10,452

The copy and proofs of all account and record books and blanks, circulars, office cards, etc., are examined in this section.

This work consumes a large part of the time of one person, but it is not practicable to report the amount statistically.

The increase in the literary output of the Survey corps during the last few months is worthy of remark. Comparison of totals shows that there was about 30 per cent more manuscript prepared for the printer this year than last year, and at the close of the year there were still in this section eleven papers awaiting preparation.

GEOLOGIC MAPS.

Mr. George W. Stose, geologist, continued in charge of this section and was assisted throughout the year by Messrs. O. A. Ljungstedt and H. S. Selden and Miss Ida C. Rogers, draftsmen, and after April 1 by Mr. Ernest F. Burchard, geologic aid.

Mr. Stose devoted his time chiefly to editing maps and sections for geologic folios and superintending the work of the section. He served also on the committee on illustrations and the committee on map editing and printing, and as secretary of the committee on geologic names. The exhibit of geologic maps for the Louisiana Purchase Exposition at St. Louis, including the compilation of a geologic wall map of the United States, was prepared largely by him. He spent a small portion of his time in field work in southern Pennsylvania and in preparing the results for publication, the details of which are included in this report under "Geology."

Mr. Ljungstedt continued to have immediate charge of the proof reading and drafting performed by Mr. Selden, Miss Rogers, and himself, and had charge of the section while Mr. Stose was in the field. Mr. Burchard was detailed to this section on April 1, and assisted chiefly in editing geologic maps and texts for folio publication and in revising proof sheets. He also spent some time in office work on notes and maps of the Yellville folio in connection with a description of the lead and zinc deposits in northern Arkansas, in which field he had previously been employed.

On July 1, 1903, active work was in progress on 16 folios, and 5 were in preparation for engraving. Within the year 26 additional folios were transmitted to the section, 2 of which, however, were withdrawn for further work. Seventeen folios, Nos. 93 to 109, inclusive, listed in the following table, were completed and issued:

Geologic folios issued during the fiscal year ending June 30, 1904.

No.	Name of folio.	State.	Limiting meridians.	Limiting parallels.	Area.	Price.
93	Elkland-Tioga	Pennsylvania	77°–77°30′	41°45′–42°	445	0.25
94	Brownsville-Connellsville	do	79°30′–80°	40°–40°15′	457	25
95	Columbia	Tennessee	87°–87°30′	35°30′–36°	969	25
96	Olivet	South Dakota	97°30′–98°	43°–43°30′	871	25
97	Parker	do	97°–97°30′	43°–43°30′	871	25
98	Tishomingo	Indian Territory	96°30′–97°	34°–34°30′	986	25
99	Mitchell	South Dakota	98°–98°30′	43°30′–44°	864	25
100	Alexandria	do	97°30′–98°	43°30′–44°	864	25
101	San Luis	California	120°30′–121°	35°–35°30′	975	25
102	Indiana	Pennsylvania	79°–79°15′	40°30′–40°45′	227	25
103	Nampa	Idaho Oregon	116°30′–117°	43°30′–44°	864	25
104	Silver City	Idaho	116°30′–117°	43°–43°30′	871	25
105	Patoka	Indiana Illinois	87°30′–88°	38°–38°30′	938	25
106	Mount Stuart	Washington	120°30′–121°	47°–47°30′	805	25
107	Newcastle	Wyoming	104°–104°30′	43°30′–44°	864	25
108	Edgemont	South Dakota Nebraska	103°30′–104°	43°–43°30′	871	25
109	Cottonwood Falls	Kansas	96°30′–97°	38°–38°30′	938	25

On June 30, 1904, 12 folios were in process of engraving, the Globe (Arizona), Bisbee (Arizona), and Latrobe (Pennsylvania) being nearly completed, and 16 were on file ready for publication. The following tables give the names of these folios and indicate the stage of progress each has attained:

Geologic folios in process of engraving June 30, 1904.

Name.	Stage.
Asheville, N. C.–Tenn	Color stones in preparation.
Bisbee, Ariz	Maps being printed.
Casselton–Fargo, N. Dak.–Minn	Engraving begun.
De Smet, S. Dak	Color stones in preparation.
Fayetteville, Ark.-Mo	Engraving begun.
Franklin Furnace, N. J	Do.
Globe, Ariz	Maps being printed.
Greeneville, Tenn.–N. C	Engraving begun.
Huron, S. Dak	Color stones in preparation.
Kittanning, Pa	Map transferred to stone.
Latrobe, Pa	Maps and sections printed.
Silverton, Colo	Engraving begun.

Geologic folios awaiting engraving June 30, 1904.

Aladdin, Wyo.–S. Dak.–Mont.	Needle Mountains, Colo.
Belair–Havre de Grace, Md.–Pa.	Patuxent, Md.–D. C.
Bradshaw Mountains, Ariz.	Rico, Colo.
Dover, Del.–Md.–N. J.	Rural Valley, Pa.
Elders Ridge, Pa.	Sundance, Wyo.–S. Dak.
Mount Guyot, Tenn.–N. C.	Tahlequah, Ind. T.–Ark.
Mount Mitchell, N. C.–Tenn.	Waynesburg, Pa.
Nantahala, N. C.–Tenn.	Yellville, Ark.–Mo.

TOPOGRAPHIC MAPS.

This section continued in charge of Mr. S. J. Kübel, Mr. James McCormick having direct supervision of the work, assisted by Messrs. H. W. Elmore, J. W. Brashears, H. S. Lewis, and A. N. Gardner.

On July 1, 1903, there were on hand awaiting editorial examination 108 manuscript topographic maps. Group III on page 349 of this report comprises 85 atlas sheets, 19 of which were edited and approved within the year. At the close of the year, therefore, there were on file awaiting editorial examination 66 topographic atlas sheets and special maps. This was little more than half the number on hand at the beginning of the year.

The progress made in the publication of new topographic sheets is shown by the lists on pages 345–350. The first group shows 123 sheets published during the year or in press at its close; the 42 sheets of the second group were in process of engraving and in various stages of progress at the close of the year; the engraving of 9 had been completed and the plate proofs read; the engraving of others was well advanced, while on others work had but just begun. So that this list of 42 represents the number of sheets required to keep the engraving division busy.

The sum of the sheets enumerated in Groups II and III—42 plus 85, or 127—represents the total number of unpublished topographic maps in hand at the close of the year. The corresponding figures a year ago were 48 plus 108, or 156. This shows a reduction during the year of 29 maps. All sheets surveyed prior to 1902 have been published, 41 sheets surveyed in 1902 are yet unpublished, but all are in process of engraving and well advanced. It seems that by the end of the ensuing year the 127 maps now in hand will have been published and the engraving of many resulting from the surveys now in progress will be well advanced.

The work of the proof readers in this section is chiefly represented by the 123 maps enumerated in Group I; in addition they read the proofs of the corrections, more or less extensive, to the 167 maps enumerated in the list entitled "Sheets corrected" (pp. 351–352).

The following list shows the publications for which map illustrations were edited during the year, and their number. The proof reading of these is done in the section of illustrations:

Bulletins Nos. 218, 219, 226, 227, 229, 233, 235, 236, 237, 238	99
Mineral Resources, 1902	1
Monograph XLVIII	6
Professional Papers Nos. 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34	99
Water-Supply and Irrigation Papers Nos. 88, 89, 90, 96, 101, 104, 105, 106, 107, 108,110	95
Total, including profiles and diagrams bearing geographic names	300

The circulars and index maps showing progress of surveys and publication of maps, including the large index map of the United States, were all revised and reissued within the year, some of them more than once.

ILLUSTRATIONS.

The personnel of this section at the beginning of the year consisted of Mr. John L. Ridgway, in charge, assisted by Messrs. H. Chadwick Hunter, H. Hobart Nichols, F. W. von Dachenhausen, Martin Solem, C. A. Weckerly, A. H. Baldwin, H. F. Clarke, L. B. Jay, and Misses Frances Wieser and Mary M. Mitchell. Later in the year the personnel was changed by the prolonged illness of Miss Mitchell and her subsequent transfer to the U. S. National Museum, and by the appointment of Mr. Walter G. Wilmarth on September 14, Miss Mary K. Sumner on November 1, and Mr. R. S. Conrad on February 8. In addition to the persons above mentioned, considerable piecework was given out during the year to Misses Maud Baggett and Marian Page and to Dr. J. C. McConnell, paleontologic draftsmen. This work consisted entirely of drawings of fossil invertebrates.

Mr. Hunter, as in previous years, rendered valuable assistance in the direct supervision of the work in the hands of the various draftsmen. In many instances the preparation of an illustration does not consist merely in the redrawing of a crude or hastily prepared sketch, but requires considerable thought in respect to arrangement, in looking up satisfactory data, and in correcting ambiguities in the original.

Following is a classified list of the illustrations prepared during the year. The total shows an increase over any previous year of more than 46 per cent.

Illustrations prepared during the year 1903–4.

Maps	235
Sections and diagrams	769
Paleontologic drawings	1,891
Photographs retouched	760
Geologic landscapes	12
Miscellaneous	664
Total	4,331

Illustrations to accompany 55 publications were transmitted. The following table shows the processes adopted for their reproduction:

Illustrations transmitted for reproduction during 1903–4 and the processes employed.

Publication.	Chromolithography.	Photolithography.	Half-tone.	Zinc etching.	Wax engraving.	3-color process.	Electrotypes.	Total.
Twenty-fifth Annual Report of Director					25			25
Monograph XLVII	1		25	15	7		18	66
Monograph XLVIII	4		118	9	2			133
Professional Paper No. 20	4		25	4				33
Professional Paper No. 21	8		33	7				48
Professional Paper No. 22	2		10					12
Professional Paper No. 23	2		10					12
Professional Paper No. 24	4		33	6			2	45
Professional Paper No. 25	2			49				51
Professional Paper No. 26	10	1	7	14			4	36
Professional Paper No. 27	4	1	15	6	2		2	30
Professional Paper No. 29	3							3

Illustrations transmitted for reproduction during 1903–4 and the processes employed—Continued.

Publication.	Chromolithography.	Photolithography.	Half-tone.	Zinc etching.	Wax engraving.	3-color process.	Electrotypes.	Total.
Professional Paper No. 30	2	......	......	......	......	......	......	2
Professional Paper No. 31	2	......	10	......	1	......	......	13
Professional Paper No. 32	15	......	52	13	13	2	30	125
Professional Paper No. 33	2	......	18	......	1	......	......	21
Professional Paper No. 34	10	1	8	......	......	......	......	19
Bulletin No. 218	2	......	8	3	......	......	......	13
Bulletin No. 219	......	......	......	......	5	......	......	5
Bulletin No. 223	3	......	22	26	10	......	......	61
Bulletin No. 224	7	......	......	......	......	......	......	7
Bulletin No. 225	......	......	......	8	......	......	1	9
Bulletin No. 226	2	......	......	......	......	......	52	54
Bulletin No. 227	4	......	......	......	4	......	8	16
Bulletin No. 229	1	......	7	6	......	......	1	15
Bulletin No. 234	......	......	......	1	......	......	5	6
Bulletin No. 235	1	......	6	1	......	......	......	8
Bulletin No. 236	2	......	14	4	......	......	......	20
Bulletin No. 237	3	......	8	8	......	......	......	19
Bulletin No. 238	2	......	8	17	1	......	......	28
Bulletin No. 241	......	......	23	13	......	......	......	36
Bulletin No. 242	2	......	5	17	......	......	......	24
Water-Supply Paper No. 89	1	......	19	31	......	......	......	51
Water-Supply Paper No. 90	5	......	2	146	1	......	2	156
Water-Supply Paper No. 91	......	......	......	3	6	......	......	9
Water-Supply Paper No. 92	......	......	......	......	......	......	9	9
Water-Supply Paper No. 94	......	......	2	6	......	......	6	14
Water-Supply Paper No. 95	......	......	3	29	......	......	34	66
Water-Supply Paper No. 96	1	......	18	8	......	......	1	28
Water-Supply Paper No. 97	......	......	......	......	......	......	1	1
Water-Supply Paper No. 98	......	......	......	......	1	......	......	1
Water-Supply Paper No. 99	......	......	......	......	......	......	1	1
Water-Supply Paper No. 100	......	......	......	......	......	......	1	1
Water-Supply Paper No. 101	2	......	10	14	2	......	......	28
Water-Supply Paper No. 104	......	......	3	7	1	......	4	15
Water-Supply Paper No. 105	......	......	20	9	18	......	11	58
Water-Supply Paper No. 106	......	......	......	2	5	......	......	7
Water-Supply Paper No. 107	......	......	13	......	10	......	......	23

Illustrations transmitted for reproduction during 1903–4 and the processes employed—Continued.

Publication.	Chromolithography.	Photolithography.	Half-tone.	Zinc etching.	Wax engraving.	3-color process.	Electrotypes.	Total.
Water-Supply Paper No. 108			8	7				15
Water-Supply Paper No. 109			11		24			35
Water-Supply Paper No. 110			6		30		4	40
Water-Supply Paper No. 111	1							1
Water-Supply Paper No. 112			12		30			42
Water-Supply Paper No. 113			6	4				10
Second Annual Report Reclamation Service			52		93		1	146
Total	114	3	650	493	292	2	198	1,752

At the close of the year illustrations to accompany 28 other reports were in hand; much of the work on these was completed or well under way.

There were received during the year and critically compared, 1,946 proofs of illustrations, and the printed editions of all plate inserts delivered at the Government Printing Office for the publications of the Survey were examined. This examination resulted in the rejection of 13,409 imperfectly printed copies.

PHOTOGRAPHIC LABORATORY.

The photographic laboratory was continued under the direction of Mr. Norman W. Carkhuff, who was assisted by Messrs. John Erbach, Charles A. Ross, Edward F. Wahl, Edgar M. Bane, Ernest A. Shuster, jr., Charles T. Bishop, Harry C. Stansbury, and E. B. Thompson.

The amount of map work performed in this section was about double that of the preceding year. To meet this increase promptly several mechanical devices were designed by the photographer in charge, and when installed permitted great rapidity in the printing of maps and plans without increasing the number of persons employed. In addition, paper negatives are made of each important map. These are filed in the various divisions from whence the original orders come, and if other copies are desired the negative is returned to the laboratory and copies are furnished without the necessity of making another negative in the camera. This greatly reduces the cost of production of these maps. Other experimental work has been completed which will further improve the quality and reduce the cost of photographic copies of maps.

The mechanical devices mentioned have been installed in the Bureau of Forestry after a careful investigation of the Survey laboratory and the methods of handling the work.

On December 27 the major portion of the laboratory was destroyed by fire. Fortunately very few negatives were destroyed, and the large camera was unharmed save by smoke. From December 28, 1903, to February 8, 1904, every man in the section was doing his utmost to get things in shape for work. The regular work of the laboratory was resumed on February 8, the photographer in charge personally superintending a day and night force until April 1, when all back work had been finished and the laboratory was again running normally. Great credit is due the assistants in this section for the willingness with which they performed the large amount of extra work caused by the fire.

In reconstructing the laboratory several changes were made which facilitate work. A photomicrographic apparatus is now being installed. The fire also necessitated the rejacketing of about 30,000 negatives.

About 700 fossil and other specimens were photographed within the year.

As in previous years, several schools made use of the Survey collection of negatives for educational purposes.

Following is a tabulated statement of the work of the laboratory for the year:

Work done in photographic laboratory, 1903–4.

Month.	Negatives.				Slides.	Prints.			
	Wet.	Paper.	Dry.	Total.		Map.	Glossy.	Mat.	Total.
1903.									
July	116	......	391	507	......	663	14	776	1,453
August	134	......	583	717	......	963	1,172	45	2,180
September	93	......	1,165	1,258	21	586	4,104	371	5,061
October	145	54	857	1,056	......	898	2,329	7	3,234
November	160	3	715	878	49	693	1,626	108	2,427
December	201	66	265	532	36	965	887	280	2,132
1904.									
January [a]	(a)	......	......	......	......	......	......	......	......
February	155	52	168	375	......	867	2,429	27	3,323
March	567	482	269	1,318	5	3,212	2,010	716	5,938
April	217	240	34	491	14	2,008	874	14	2,896
May	311	173	223	707	4	1,960	78	1,017	3,055
June	264	191	516	971	27	2,052	672	912	3,636
Total	2,363	1,261	5,186	8,810	156	14,867	16,195	4,273	35,335

[a] Laboratory disabled by fire.

Size.	Negatives.			Prints.
	Glass.	Paper.	Total.	
30 by 42	....	95	95	525
28 by 34	760	426	1,186	4,604
22 by 28	416	280	696	3,047
20 by 24	667	301	968	4,223
14 by 17	235	159	394	2,468
11 by 14	298	....	298	203
8 by 10	44	....	44	665
6½ by 8½	187	....	187	1,647
5 by 7	1,257	....	1,257	5,697
4 by 5	3,685	....	3,685	12,256
Slides	**156*	....	....	....
Total	7,549	1,261	8,810	35,335

*Not included in total.

Division of Engraving and Printing.

This division was continued in charge of Mr. S. J. Kübel, chief engraver, who was occupied in administrative duties pertaining to the editing, engraving, and printing of topographic atlas sheets, geologic folios, and miscellaneous maps and publications, and in the supervision of the work of the instrument shop. The various branches were in charge of the following-named persons: Mr. James McCormick, in charge of editing of maps; Mr. L. P. Daniel, in charge of copperplate engravers and photolithographic branch; Mr. O. Schleichert, foreman of stone engravers; Mr. R. H. Payne, foreman of transferrers; Mr. F. P. Droney, foreman of lithographic presswork; Mr. H. J. Schaefer, foreman of compositors; Mr. O. H. Rynex, in charge of type presswork; Mr. B. H. Cohill, in charge of binding, paper, and map mounting; Mr. Ernest Kübel, mechanician in charge of the instrument shop.

The number of employees remained as last year, 85, consisting of 1 chief engraver, 2 draftsmen, 1 map reviser, 1 clerk, 1 engraver's clerk, 1 stenographer and typewriter, 1 mechanician, 25 copperplate map engravers, 5 lithographic engravers, 45 printers and assistants, 1 skilled laborer, and 1 photolithographer.

The equipment was increased by the purchase of a plate-polishing machine and the application of electric motors to all the moving machinery. For the latter a special appropriation of $6,000 was made by Congress. The total appropriation for the engraving division was $100,000, which was expended as follows: Salaries for the year, $71,000; piecework engraving, $5,600; supplies and maintenance, $23,400.

On July 1, 1903, there were reported on hand, for engraving, manuscript atlas sheets and special maps to the number of 156. One of these (Jamul, Cal.) was withdrawn, leaving 155. During the year 89 new sheets were received from the topographic branch. Two (Litchfield, Conn., and Islip, N. Y.) were made by the reduction of four larger-scale sheets; two others (Boston and vicinity and Cleveland and vicinity) were made by combining atlas sheets or parts of sheets on the same scale; another (Greeneville, Tenn.–N. C.) was extensively revised and reengraved; and a sixth (Dover, Del.–Md.–N. J.), although engraved in 1899, is now published for the first time. This gives a total of 250 atlas sheets and special maps, which are listed below in three groups.

Group I comprises 123 sheets (double sheets counted as one) which were published during the year or were in press at the close of the year, a gain of 20 per cent over last year's output.

Group II comprises 42 sheets which were in process of engraving at the close of the year.

Group III comprises 85 sheets which at the close of the year had not yet been transmitted to the engravers.

It appears, therefore, that at the close of the year there were in hand 127 unpublished atlas sheets and other maps—29 less than last year—and that the engraving of 42 of these was in various stages of progress.

The actual increase of engraving over the preceding year is not shown by these lists. There were in reality 132 atlas sheets or their equivalent engraved during the year, but the results will not appear in the lists of published sheets until next year. As in the year preceding, a limited amount of piecework engraving was done outside of the office. An allotment of $5,600 was made for this purpose, as shown by the statement above.

In addition to the engraving of new atlas sheets, corrections, more or less extensive, were made on the plates of 167 sheets. Editions of 83 sheets were printed after correction, and the names of these are also included in the list of "sheets printed," etc., on pages 353–355. The latter is a list of 233 sheets, editions of which were printed and delivered during the year. Of these, 115 are maps heretofore published, of which 6 (Gadsden, Ala.; Grantsville, Md.-Pa.; Kaaterskill, N. Y.; Masontown, Pa.; Pomona, Cal., and Tolchester, Md.) bear new-edition dates, 109 are reprints, and 118 are new maps.

During the year 16 geologic folios were published. In this number are 10 folios reported partly finished last year. The number now in hand partly completed is 7. On page 356 of this report are two lists giving details and statistics concerning these.

During the year the photolithographic section has grown in importance. On the 1st of February, 1904, Mr. James W. Painter resigned and his place was filled by the temporary appointment of Mr. Andrew H. Linsenmeyer, who later. on

June 1, was regularly appointed, after certification by the Civil Service Commission.

Besides the ordinary work of photolithography and the photo-tracing process for transferring maps to copperplates before engraving, a process for making transferable celluloid prints has been introduced and developed in this section and has proved very useful. By the latter process a map or a portion of a map may be reduced to any desired scale and a negative print made on a sheet of transparent celluloid. This is so prepared that when laid upon a sheet of drawing paper and burnished down a faint print is made upon the paper, like a pencil drawing ready for inking. Superfluous lines may be removed by a rubber eraser. In practice the celluloid sheets and the final drawing may be laid off in corresponding squares and necessary adjustments made.

This process is now generally employed in this office to aid topographers and draftsmen in assembling sections of atlas sheets and special maps from the field sheets to the final drawing and in the compilation of maps. It has entirely superseded the time-consuming methods formerly in use. A transfer which heretofore would have required several days' labor by a topographer or draftsman in tracing line by line is now made in as many hours. The assembling of the field sheets of the Boston map, on the scale of 1:20,000, and of the St. Louis map and the Pittsburg map, each on the scale of 1:22,500. was simplified and expedited by this process; and the preliminary work of revising or recompiling the great map of the United States, now progressing, was facilitated in the same way, requiring the making of hundreds of photographic negatives and celluloid prints. During the year about 2,200 of these prints were made, of different sections of maps.

In the winter and spring months unusual demands were made upon the photolithographic section by the topographic branch for photolithographs of atlas sheets—the so-called "engineering sheets," on the scale of 1:48,000. Engineering sheets to the number of 75 were made and editions of 100 of each were printed The orders for these, as well as the celluloid prints, were all "rush orders," for the topographers must be kept continuously employed, and this required prompt execution of the work and return of the drawings. The facilities were therefore often severely taxed for the time being and sometimes overtaxed.

GROUP I.—*Topographic atlas sheets and other maps engraved and printed or in press during the fiscal year 1903–4.*

Quadrangle and State.	Position of SE. corner.				Contour interval.	Scale.
	Latitude.		Longitude.			
	°	′	°	′	*Feet.*	
Annapolis, Md. [a]	38	45	76	15	20	1:62,500
Ann Arbor, Mich	42	00	83	30	20	1:125,000
Apalachin, N. Y	42	00	76	00	20	1:62,500
Ayden, N. C	35	15	77	15	10	1:62,500
Baltimore, Md. [a]	39	15	76	30	20	1:62,500
Bar Harbor, Me	44	15	68	00	20	1:62,500
Barnesboro, Pa	40	30	78	45	20	1:62,500
Bastrop, Tex. [a]	30	00	97	00	25	1:125,000
Beaver, Pa	40	30	80	15	20	1:62,500
Bellevue, Ohio	41	15	82	45	10	1:62,500
Berne, N. Y	42	30	74	00	20	1:62,500
Binghamton, N. Y	42	00	75	45	20	1:62,500
Blacksville, W. Va.-Pa	39	30	80	00	20	1:62,500
Bluehill, Me	44	15	68	30	20	1:62,500
Boston and vicinity, Mass. [b]					20	1:62,500
Boulder, Colo	40	00	105	15	100	1:62,500
Bowling Green, Ohio	41	15	83	30	10	1:62,500
Brandon, Vt	43	45	73	00	20	1:62,500
Bruceton, W. Va.-Pa	39	30	79	30	20	1:62,500
Cadiz, Ohio	40	15	80	45	20	1:62,500
Cameron, W. Va.-Ohio-Pa	39	45	80	30	20	1:62,500
Carlisle, Pa	40	00	77	00	20	1:62,500
Carthage, N. Y	43	45	75	30	20	1:62,500
Chautauqua, N. Y	42	00	79	15	20	1:62,500
Cherryfield, Me	44	30	67	45	20	1:62,500
Chief Mountain, Mont	48	30	113	30	100	1:125,000
Chiwaukum, Wash	47	30	120	30	100	1:125,000
Cleveland, Ohio	41	15	81	30	20	1:62,500
Curwensville, Pa	40	45	78	30	20	1:62,500
Cuyamaca, Cal	32	30	116	30	100	1:125,000
Deer Isle, Me	44	00	68	30	20	1:62,500

[a] Resurvey. [b] Double sheet.

GROUP I.—*Topographic atlas sheets and other maps engraved and printed or in press during the fiscal year 1903–4*—Continued.

Quadrangle and State.	Position of SE. corner.				Contour interval.	Scale.
	Latitude.		Longitude.			
	°	′	°	′	*Feet.*	
Delaware, Ohio	40	15	83	00	10	1:62, 500
Dover, Del.–Md.–N. J	39	00	75	30	20	1:125, 000
Dublin, Ohio	40	00	83	00	10	1:62, 500
Easthampton, N. Y	40	45	72	00	20	1:62, 500
Ebensburg, Pa	40	15	78	30	20	1:62, 500
Edenton, N. C	36	00	76	30	10	1:62, 500
Elders Ridge, Pa	40	30	79	15	20	1:62, 500
Elmore, Ohio	41	15	83	15	10	1:62, 500
Euclid, Ohio	41	30	81	30	20	1:62, 500
Fairfax, Iowa	41	30	91	30	20	1:125, 000
Findlay, Ohio	41	00	83	30	10	1:62, 500
Fire Island, N. Y	40	30	73	00	20	1:62, 500
Fremont, Ohio	41	15	83	00	10	1:62, 500
Gilboa, N. Y	42	15	74	15	20	1:62, 500
Gloversville, N. Y	43	00	74	15	20	1:62, 500
Goleta Special, Cal					50	1:62, 500
Gravois Mills, Mo	38	15	92	45	20	1:62, 500
Greeneville, Tenn.–N. C.[a]	36	00	82	30	100	1:125, 000
Harford, N. Y	42	15	76	00	20	1:62, 500
Hartford, Wis	43	15	88	15	20	1:62, 500
Hayden Peak, Utah–Wyo	40	30	110	30	100	1:125, 000
Hollidaysburg, Pa	40	15	78	15	20	1:62, 500
Honeoye, N. Y	42	45	77	30	20	1:62, 500
Hueneme, Cal	34	00	119	00	50	1:62, 500
Huntingdon, Pa	40	15	78	00	20	1:62, 500
Indio Special, Cal					100	1:125, 000
Iola, Kans.[b]	37	30	95	00	20	1:125, 000
Islip, N. Y	40	30	73	00	20	1:125, 000
Juneau Special, Alaska					100	1:62, 500
La Jolla, Cal	32	45	117	00	25	1:62, 500
Lancaster, Pa	40	00	76	15	20	1:62, 500
Lassellsville, N. Y	43	00	74	30	20	1:62, 500
Litchfield, Conn.–N. Y	41	30	73	00	40	1:125, 000
Llano, Tex.[b]	30	30	98	30	25	1:125, 000
Margaretville, N. Y	42	00	74	30	20	1:62, 500
Massillon, Ohio	40	45	81	30	20	1:62, 500
Montauk, N. Y	41	00	71	45	20	1:62, 500

[a] Revised and reengraved. [b] Resurvey.

GROUP I.—*Topographic atlas sheets and other maps engraved and printed or in press during the fiscal year 1903–4*—Continued.

Quadrangle and State.	Position of SE. corner.				Contour interval.	Scale.
	Latitude.		Longitude.			
	°	′	°	′	*Feet.*	
Mount Carmel, Ill.–Ind	38	15	87	45	20	1:62,500
Mount Desert, Me	44	15	68	15	20	1:62,500
Mount Pinos, Cal	34	30	119	00	100	1:125,000
Nashville, Tenn	36	00	86	30	50	1:125,000
Newbern, N. C	35	00	77	00	10	1:62,500
North Point, Md	39	00	76	15	20	1:62,500
Oxford, Md	38	30	76	00	10	1:62,500
Palmyra, Mo	39	30	91	30	20	1:125,000
Parkersburg, Ohio–W. Va	39	15	81	30	20	1:62,500
Patoka, Ind.–Ill	38	00	87	30	20	1:125,000
Patton, Pa	40	30	78	30	20	1:62,500
Petit Manan, Me	44	15	67	45	20	1:62,500
Pitcher, N. Y	42	30	75	45	20	1:62,500
Port Washington, Wis. [a]	43	15	87	45	20	1:62,500
Ramona, Cal	33	00	116	30	100	1:125,000
Rapid, S. Dak. [b]	44	00	103	00	50	1:125,000
Republic, Wash	48	30	118	30	100	1:125,000
Riddles, Oreg	42	30	123	00	100	1:125,000
Roan Mountain, Tenn.–N. C. [a]	36	00	82	00	100	1:125,000
Rosendale, N. Y	41	45	74	00	20	1:62,500
Rural Valley, Pa	40	45	79	15	20	1:62,500
St. Louis and vicinity, [a] Ill. [c]–Mo					20	1:62,500
St. Michaels, Md	38	45	76	00	10	1:62,500
San Diego, Cal	32	30	117	00	25	1:62,500
Sandusky, Ohio	41	15	82	30	10	1:62,500
Santa Barbara Special, Cal					50	1:62,500
Santanoni, N. Y	44	00	74	00	20	1:62,500
Santa Paula, Cal	34	15	119	00	50	1:62,500
Saranac, N. Y	44	15	74	00	20	1:62,500
Saypo, Mont	47	30	112	30	100	1:125,000
Scio, Ohio	40	15	81	00	20	1:62,500
Setauket, N. Y	40	45	73	00	20	1:62,500
Sharps Island, Md. [a]	38	30	76	15	10	1:62,500
Siloam Springs, Ind. T.–Ark	36	00	94	30	50	1:125,000
Southern California, Sheet No. 2					250	1:250,000
Springhope, N. C	35	45	78	00	20	1:62,500
Steubenville, Ohio–W. Va.–Penn	40	15	80	30	20	1:62,500

[a] Resurvey. [b] Revised and reengraved. [c] Double sheet.

GROUP I.—*Topographic atlas sheets and other maps engraved and printed or in press during the fiscal year 1903–4*—Continued.

Quadrangle and State.	Position of SE. corner.				Contour interval.	Scale.
	Latitude.		Longitude.			
	°	′	°	′	*Feet.*	
Swan Island, Me	44	00	68	15	20	1:62,500
Terlingua, Tex	29	00	103	30	100	1:125,000
Tonopah mining map, Nev					20	1:12,000
Vadis, W. Va	39	00	80	30	20	1:62,500
Vanceboro, N. C	35	15	77	00	10	1:62,500
Ventura, Cal	34	15	119	15	50	1:62,500
Vermilion, Ohio	41	15	82	15	10	1:62,500
Vinalhaven, Me	44	00	68	45	20	1:62,500
Wahpeton, N. Dak.-Minn	46	00	96	30	20	1:125,000
Waukon, Iowa-Wis	43	00	91	00	20	1:125,000
Wayland, N. Y	42	30	77	30	20	1:62,500
Waynesburg, Pa	39	45	80	00	20	1:62,500
Wellsville, Ohio	40	30	80	30	20	1:62,500
West Bend, Wis	43	15	88	00	20	1:62,500
West Chester, Pa.-Del	39	45	75	30	20	1:62,500
Westerville, Ohio	40	00	82	45	10	1:62,500
Weston, W. Va	39	00	80	15	20	1:62,500
Wooster, Ohio	40	45	81	45	20	1:62,500

Résumé by States.

Alaska	1
Arkansas	1
California	12
Colorado	1
Connecticut	1
Delaware	2
Illinois	3
Indian Territory	1
Indiana	2
Iowa	2
Kansas	1
Maine	8
Maryland	7
Massachusetts	1
Michigan	1
Minnesota	1
Missouri	3
Montana	2
Nevada	1
New Jersey	1
New York	22
North Carolina	7
North Dakota	1
Ohio	17
Oregon	1
Pennsylvania	19
South Dakota	1
Tennessee	3
Texas	3
Utah	1
Vermont	1
Washington	2
West Virginia	7
Wisconsin	4
Wyoming	1
Total	142
Deduction for sheets counted in more than one State	19
Balance	123

GROUP II.—*Topographic atlas sheets and other maps in process of engraving, 1903–4.*

Amity, Pa.
Anson, Me.
Assinniboine, Mont.
Batavia, N. Y.
Berea, Ohio.
Boonville, N. Y.
Caledonia, N. Y.
Chickasha, Ind. T.-Okla.
Chinook, Mont.
Cleveland and vicinity, Ohio.
Columbia, S. C.
Congress, Ariz.
Copake, N. Y.
Coventry, N. Y.
Cripple Creek Special, Colo.[a]
San Antonio, Tex.[b]
Eldon, Mo.
Falkland, N. C.
Greene, N. Y.
Havre, Mont.
Hobart, N. Y.
Kaiser, Cal.
Kaweah, Cal.
Long Lake, N. Y.
Marietta, Ohio-W. Va.
Mount Aix, Wash.
Needles Spec., Cal.-Ariz.
Nepesta, Colo.[a]
Newcastle, Pa.
Niwot, Colo.
Ouray, Colo.
Osoyoos, Wash.
Ovando, Mont.
Philippi, W. Va.
Richmondville, N. Y.
Rocky Mount, N. C.
Sag Harbor, N. Y.
Santa Ynez, Cal.
Skykomish, Wash.
Stehekin, Wash.
Wilson, N. C.
Yantic, Mont.

GROUP III.—*New topographic atlas sheets in hands of editor and not yet transmitted to engravers.*

*Akron, Ohio.
Ashtabula, Ohio.
*Athens, Ohio.
*Belleville, W. Va.-Ohio.
Bonneterre, Mo.
Bingham, Me.
Boquillas, Tex.
Bowdoin, Mont.
Bright Angel, Ariz.
Bully Hill Special, Cal.
Burnsville, W. Va.
Butte Special, Mont.[a]
Calhoun, Ky.
Cartersville Special, Ga.
Central City, Colo.
Chisos Mountains, Tex.
Chocowinity, N. C. (Called Grimesland in 24th Ann. Rept.)
Chopaka, Wash.
Clarington, Ohio.
Clymer, N. Y.
Detroit River, Mich.
Devils Tower, Wyo.-Mont.
*Flushing, Ohio.
*Gardiners Island, N. Y.
Genesee Falls, N. Y.
Georgetown, Colo.
Glenville, W. Va.
Guadalupe, Cal.
*Hamilton, Ohio.
Harlem, Mont.
Harrodsburg, Ky.
Houtzdale, Pa.
Independence, Kans.[a]
Jamestown, N. Y.
*Lake City, Colo.
Laramie, Wyo.[a]
Little Backbone Special, Ariz.
Littleton, W. Va.-Pa.
Macksburg, Ohio.
Manchester, N. H.
Mannington, W. Va.-Pa.
*Marion, Ohio.
Mentor, Ohio.
*Middlebury, Vt.
*Montague, Tex.-Ind. T.
Morganton, N. C.[a]
*Moriches, N. Y.

* Edited and approved. [a] Resurvey. [b] Double sheet.

Newburg, Ind.-Ky.
*New Martinsville, W. Va.-Ohio.
New Matamoras, Ohio.
Nineveh, N. Y.
Nogales, Ariz.
Northville, Mich.
Nunda, N. Y.
Oakesdale, Wash.-Idaho.
Okanogan, Wash.
Orwell, N. Y.
Patagonia, Ariz.
*Perry, Ohio.
Richland Center, Wis.
*Riverhead, N. Y.
Rogersville, Pa.
Saco Special, Mont.
St. Clairsville, Ohio.
St. Onge, S. Dak.
*St. Regis, N. Y.
Salem, W. Va.
Salineville, Ohio.
Santa Maria, Cal.
*Shelter Island, N. Y.
Sherman, Wyo.
*Slide Mountain, N. Y.
Taberg, N. Y.
Tehama, Cal.
Tehipite, Cal.
Trent River, N. C.
Tucson, Ariz.
Vina, Cal.
Wayne Creek, Mont.
Waynesboro, Tenn.-Ala.
Westminster, Md.-Pa.
West Union, W. Va.
Winterville, N. C.
Woodsfield, Ohio.
*Yuma, Cal.

The progress in the publication of maps on the scale of 1:125,000 by the reduction and combination of those originally published on the scale of 1:62,500 is shown in the following table:

Progress in publication of maps on scale of 1:125,000 by reduction and combination.

Name of sheet, scale 1:125,000.	Names of sheets, scale 1:62,500, reduced and combined.	Stage of progress in publication.
Holyoke, Mass.-Conn	Chesterfield, Granville, Northampton, Springfield.	Published prior to July, 1898.
Nomini, Md.-Va	Leonardtown, Montross, Piney Point, Wicomico.	Do.
Housatonic, Mass.-Conn.-N. Y.	Becket, Pittsfield, Sandisfield, Sheffield.	Published during fiscal year 1898-99.
Niagara, N. Y	Lockport, Niagara Falls, Olcott, Tonawanda, Wilson.	Do.
Patuxent, Md.-D. C	Brandywine, East Washington, Owensville, Prince Frederick.	Do.
Raritan, N. J	Hackettstown, High Bridge, Lake Hopatcong, Somerville.	Published during fiscal 1899-1900.
Passaic, N. J.-N. Y	Morristown, Paterson, Plainfield, Staten Island.	Do.
San Luis, Cal	Arroyo Grande, Cayucos, Port Harford, San Luis Obispo.	Do.
Camden, N. J.-Pa.-Del	Chester, Glassboro, Philadelphia, Salem.	Published during fiscal year 1900-1901.
Rancocas, N. J	Hammonton, Mount Holly, Mullica, Pemberton.	Do.

* Edited and approved.

Progress in publication of maps on scale of 1:125,000 by reduction and combination—Continued.

Name of sheet, scale 1:125,000.	Names of sheets, scale 1:62,500, reduced and combined.	Stage of progress in publication.
Taconic, N. Y.-Mass.-Vt.	Bennington, Greylock, Berlin, Hoosick.	Published during fiscal year 1900-1901.
Navesink, N. J.-N. Y ...	New Brunswick, Asbury Park, Cassville, Sandy Hook.	Published during fiscal year 1901-2.
Mattawee, N. Y.-Vt	Fort Ann, Pawlet, Cambridge, Equinox.	Published during fiscal year 1902-3.
Ditney, Ind..............	Petersburg, Velpen, Boonville, Degonia Springs.	Do.
Patoka, Ind.-Ill	Mount Carmel, Princeton, New Harmony, Haubstadt.	Published during fiscal year 1903-4.
Islip, N. Y	Babylon, Fire Island, Northport, Setauket.	Do.
Litchfield, Conn	Cornwall, New Milford, Waterbury, Winsted.	Do.

Topographic sheets corrected during the fiscal year 1903-4.

Aberdeen, S. Dak.
Alpine, Tex.
Amsterdam, N. Y.
Anthracite, Colo.
Arapahoe, Nebr.-Kans.
Arredondo, Fla.
Asheville, N. C.-Tenn.
Baldwinsville, N. Y.
Banner Hill Special, Cal.
Bath, Me.
Beloit, Kans.
Bisbee, Ariz.
Bisbee Spec., Ariz.
Block Island, R. I.
Boston, Mass.
Boston Bay, Mass.
Bridgeport, Conn.
Brookfield, Mass.-Conn.
Brooklyn, N. Y.
Burlington, N. J.-Pa.
Byron, S. Dak.
Canyon, Y. N. P.-Wyo.
Cape May, N. J.
Carson, Nev.
Casco Bay, Me.
Casselton, N. Dak.
Castleton, Vt.-N. Y.
Cazenovia, N. Y.
Cherry Creek, N. Y.
Citra, Fla.
Clove, N. Y.-Conn.
Columbia, S. Dak.-N. Dak. (1:125,000).
Cottonwood Falls, Kans.
Coxsackie, N. Y.
Dalton, Ga.-Tenn.
Delaware Water Gap, Pa.-N. J.
Derby, Conn.
De Smet, S. Dak.
Dover, Del.-Md.
Dryden, N. Y.
Dunnellon, Fla.
Duxbury, Mass.
Eckelson, N. Dak.
Ellicott, Md.
Elmira, N. Y.
Fall River, Mass.-R. I.
Fargo, N. Dak.-Minn.
Fayetteville, Ark.-Mo.
Fitchburg, Mass.-N. H.
Fort Ann, N. Y.-Vt.
Fort Benton, Mont.
Fort McKavett, Tex.
Franklin, Mass.-R. I.
Franklin Furnace, N. J.
Frederick, Md.-Va.
Gadsden, Ala.
Gallatin, Y. N. P.-Wyo.
Garden, Kans.
Gibson, La.
Glens Falls, N. Y.

Topographic sheets corrected during the fiscal year 1903–4—Cont'd.

Gloucester, Mass.
Granbury, Tex.
Grantsville, Md.-Pa.
Greeneville, Tenn.-N. C.
Greenfield, Mass.-Vt.
Hammonton, N. J.
Harlem, N. Y.-N. J.
Hartford, Conn.
Haverhill, Mass.-N. H.
Hawley, Mass.-Vt.
Hazleton, Pa.
Hillsville, Va.-N. C.
Houma, La.
Huron, S. Dak.
Ithaca, N. Y.
Kaaterskill, N. Y.
Kittanning, Pa.
Lac des Allemands, La.
Lake, Y. N. P.-Wyo.
Latrobe, Pa.
Laurel, Md.
Lebanon, Pa.
Little Falls, N. Y.
Londonderry, Vt.
Lowell, Mass.-N. H.
Macedon, N. Y.
Madison, Wis.
Marthas Vineyard, Mass.
Masontown, Pa.
Montross, Va.-Md.
Morrillton, Ark.
Mount Airy, La.
Mount Washington, N. H.
Muskeget, Mass.
Nampa, Idaho-Oreg.
Narragansett Bay, R. I.
New Bedford, Mass.
Newbern, N. C.
Newburyport, Mass.-N. H.
New London, Conn.-N. Y.
Niagara, N. Y.
Northampton, Mass.
Nueces, Tex.
Oakes, N. Dak.
Ocala, Fla.
Oswego, N. Y.
Palmer, Mass.-Conn.
Palo Pinto, Tex.
Panasoffkee, Fla.
Pasadena, Cal.
Patoka, Ind.-Ill.
Patrick, Wyo.-Nebr.
Phillipsburg, Kans.
Plymouth, Mass.
Pomona, Cal.
Providence, R. I.-Mass.
Putnam, Conn.-R. I.
Remsen, N. Y.
St. George, W. Va.
St. Mary, Md.-Va.
Salamanca, N. Y.
Salem, N. J.-Del.
Sandy Hook, N. J.
San Luis Obispo, Cal.
Santa Monica, Cal.
Saybrook, Conn.
Schoharie, N. Y.
Schunemunk, N. Y.
Sedalia, Mo.
Seward Peninsula, Alaska (SW. ¼).
Shasta, Cal.
Shoshone, Y. N. P.-Wyo.
Silver Lake, Wis.
Silverton, Colo.
Springville, Ala.
Stamford, Conn.-N. Y.
Staten Island, N. Y.-N. J.
Stonington, Conn.-R. I.-N. Y.
Stoughton, Wis.
Sun Prairie, Wis.
Tahlequah, Ind. T.-Ark.
Tejon, Cal.
Texas State map (NE. ¼).
Texas State map (NW. ¼).
Texas State map (SE. ¼).
Texas State map (SW. ¼).
Ticonderoga, N. Y.-Vt.
Tolchester, Md.
Topeka, Kans.
Tsala Apopka, Fla.
Uniontown, Pa.
U. S. base map (11 by 16).
U. S. contour map (17 by 28).
Utica, N. Y.
Valentine, Tex.
Walhalla, Ga.-S. C.-N. C.
Wartburg, Tenn.
Watertown, N. Y.
Watkins, N. Y.
Waynesburg, Pa.
Wellington, Cal.-Nev.
West Point, N. Y.
Whitehall, N. Y.-Vt.
Whitesburg, Ky.-Va.
Whitewater, Wis.
Worcester, Mass.
York, Me.-N. H.

Topographic atlas sheets printed and the number of copies delivered during the fiscal year 1903–4.

Name of sheet.	Copies.	Name of sheet.	Copies.
Amelia, Va	2,137	Cayucos, Cal	3,127
Amsterdam, N. Y	2,102	Cazenovia, N. Y	2,089
Ann Arbor, Mich	3,000	Cherry Creek, N. Y	2,155
Anthracite, Colo	2,080	Cherryfield, Me	3,000
Apalachin, N. Y	3,082	Chief Mountain, Mont	3,000
Arredondo, Fla	602	Chiwaukum, Wash	3,000
Arroyo Grande, Cal	2,126	Citra, Fla	607
Asheville, N. C.–Tenn	2,136	Cleveland, Ohio	3,090
Ayden, N. C	3,127	Clove, N. Y.–Conn	2,030
Babylon, N. Y	3,059	Coos Bay, Oreg	2,108
Baldwinsville, N. Y	2,134	Coxsackie, N. Y	2,000
Baltimore, Md	3,064	Curwensville, Pa	3,125
Banner Hill Special, Cal	3,100	Cuyamaca, Cal	3,063
Bar Harbor, Me	3,000	Deer Isle, Me	3,058
Barnesboro, Pa	3,115	Delaware, Ohio	3,081
Bastrop, Tex	3,000	Delaware Water Gap, Pa.–N. J	2,003
Bath, Me	2,108	Derby, Conn	2,135
Beaver, Pa	3,129	Dover, Del.–Md	2,060
Bellevue, Ohio	3,084	Dryden, N. Y	2,078
Berne, N. Y	3,085	Dublin, Ohio	3,084
Big Moose, N. Y	3,053	Dulac, La	897
Binghamton, N. Y	3,067	Dunnellon, Fla	606
Blackstone, Mass.–R. I	2,138	Duxbury, Mass	2,132
Block Island, R. I	2,122	Ebensburg, Pa	3,065
Bluehill, Me	3,088	Elcajon, Cal	2,085
Blue Mountain, N. Y	3,126	Elders Ridge, Pa	3,000
Boston, Mass	3,620	Ellijay, Ga.–N. C.–Tenn	2,131
Boston Bay, Mass	3,585	Elmira, N. Y	2,118
Boston and vicinity, Mass	2,610	Elmore, Ohio	3,095
Bowling Green, Ohio	3,085	Euclid, Ohio	3,100
Brandon, Vt	3,000	Fairfax, Iowa	3,118
Brookfield, Mass.–Conn	2,107	Fall River, Mass.–R. I	2,116
Browning, Mont	3,115	Findlay, Ohio	3,020
Bruceton, W. Va.–Pa	3,000	Fire Island, N. Y	3,130
Buffalo, N. Y	2,102	Fort Ann, N. Y.–Vt	3,085
Cadiz, Ohio	3,106	Fort Benton, Mont	1,054
Camulos, Cal	3,107	Franklin, Mass.–R. I	2,116
Canton, Ohio	3,126	Frederick, Md.–Va	2,099
Carlisle, Pa	3,085	Fremont, Ohio	3,133
Casco Bay, Me	2,095	Fullerton, N. Dak	908

Topographic atlas sheets printed and the number of copies delivered during the fiscal year 1903-4—Continued.

Name of sheet.	Copies.	Name of sheet.	Copies.
Gadsden, Ala	3,106	Margaretville, N. Y	3,075
Gilboa, N. Y	2,582	Marthas Vineyard, Mass	2,065
Glens Falls, N. Y	2,089	Masontown, Pa	3,096
Gloucester, Mass	2,104	Massillon, Ohio	3,115
Gloversville, N. Y	3,105	Mount Carmel, Ill.-Ind	3,000
Goleta, Cal	3,098	Mount Desert, Me	3,000
Grantsville, Md.-Pa	3,082	Mount Pinos, Cal	3,159
Greenfield, Mass.-Vt	2,105	Mount Washington, N. H	2,124
Hammonton, N. J	2,127	Muskeget, Mass	2,108
Harford, N. Y	3,115	Nashville, Tenn	3,084
Harlem, N. Y.-N. J	2,110	Newbern, N. C	3,116
Hartford, Conn	2,108	Newburg, N. Y	3,066
Hartford, Wis	3,000	Newburyport, Mass.-N. H	2,088
Haubstadt, Ind	3,120	New London, Conn.-N. Y	2,111
Hayden Peak, Utah-Wyo	3,053	Niagara Falls, N. Y	2,106
Hazleton, Pa	2,129	Northampton, Mass	2,075
Hecla, S. Dak.-N. Dak	900	North Point, Md	3,000
Hillsville, Va.-N. C	1,284	Northport, N. Y	3,109
Hollidaysburg, Pa	3,085	Oberlin, Ohio	3,119
Honeoye, N. Y	3,000	Ocala, Fla	609
Hueneme, Cal	3,000	Oxford, Md	3,000
Huntingdon, Pa	3,137	Palmer, Mass.-Conn	2,074
Huntley, Mont	1,062	Palmyra, Mo	3,098
Indio Special, Cal	3,084	Panasoffkee, Fla	610
Iola, Kans	3,156	Pasadena, Cal	2,105
Islip, N. Y	3,000	Paterson, N. J.-N. Y	2,134
Ithaca, N. Y	2,088	Patoka, Ind.-Ill	3,121
Jonesville, Ky.-Va.-Tenn	2,125	Patrick, Wyo.-Nebr	892
Juneau Special, Alaska	3,080	Patton, Pa	3,000
Kaaterskill, N. Y	3,024	Pemberton, N. J	2,116
Kingfisher, Okla	1,078	Petit Manan, Me	3,123
Koshkonong, Wis	597	Philadelphia and vicinity, Pa.-N. J.-Del	3,011
La Jolla, Cal	3,095	Phoenicia, N. Y	3,114
Lake Felicity, La	871	Pitcher, N. Y	3,101
Lampasas, Tex	884	Plainville, Kans	1,060
Lancaster, Pa	3,000	Plymouth, Mass	2,108
Lassellsville, N. Y	3,094	Pomona, Cal	3,116
Llano, Tex	3,100	Port Harford, Cal	2,024
Madison, Wis	904		

Topographic atlas sheets printed and the number of copies delivered during the fiscal year 1903-4—Continued.

Name of sheet.	Copies.	Name of sheet.	Copies.
Port Washington, Wis	3,134	Springfield, Mass.-Conn	2,118
Providence, R. I.-Mass	2,109	Springville, Ala	1,310
Put-in-Bay, Ohio	3,116	Stamford, Conn.-N. Y	2,075
Ramona, Cal	3,096	Standingstone, Tenn	2,123
Rapid, S. Dak	2,592	Stonington, Conn.-R. I.-N. Y	2,110
Raquette Lake, N. Y	3,125	Stoughton, Wis	870
Remsen, N. Y	2,088	Swan Island, Me	3,068
Republic, Wash	3,077	Tarboro, N. C	3,135
Riddles, Oreg	3,099	Tarrytown, N. Y	2,114
Roan Mountain, Tenn.-N. C	3,000	Tejon, Cal	3,103
Rosendale, N. Y	3,000	Terlingua, Tex	3,014
Ruidosa, Tex	898	Timbalier, La	899
Rural Valley, Pa	3,074	Tolchester, Md	3,148
St. George, W. Va	1,630	Tonopah Mining Map, Nev	3,107
St. Louis, Mo.-Ill	4,001	Tsala Apopka, Fla	545
St. Mary, Md.-Va	2,070	Uniontown, Pa	2,109
St. Michaels, Md	3,000	Utica, N. Y	2,121
Salamanca, N. Y	2,116	Ventura, Cal	3,088
Salem, N. J.-Del	2,080	Vermilion, Ohio	3,093
San Antonio, Cal	3,054	Vinalhaven, Me	3,040
Sandusky, Ohio	3,084	Wahpeton, N. Dak.-Minn	3,000
Sandy Hook, N. J.-N. Y	2,016	Walhalla, Ga.-S. C.-N. C	2,112
San Luis Obispo, Cal	2,118	Wartburg, Tenn	2,110
Santa Barbara, Cal	3,132	Watertown, N. Y	2,104
Santanoni, N. Y	3,110	Watkins, N. Y	2,075
Santa Paula, Cal	3,139	Waukon, Ia.-Wis	3,126
Savanna, Ia.-Ill	1,096	Waynesburg, Pa	3,088
Saypo, Mont	2,629	Wellington, Cal.-Nev	2,144
Schoharie, N. Y	2,123	West Bend, Wis	3,126
Schunemunk, N. Y	2,112	West Canada Lakes, N. Y	3,097
Scio, Ohio	3,000	West Delta, La	1,304
Seattle, Wash. (1:125,000)	2,037	Weston, W. Va	3,000
Setauket, N. Y	3,000	West Point, N. Y	2,131
Shasta, Cal	2,112	Whitefield, N. H	2,087
Siloam Springs, Ind. T.-Ark	3,145	Whitewater, Wis	1,116
Silver Lake, Wis	1,095	Wilmington, Vt	2,006
Snoqualmie, Wash	3,089	Wooster, Ohio	3,140
Southern California, No. 2	3,000	Worcester, Mass	2,135

Geologic folios completed and number of copies delivered during fiscal year 1903–4.

No.	Name.	Edition.
94	Brownsville-Connellsville, Pa. (double folio)	7,096
95	Columbia, Tenn	5,093
96	Olivet, S. Dak	5,098
97	Parker, S. Dak	5,186
98	Tishomingo, Ind. T	5,069
99	Mitchell, S. Dak	5,074
100	Alexandria, S. Dak	5,069
101	San Luis, Cal	5,000
102	Indiana, Pa	7,203
103	Nampa, Idaho	5,277
104	Silver City, Idaho	5,198
105	Patoka, Ind	5,000
106	Mount Stuart, Wash	5,000
107	Newcastle, Wyo	5,000
108	Edgemont, S. Dak	5,000
109	Cottonwood Falls, Kans	5,000
	Total	85,363

Geologic folios in press June 30, 1904.

Asheville, N. C.
Bisbee, Ariz.
De Smet, S. Dak.
Franklin Furnace, N. J.
Globe, Ariz.
Huron, S. Dak.
Latrobe, Pa.

Miscellaneous matter printed during fiscal year 1903–4.

Items.	Number of copies.	Number of printings.
Photolithographs on celluloid	2,169	2,169
Photolithographs on tracing cloth	3	3
Photolithographs on drawing paper	73	73
Photolithographs on map paper	8,786	8,786
Photolithographs on tracing paper	7	7
Press bulletins	104,243	104,243
Map circulars	12,159	48,636
Special copies of maps on drawing paper	319	957
Special copies of maps on map paper	283	849
Circular letters	9,550	9,550
Preliminary assignments (pamphlet)	1,000	1,000
United States land-classification map	2,000	12,000

Miscellaneous matter printed during fiscal year 1903–4—Continued.

Items.	Number of copies.	Number of printings.
Map of Lake Superior region (distribution of iron ore)	2,088	6,264
U. S. Geological Survey signal flags	500	500
Prints for projection of United States map	3	3
United States map (7½ by 11½ inches)	100	200
Millimeter ruling	728	728
Terlingua, Tex. (Texas mineral survey)	6,156	18,468
Memoranda jackets	50	50
St. Louis (Missouri) special map	294,500	446,000
Alaska map (photolithograph)	5,089	15,267
Salt River Valley map, Arizona (photolithograph)	4,000	12,000
Total	453,806	687,753

Totals derived from the foregoing statements.

Engraving of topographic atlas sheets:	
Sheets completed (counting double sheets two)	132
Sheets completed in part	35
Sheets corrected	167
Engraving of bases for geologic folios:	
Bases completed	10
Bases completed in part: Franklin Furnace; Franklin Furnace Special; Kittanning	3
Printing:	Copies delivered.
Atlas sheets printed (233)	581,708
Geologic folios completed (16)	85,363
Miscellaneous printings (692,760)	453,813
Total printed sheets delivered	1,120,884
Maps mounted	475
Transfer impressions made and sent to contracting printers	350
Negatives made:	
Photo tracing	155
Photolith	630

INSTRUMENT SHOP.

The work of repairs to instruments was under the immediate supervision of Mr. Ernest Kübel, who was assisted for thirty-eight days by Mr. Charles C. Venable, assistant mechanician, and forty days by Mr. Milton T. Noyes, laborer.

Messrs. H. Matthews and H. Colbert aided in the work of plate making and electrotyping. On October 10, 1903, Mr.

Colbert died, and thereafter the work of plate making and electrotyping went on with one laborer.

Repairs to instruments were made as follows:

Instruments repaired in 1903-4.

Telescopic alidades	138
Wye (Y) levels	87
Transits	7
Box compasses	216
Declination compasses	42
Circular levels	15
Locke levels	15
Abney levels	3
Rod levels	9
Steel tape lines	49
Sight alidades	94
Pocket compasses, prismatic and clinometer	51
Plane-table plates	152
Fitting shoes on traverse tripod legs	175
Johnson-movement tripods	141
Traverse tripods	116
Level tripods	93
Theodolite tripods	13
Transit tripods	10
Protractors	4
Aneroid barometers	5
Drawing instruments (dividers and pens)	18
Tally registers	23
Striding levels	3
Hand magnifying glass	1
Triangle and straight edges	4
Standardizing screws and sockets	500

The progress of the copperplate and electrotype work is shown in the following table:

Copperplate making and electrotyping.

New plates made	362
Plates resurfaced and cut	31
Plates electrotyped, "bassos"	18
Plates electrotyped, "altos"	21
Square inches of new plates	136,374
Square inches electrotyped	13,923
Square inches resurfaced	11,067

Division of Documents.

This division remained in charge of Mr. W. D. Wirt, who was assisted by Messrs. H. E. Crook, J. P. Benfer, H. W. Meredith, J. R. Walsh, Miss M. E. Mullen, and Messrs. W. J.

Yaste, J. W. Green, J. S. Donohue, W. C. Douglas, and W. D. Vaughan.

The work increased so greatly that it taxed the capacity of all employed in the division, and lack of floor space hampered the receiving and mailing of documents. The following tabulated statistics for the last four years exhibit the increase mentioned.

Documents received and distributed, 1900–1904.

	1900–1901.	1901–2.	1902–3.	1903–4.
Received:				
Volumes	104,465	186,120	276,453	239,966
Folios	66,000	50,803	58,800	72,937
Maps	538,653	598,881	469,422	591,985
Total	709,118	835,804	804,675	904,888
Distributed:				
Volumes	138,621	145,837	253,507	307,004
Folios	42,936	39,424	43,182	44,397
Maps	327,603	413,874	440,422	475,324
Total	509,160	599,135	737,111	826,725

The publications received were: Twenty-fourth Annual Report; Monographs, XLIII, XLV, and XLVI; Professional Papers Nos. 9, 11 to 21; Bulletins Nos. 182, 193, 208, 211, 212, 214 to 225, 227 to 229; Water-Supply and Irrigation Papers Nos. 79 to 81, 83 to 92, 94; Mineral Resources of the United States, 1902, and separates therefrom to the number of 43; 2 miscellaneous publications; geologic folios Nos. 91 to 106 and No. 109; 233 topographic maps, of which 128 are new editions and 105 are reprints, the total combined editions of atlas sheets numbering 591,708 sheets; 4 special maps, the total editions numbering 10,177, of which 9,927 were distributed.

During the year 307,004 volumes, 44,397 folios, and 475,324 maps were sent out.

The total amount received and turned into the Treasury as the result of sales of publications was $11,089.75.

ADMINISTRATIVE BRANCH.

Executive Division.

Work not otherwise assigned, such as that pertaining to appointments, records, correspondence, etc., as well as the watch, messenger, and labor force, was, as in previous years, in general charge of the chief clerk, Col. H. C. Rizer, who has general supervision of all the business of the Survey, and also serves as Acting Director whenever the Director is in the field.

CORRESPONDENCE AND RECORDS, SUPPLIES, AND SHIPMENTS.

The work of this section remained in charge of Mr. A. F. Dunnington. He was assisted by Mr. W. F. Morsell, appointment clerk; Mr. J. E. Allen, clerk in charge of supplies; Mr. P. M. Bryan, mail clerk and stenographic assistant; Mr. A. B. Anderson, freight and express clerk; Mr. A. G. McChesney, property clerk; Mr. C. T. Bright, stationery clerk; and Miss L. E. Thorwarth, Mrs. E. V. M. Clarke, and Mr. J. P. Hendley, clerks. Miss Alice F. Susan, stenographer and typewriter, succeeded Miss H. S. Cooke, who resigned, and Mr. J. R. Stilson, messenger, succeeded Mr. H. P. Seidemann, who was transferred to the hydrographic branch.

Nearly every branch of the work showed increase in volume. The detailed record for the year follows:

Mail desk.—There were 96,300 pieces of first-class mail received during the year.

Appointments, attendance, etc.—The record for the year is given in the following table:

Record of appointments, attendance, etc.

	1904.	1903.
Appointments and reinstatements	225	372
Extensions of limited temporary appointments	42	48
Reappointments, changes of designation and of basis of pay, and other changes involving no increase of force nor any increase or reduction of compensation	259	61
Promotions	299	164
Reductions in pay	5	2
Separations (including resignations, dismissals, deaths, etc.), of which 4 were due to death	74	81
Changes of all kinds	904	728

About 65 of the appointments made during the year were temporary, running from ten days to six months. A comparison of the total number of changes made during 1904 with the total for the preceding year shows an increase of 176, or about 24 per cent. Compared with 1902 the total changes show an increase of 144 per cent.

There are now on the Survey roster, holding appointments from the Secretary of the Interior, 770 persons.

Not included in the roster of regular appointments, but involving in each instance nearly as much time and attention as an appointment, are the authorizations from the Secretary of the Interior to employ temporary assistants in office work, the designation of special disbursing agents, etc. These authorizations during the year numbered about 40, and the number of officers of the Survey who were designated by the Secretary as special disbursing agents is 15.

Other matters attended to by the appointment clerk include the issuance of identification cards to persons in the field service; letter writing, including letters on miscellaneous business as well as appointments; oral conferences, etc.; also attendance work.

The attendance work, like the appointment, shows an increase over any previous year. Of sick leaves there were upward of 400, as against 350 the previous year, and of leaves without pay there were 75.

Property accountability.—The system of property accountability which was introduced just prior to the close of the last fiscal year was carried forward successfully, and its value and usefulness have been demonstrated.

In the hydrographic division and the reclamation service a slight deviation from the general idea was found necessary, owing to the vast amount of nonexpendable property accumulated by the great number of assistants who were making purchases in the field; and, in order to concentrate the accountability for property, it was deemed advisable to appoint subcustodians in the field. This entailed extra work in the preparation of monthly abstracts of purchase for these two divisions. The number of abstracts forwarded to the 20 subcustodians in the stream gaging division was 97, and to the 16 in the reclamation service, 153.

During the year abstracts of purchase were prepared in duplicate and forwarded for signature (beside those noted above for stream gaging and reclamation) as follows:

Abstracts of purchase prepared.

Eastern topography	53
Western topography	40
State topography	12
Geology	20
Mineral resources of Alaska	10
Surveying forest reserves	8
Office	12
Instruments	4
Photography	4
Total	163

In the preparation of abstracts of purchase for the several custodians it was necessary to abstract all of the vouchers of the many appropriations in the division of disbursements and accounts. In all 16,352 vouchers were examined, together with the numerous subvouchers, an average of 1,363 vouchers a month.

Property returns for all of the custodians were prepared quarterly, and permanent records of the same are on file. From the property returns was dropped the property which, by fair wear and tear in the public service, had become unserviceable; also that advertised and sold at public auction. The amount derived from the latter source, $1,918.22, was received and turned over to the division of disbursements and accounts.

Preparation of vouchers.—On March 15 the preparation of vouchers for the purchase of all supplies, in open market and on contract, was transferred to this section. After that date 502 vouchers, an average of 144 a month, were prepared, in duplicate, and forwarded for payment.

Purchase and distribution of supplies.—In this work two persons are engaged. The following table indicates the amount of work they performed:

Record of purchase and distribution of supplies.

Applications made to the Secretary of the Interior for authority to purchase supplies (involving an expenditure of $180,261.20)	278
Requisitions drawn on the Department for miscellaneous supplies	264
Requisitions filled from stock on hand	810
Orders drawn on dealers and others	3,154
Bills received and checked (approximate)	2,300

From May 18 to 27 the supplies clerk, Mr. J. E. Allen, was engaged for the greater part of each day at the Department, as a member of a board appointed to open and award bids for stationery for the year 1905.

Express, freight, and registered mail.—In the work of the express, freight, and registered mail desk there was, on the whole, an increase, more especially as regards the number of bills of lading covering shipments from and to points other than Washington, D. C. In the amount of mail registered there was a decrease, due to increased use of the ordinary mails.

Record of express, freight, and registered mail matter handled.

	1904.	1903.
Freight and express:		
Pieces shipped	1,954	2,934
Pieces received	3,969	2,668
Total pieces handled	5,923	5,602
Registered mail:		
Pieces forwarded	39,164	50,758
Pieces received	1,953	1,994
Total pieces handled	41,117	52,752
Bills of lading issued during the year	....	877
Accounts checked	....	339

Miscellaneous work consisted of custom-house entries, tracing shipments, transmitting packages to members of the Survey located at the National Museum, of which a record is maintained, etc.

During the year a change in the manner of issuing and handling Survey bills of lading was effected. The system adopted has met the approval of transportation companies and proved satisfactory to the Survey by reason of saving unnecessary labor and expediting the passing of transportation accounts, as well as frequently avoiding delay in the delivery of freight. These bills of lading are payable by the Treasury Department, and relieve members of the Survey of the necessity of carrying freight and express charges on subvouchers in their field accounts.

Stationery.—The clerk in charge of the stationery room filled 7,808 requisitions for blanks, blank books, and stationery, the larger part of which supplies required to be wrapped and mailed to persons in the field. Requisitions on the Department to the number of 853 were drawn. The stationery clerk, in addition to his other duties, had charge of the distribution of incoming mail. He handled and distributed a daily average (estimated) of 1,650 pieces.

Disbursements and Accounts.

This division remained in charge of Mr. John D. McChesney, who has so faithfully and efficiently supervised this part of the work since the establishment of the Survey. A summarized statement of disbursements follows:

Analysis of disbursements.

Opposite the following heads appear the total expenditures under the various appropriations:

1. Salaries of scientific assistants	$29,247.83
2. Skilled laborers and various temporary employees	19,993.04
3. Topographic surveys	298,288.68
4. Geologic surveys	139,861.30
5. Paleontology	8,366.96
6. Chemical and physical researches	17,239.52
7. Preparation of illustrations	17,772.90
8. Mineral resources of the United States	58,320.02
9. Books for the library, etc	2,980.14
10. Gaging streams, etc	175,655.17
11. Geological maps of the United States	91,712.78
12. Mineral resources of Alaska	59,742.54
13. Salaries, office of Geological Survey	32,439.00
14. Surveying forest reserves	126,828.86
15. Replacing articles destroyed by fire	6,210.81
16. Fire-alarm system	108.00
17. Testing fuel	3,051.75
Total	1,087,819.30

FINANCIAL STATEMENT.

Amounts appropriated for and expended by the United States Geological Survey for the fiscal year ending June 30, 1904.

	Geological Survey, 1904.	Geological Survey, 1903 and 1904.	Geological maps of the United States, 1904.	Surveying forest reserves, 1903 and 1904.	Testing fuel.	Total.
Appropriations: Acts approved Mar. 3, 1903; Feb. 18, 1904, and Apr. 27, 1904	$407,620.00	$510,000.00	$100,000.00	$130,000.00	$60,000.00	$1,207,620.00
Amounts expended classified as follows:						
Services	277,006.19	323,141.63	76,011.79	84,278.79	1,404.35	761,842.75
Traveling expenses	35,899.44	40,751.82	41.15	4,052.20	504.04	81,248.65
Field subsistence, supplies, and expenses	24,181.94	109,153.52		34,503.79	1,136.05	168,975.30
Instruments	6,524.94	9,912.83		1,961.27		18,399.04
Laboratory material	3,710.24					3,710.24
Photographic material	8,928.31	1,443.73		177.89		10,549.93
Books and maps	2,321.93	240.17		75.00		2,637.10
Stationery and drawing material	274.25	687.30		90.75		1,052.30
Illustrations for reports	435.00					435.00
Office supplies and repairs	8,232.29	3,316.19		689.40		12,237.88
Correspondence	280.95	315.16	6.63	69.45	7.31	679.50
Materials for engraving and printing maps			15,649.52			15,649.52
Railroad accounts settled at United States Treasury:						
Passenger	330.28	3,175.53		516.93		4,022.74
Freight	207.63	5,754.64	3.69	413.39		6,379.35
Total expenditures	368,333.39	497,892.52	91,712.78	126,828.86	3,051.75	1,087,819.30
Balance unexpended July 1, 1904	39,286.61	12,107.48	8,287.22	3,171.14	56,948.25	119,800.70
Probable amount required to meet outstanding liabilities	38,326.48	12,107.48	8,287.22	3,171.14	56,948.25	118,840.57

Library.

The library remained in charge of Mr. F. B. Weeks, librarian, who was assisisted by Misses Julia L. McCord, M. E. Latimer, Sara G. Hyde, E. A. Hedrick, Ida Bengston, and Messrs. J. M. Nickles, Thomas K. Gallaher, and J. E. Latimer. Mr. Nickles was added to the force on the 1st of July and Miss Bengston on the 1st of August, 1903. Mr. C. C. Darwin was continued as assistant librarian.

During the year 3,179 books were recorded in the accessions book, of which 2,387 were received through exchange or presentation and 792 were purchased. All purchases were made with the approval of the library committee, and the allotment of $2,000 for this purpose was fully expended. About 300 periodicals were received by the library, partly by purchase and partly as exchanges.

There were 1,550 books bound, of which 250 were books rebound, because of injury in the fire that occurred on December 27, 1903.

During the year an extra effort was made by correspondence to procure separates of geologic publications from authors, and as a result there was a very large increase in the number of pamphlets received.

The work of recording, accessioning, and cataloguing the publications and pamphlets received progressed satisfactorily. The rearrangement of the books on the shelves according to subject-matter was nearly completed at the close of the year.

Three card catalogues of the library are now in course of preparation—a shelf list, a subject index, and an author catalogue. Much work has also been done on an author catalogue of the books (approximately 3,000) which are kept in the chemical-physical laboratory for the use of that division. The work of making the card catalogues has been materially aided by the use of the printed catalogue cards of geologic publications contained in the John Crerar Library, of Chicago, furnished by the librarian of that institution, and also by the use of the catalogue cards of the Library of Congress. Approximately 2,000 cards have been added to the Survey catalogue by the John Crerar Library. Arrangements have recently been made with the Library of Congress by which catalogue cards are to be printed from manuscript furnished by the Survey, and work has been begun on the catalogue of the reports of the various State geological surveys. The reports of the State geological survey of Kentucky were selected to inaugurate the plan, as the irregular manner of their publication offered many difficulties to systematic cataloguing. The work has progressed satisfactorily and the cards are now in process of printing. It is expected that work of this kind will form a considerable addition to the printed-card catalogue of the Survey library. Work was continued on the cataloguing of the reports of the various State geological surveys, those for the New England, the Middle Atlantic, and the South Atlantic States having been completed and typewritten cards placed in the catalogue case.

During the year the foreign and domestic exchange lists were revised and a new scheme for carrying on this work was adopted. The new scheme provides that complete sets of the Survey publications shall be sent to the libraries of nearly all the universities, to most of the departments of geology in the universities, and to some professors of geology. To meet the needs of geologists who are not teachers and of the large class of persons who are interested only in the economic work of the Survey, a circular of new publications is issued at intervals of about two months. From this circular each person who receives it can select such publications as he specially desires. In brief, the exchange account comprises two lists, one comprising the names of persons and institutions that receive all book publications, and the other the names of those that receive the circular of new publications and such books as may be selected therefrom. Seven numbers of the circular have already been distributed, and the many expressions of approval received from correspondents show that the plan works satisfactorily.

Shortly after the beginning of the present fiscal year the manuscript of the Bibliography of North American Geology, etc., for 1902 (calendar year) was submitted, and in due time it appeared as Bulletin No. 221. The annual bibliography for 1903 (Bulletin No. 240) was submitted for publication on June

1, and is now in the hands of the printer, and the 1904 bibliography is nearly up to date. The greater part of the work of preparing these bibliographies has been performed by Mr. J. M. Nickles.

A portion of the time of the librarian was devoted to field and office work on the underground waters of New York State, and about three months were consumed in field work in the West, principally in Utah and Nevada.

There is a steady increase in the use of the library by members of the Survey, both in Washington and elsewhere, and also by other students of geology and the related sciences, to whom its facilities are cordially extended.

NECROLOGY.

MARCUS BAKER.

Mr. Marcus Baker, cartographer of the United States Geological Survey, died at his home in Washington, D. C., on December 12, 1903, at the age of 54. Several months earlier he suffered an attack of typhoid fever, from which he never fully recovered.

Mr. Baker joined the Geological Survey in April, 1886. At the time of his death he was on leave of absence, without pay, and was filling the position of assistant secretary of the recently established Carnegie Institution of Washington. The following sketch of his life is taken from the "Yearbook No. 2, 1903" of that institution. The justness of its tribute to his talents and attainments, his geniality, and the value of his work will be recognized by all his associates in the Geological Survey:

Marcus Baker, the assistant secretary of the Carnegie Institution, performed his last work in editing the present volume. He had been in failing health for some months, and the end came while the book was on the press. He was a scholarly man, of broad culture, and talented in many fields; he was a conscientious, painstaking, accurate man, doing thoroughly and well that which he undertook; and he was an optimistic and affable man, who delighted to be of service to others. His activities were so varied and his responsibilities so numerous that the Carnegie Institution is but one of several organizations to suffer by his loss; yet the institution will miss him most, for he had assisted in its organization and knew all the details connected with its affairs. He was a man of science, occupied chiefly with geographic and bibliographic researches, but a contributor also to history, and a lifelong student of mathematics. Though possessing no capital and not engaged in business in the ordinary sense, he yet held several positions of trust in business organizations. He had also completed a law course, and was competent for admission to the bar. An outline of his life is given below.

He was born at Kalamazoo, Mich., on the 23d of September, 1849, the earlier part of his youth being spent on a farm, and the later in the city of Kalamazoo. His education began in the common schools of Michigan. Two years were spent in Kalamazoo College and two in the University of Michigan, from which he was graduated in 1870. The degree of LL. B. was received from Columbian University in 1896.

In the summer after graduation he assisted Professor Watson, of Ann Arbor, in computations for the Nautical Almanac. Then for a year he held the chair of mathematics in Albion College, and for two years was instructor in mathematics in the University of Michigan. He then availed himself of an opportunity to enter the United States Coast Survey, and was a member of that corps for thirteen years. He assisted Dr. W. H. Dall in surveys of the coast of Alaska, having for his special function the astronomical determination of latitude and longitude. Afterwards, at the offices of the Survey in San Francisco and Washington, he aided in the preparation of the Coast Pilot of Alaska and of a bibliography of the geography of Alaska. In later years he compiled for the Geological Survey a dictionary of Alaskan names. In 1882 he was sent to Los Angeles, Cal., by the Coast Survey to install and conduct a primary magnetic station or observatory, and he was afterwards assigned to an investigation of the tides and currents of New York Harbor and their relation to the coastal bar and other shoals.

In 1886 he resigned to accept a position in the United States Geological Survey, and he was connected with that organization until the founding of the Carnegie Institution. For a number of years he had charge of the northeastern topographic division, supervising the mapping of Massachusetts, Rhode Island, Connecticut, and a part of Pennsylvania. He was afterwards editor of topographic maps. While these were his principal routine duties they occupied only a portion of his time. He was from time to time intrusted with various special researches, usually of a literary or bibliographic character, for the purpose of aiding the Director in the preparation of special reports and other documents. He represented the Geological Survey on the Board on Geographic Names, and for more than ten years was the secretary of that board, having charge of its files and collating the recorded usage of most of the names submitted to the board for decision. He was also the editor of its bulletins.

When a commission was appointed by our Government to investigate the matter of the Venezuelan boundary, Mr. Baker was employed as geographic expert, taking leave of absence from the Survey for that purpose. He prepared a compendious report, including an exhaustive bibliography of the maps bearing on the boundary dispute. Afterwards, when arrangement was made for arbitration, he was employed by the counsel for Venezuela, and spent two years on the preparation of the case.

Mr. Baker was a member of a number of scientific societies, from which he accepted duties that occupied much of his leisure. For several years he was secretary of the Philosophical Society of Washington and editor of its bulletin, and afterwards he was its president. He was an officer of the Geographic Society from its organization, and also of the Historical Society. When the scientific societies of Washington became affiliated through the constitution of a joint commission, he was chosen its secretary, and in that capacity began the preparation of the joint directory of scientific societies, which he continued from year to year. In the same connection he was made secretary of the local committee for the entertainment of the American Association for the Advancement of Science, in 1891. When the joint commission was succeeded by the Washington Academy of Sciences in 1898, Mr. Baker was chosen not only to the Academy but to its board of managers, and he afterwards became the editor of its proceedings.

Mr. Baker in 1874 married Sarah Eldred, who died in 1897. In 1899 he married Marion Una Strong, who, with two children, survives him.

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G.

J.

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O

LIBRARY CATALOGUE SLIPS.

[Mount each slip upon a separate card, placing the subject at the top of the second slip. The name of the series should not be repeated on the series card, but the additional numbers should be added, as received, to the first entry.]

Author.

U. S. Geological survey.

. . . Twenty-fifth annual report of the director [Charles D. Walcott] of the United States Geological survey to the secretary of the interior, 1903–4. Washington, Gov't print. off., 1904.

388 p., 1 l. illus., 25 pl. (maps) $23\frac{1}{2}^{cm}$.

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Reference.

Walcott, Charles Doolittle.

see as director, 1894-

U. S. Geological survey.

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