U. S. DEPARTMENT OF THE INTERIOR

ANNUAL REPORT OF THE DIRECTOR OF THE GEOLOGICAL SURVEY

TO THE SECRETARY OF THE INTERIOR

FOR FISCAL YEAR ENDED JUNE 30, 1926

DEPARTMENT OF THE INTERIOR
Hubert Work, Secretary

U. S. GEOLOGICAL SURVEY
George Otis Smith, Director

FORTY-SEVENTH ANNUAL REPORT

OF THE

DIRECTOR OF THE GEOLOGICAL SURVEY

TO THE

SECRETARY OF THE INTERIOR

FOR THE FISCAL YEAR
ENDED JUNE 30

1926

WASHINGTON
GOVERNMENT PRINTING OFFICE
1926

Directors of the Geological Survey

CLARENCE KING, 1879–1881
JOHN WESLEY POWELL, 1881–1894
CHARLES DOOLITTLE WALCOTT, 1894–1907
GEORGE OTIS SMITH, 1907–

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ANNUAL REPORT

OF THE

DIRECTOR OF THE GEOLOGICAL SURVEY

DEPARTMENT OF THE INTERIOR,
GEOLOGICAL SURVEY,
September 1, 1926.

SIR: The appropriations made directly for the work of the Geological Survey for the fiscal year 1926 included 12 items, amounting to $1,952,610. In addition $85,930 was appropriated for printing the reports of the Geological Survey, and $11,700 for miscellaneous printing and binding, and an allotment of $6,165 for miscellaneous supplies was made from appropriations for the Interior Department.

A detailed statement of the amounts appropriated and expended is given at the end of this report. The balance shown, including a budget reserve of $11,435, is $48,055.73.

COOPERATION

Cooperation with the States and other public agencies continued as in other years. The value of the mapping and investigative work of the Geological Survey and the necessity of expediting the completion of this physical inventory of the country's resources is now so widely recognized that 37 States as well as many counties and municipalities shared with the Federal Government in meeting the cost.

The total amount thus contributed was $665,731.35. Funds aggregating $213,695.39 were placed to the credit of the Geological Survey for services rendered to other Government bureaus and offices and permittees under the Federal power act. The total expenditure, measuring the amount of work accomplished during the year, was $2,783,981.01.

SUMMARY OF THE WORK OF THE YEAR

In the itemized summary of the year's program, as given below, no emphasis is put on items that are new, nor even are comparisons made with the accomplishments of other years. Certain noteworthy items may, however, be cited as possibly illustrating the trend of the Geological Survey's investigations in the fields assigned to it by congressional authority.

Cooperation with the Geological Survey's topographic engineers has been continued by the United States Army Air Service, which has photographed approximately 7,500 square miles for use in the topographic mapping program. This has resulted in a large saving in the cost of ground surveys of areas to which aerial photography is adapted. In the present stage of development aerial photography can only supplement topographic surveys by ground methods and can not replace them to any large extent. As methods and instruments are improved, however, this new aid to ground surveys will prove a greater benefit and will result in larger savings in cost.

An expedition organized by the Bureau of Aeronautics of the Navy began aerial photographic surveys in southeastern Alaska in response to the request of the Geological Survey, indorsed by the other bureaus needing maps of this region.

Survey physicists and chemists joined the geologists in seeking to serve the oil industry in the effort to recover a larger part of the oil already found, as well as to discover new fields. Laboratory experiments of promise are being put to the test of actual field practice. Cooperation of this type is appreciated by the producers.

The technical administration of the oil and gas, coal, and other leases on the public domain has been under the Geological Survey only the past year. The principal change in policy during that period has been the placing of more authority in the field officers in the handling of technical questions, thus relieving the operating lessees from vexatious delays that might involve large expense. When the mineral leasing law was enacted the cost of administration was estimated at 10 per cent of the total receipts, but the present cost of the Geological Survey's supervisory work is only about one-fifth of that, or 2 per cent of the aggregate rents and royalties involved. Even without allowing for the services rendered to the Indian lessors the cost of supervision is but a small fraction of the actual return to the Federal Treasury, which is only 10 per cent of the total receipts, the remainder going to the States either directly or through the reclamation fund. Moreover, the future values preserved by practical conservation of this type far exceed any present returns under the leasing system.

A marked reduction in the number of publications issued and of copies distributed is due principally to the transfer of the mineral-statistics division to the Department of Commerce. In the preceding year 61 chapters were issued, each treating of a separate mineral product. The growth of this special statistical service rendered to the mineral industry has been marked since the appearance of the first annual report on mineral resources in 1883, when $10,000 was authorized for this statistical work, as contrasted with the appropriation of $125,000 for 1925. In that same period, however, the mineral production of the United States increased from $454,000,000 to $5,696,000,000; moreover, the total value of the output for the earlier year was exceeded by the value last year of four products not even mentioned in the 1883 report—natural gas, gasoline from natural gas, aluminum, and gravel. This marvelous growth of a basic industry has been faithfully recorded year by year in these volumes, which will hereafter bear the imprint of the Bureau of Mines.

As has been true for several years, the Geological Survey distributes more copies of its book publications than are currently issued, owing to the continued demand for reports issued in other years, and a further measure of this demand is afforded by the fact that fully one request in five for publications is unfilled by reason of reports being out of print. The Geological Survey type of Government publication is not accumulating on the shelves of any document room.

The map-printing plant of the Geological Survey, which last year had an appropriation of $105,000 for engraving and printing the topographic and geologic maps, is to be credited with $48,251.36 turned into the Treasury from the sales of maps and transfers. Ten years ago, with a slightly larger appropriation, the miscellaneous receipts from this source were $30,369.35. Since 1920 the map sales have increased in number more than 25 per cent.

The net reduction in force during the year, as determined by comparing the payrolls of July 1, 1925, and June 30, 1926, was 72. In so far as this reduction has to do with the clerical and other employees representing purely administrative—that is, nonproductive—overhead, the smaller expenditure can be regarded as expressing a corresponding economy; but whatever reduction there has been in the technical staff indicates that there has been a corresponding loss in production, for otherwise this staff must have previously included nonworkers, which was not the case. The volume of geologic investigation, of topographic mapping, of stream measurements has always been far less than the demand, so that any decrease in output is a still greater deficiency in accomplishment of what is expected from the Geological Survey not only by the public but by the committees of Congress which specify the types of work to be carried on. To that degree any reduction in productive force is not a saving but a loss—a deficiency that must sometime be met.

Cutting in two the geologic working force of the Alaskan branch can mean nothing less than retarding the exploration of Alaskan resources; the 3 per cent reduction in the technical staff of the water-resources branch during the year and the 5 per cent reduction in the number of geologists in the geologic branch are both expected to be reflected in the volume of work accomplished, and the loss in both quantity and quality of work done will unfortunately be greater than these percentages would suggest, because the recruits to the staff lack the maturity of experience possessed by most of the technical men who leave the Geological Survey to accept educational or corporation positions. These foreseen deficiencies in results are especially to be regretted in view of the arrears already existing in the current work.

It is of course impossible to express quantitatively the unoccupied fields, the untouched problems, the unanswered requests for investigation, but for a few concrete items figures are available with which to measure the lag in current work. Thus, in the various types of land-classification cases on which technical reports are made to the Secretary of the Interior or the Commissioner of the General Land Office, the arrears at the end of the year were from two to four months; in the handling of coal and phosphate withdrawals recent progress has been so slow that a delay of many years must be expected in completing the examination and classification, and the

deficiency is even worse in the power examination of the remaining 15,000 miles of streams in the public-land States. The analytical work of the chemical laboratory is something like three months in arrears. The preparation of stream-gaging records for publication is 17 months behind. The engraving of topographic maps is 15 months from being current. The editing of texts for the printed reports is 9 months in arrears, and the preparation of illustrations was 1½ years in arrears at the end of the year, but with the increase in force now provided this record will be considerably bettered next year. In addition to this lag in the preparation of manuscripts the printing of the reports ready for the printer may be conservatively stated as five months in arrears. With the one exception noted above no appreciable improvement in this record can be expected under present conditions, much as it is desired. The delay in making public the full results of investigations too often involves a real loss in value.

The attendance of the members of the Geological Survey shows a gratifying appreciation of the demand for increased output. The average length of the working year last year was shortened less than 25 days by the annual and sick leave actually taken. Adequate records of overtime service, for which no pay is allowed, are not available, but it is conservative to estimate that at least 3 days was added to the average year in this way, so that the year for which salary is paid includes a net loss of time not exceeding 22 days.

At the end of the year the average salary paid to the 515 members of the technical and clerical staff with headquarters in Washington was $2,480; the mean salaries permissible for each grade under the classification act for these same employees would have averaged $2,657.

WORK IN GEOLOGY

Made geologic surveys in 43 States and in the District of Columbia and Alaska, including geologic mapping, determination of stratigraphy, structure, and geologic history, and examination of mineral resources.

Cooperated with eight States in geologic work.

Continued detailed geologic mapping of the coal fields of the public-land States, preparing reports that show distribution of outcrops, thickness and quality of coal, and estimates of available tonnage.

Continued the examination of the metalliferous regions of the Western States, the resulting reports and maps indicating the distribution of ores and of the rock formations that contain or have caused the formation of the ore bodies.

At the request of the Colorado Metal Mining Fund, began a cooperative study of that part of Colorado that contains or may contain metalliferous minerals, with the primary purpose of aiding in the search for ore.

Continued the search in Texas, New Mexico, Colorado, and Utah for potash, through a study of the records of wells drilled usually for oil, obtaining data which prove that potash exists in several areas but which do not determine whether it is present in commercial quantities.

As a result of laboratory experiments, made suggestions to the oil operators in the Bradford field, Pa., that the usual water drive be modified by the introduction of an inexpensive soda solution, which under laboratory conditions greatly increases the production of oil.

Made field studies of the areas affected by the Montana and New England earthquakes of 1925. Located the point of origin of the Montana quake, and sent to press a report discussing the event fully. Issued a press bulletin giving the preliminary findings in the New England earthquake study.

Continued work in volcanology at the Hawaiian Volcano Observatory, including observations of the spectacular eruption of Mauna Loa in April.

WORK IN CHEMISTRY AND PHYSICS

Made quantitative analyses and studies of 2,621 mineral specimens and identified 3,653 specimens in response to inquiries from the public.

Tested for potash 1,800 samples from wells in Texas and New Mexico, the results confirming the conclusion that rich potash salts may be expected at relatively shallow depth.

Continued investigations of the porosity of oil sands.

Conducted temperature tests in deep wells.

Cooperated with producers in developing the field technique of the application of sodium carbonate solutions to the driving of petroleum from oil sands.

WORK IN ALASKA

Maintained eight field parties in Alaska during the field season.

Continued geologic and topographic mapping and investigation of the mineral resources of the Territory, making geologic surveys, including reconnaissance and exploratory, of 13,915 square miles, and similar topographic surveys of 9,500 square miles.

Continued the survey of Naval Petroleum Reserve No. 4, in northern Alaska, for the Navy Department.

Sent a representative to accompany the party organized by the Bureau of Aeronautics of the Navy for the airplane photographing of islands of southeastern Alaska in order to expedite topographic and geologic mapping of some 18,000 square miles of difficult territory.

Took over, by transfer from the Bureau of Mines, the supervision of the production of coal and oil on public lands in Alaska and the supervision of mine safety.

TOPOGRAPHIC WORK

Surveyed for mapping 15,535 square miles in the United States, resurveyed 1,973 square miles, made river-profile surveys of 507 miles, and ran 5,591 miles of levels.

Established 1,643 permanent bench marks, occupied 153 triangulation stations, ran 5,021 miles of transit-traverse lines, and set 1,332 permanent marks.

Mapped 838 square miles in Hawaii.

Published 61 new standard topographic maps, 15 new editions of topographic maps, 4 new or special editions of other maps, 43 river plans and profiles, advance photolithographs of 151 new topographic maps (to be engraved later), and 50 photolithographs of new topographic maps for which publication is not otherwise provided.

Maintained cooperation in topographic mapping in 24 States and Hawaii.

WORK ON WATER RESOURCES

Continued stream measurements at 1,730 gaging stations in the United States and Hawaii, 30 States cooperating, to determine the quantity of water available for irrigation, power, industrial, municipal, and domestic uses.

Conducted underground-water studies in 19 States and Hawaii.

Made 560 water analyses.

Issued monthly and annual statements on the production of electricity and consumption of fuel by public-utility power plants; also a statement on the developed water power of the United States.

Made surveys of the power or irrigation value of San Juan, Colorado, and other rivers in Colorado, Idaho, Utah, and Washington.

WORK IN CLASSIFICATION AND LEASING OF PUBLIC LANDS

Reported on 12,351 cases arising under the administration of the public-land laws.

Made classifications of public land resulting in net decreases of 313,754 acres in the total area withdrawn as possible coal land, 137,904 acres in areas withdrawn as possible oil land, and 480 acres in areas withdrawn as possible oil-shale land; also increases of 160 acres in areas withdrawn as possible phosphate land and 7,418,437 acres in areas withdrawn as possible potash land.

Reported on 5,801 applications for permits, leases, or patents under the mineral-land leasing laws.

Recommended the addition of 393,563 acres to the power-site reserves and the elimination of 35,081 acres.

Increased the area withdrawn under the Nevada ground-water reclamation act from 1,550,420 acres to 1,559,255 acres.

Recommended designations involving 705,017 acres of land available for settlement under the enlarged-homestead acts and the cancellation of designations involving 509,674 acres.

Recommended the addition of 5,466 acres to the public water reserves and the elimination of 3,591 acres.

Recommended the designation of 1,041,352 acres as stock-raising homestead land and the cancellation of designations covering 38,819 acres.

Supervised 21,273 mineral leases, licenses, and permits on public lands and naval petroleum reserves.

Supervised mineral operations on Indian lands involving 7,633 productive oil and gas wells and 86,143 acres of land containing coal, asphalt, or lead and zinc.

WORK IN PRINTING AND PUBLICATION

Edited and prepared for printing 22,342 pages of manuscript, and prepared indexes for 40 publications covering 5,686 pages.

Prepared 1,629 illustrations for reproduction in reports.

Edited for engraving 97 new topographic maps, 236 maps for reprinting, and 375 other maps.

Issued 74 books and pamphlets, including 10,133 pages; 128 new or revised maps; reprinted 188 maps—the editions aggregating 215,126 copies of books, 5,715 geologic maps and folios, and 781,947 topographic and other maps, a total of 1,002,788 copies.

Printed maps, folios, charts, etc., in a total of 3,458,459 copies, in part for 36 other Federal offices.

Distributed 227,036 books, 8,949 geologic folios, and 760,346 maps, of which 637,779 maps and folios were sold for $47,840.86.

WORK BY THE DIRECTOR

The principal activity of the Director, outside of his routine administrative duties, was service as chairman of the advisory committee selected by the four Cabinet officers forming the Federal Oil Conservation Board, to assist them in their general study of the petroleum problem. This service and the addresses given and articles written all express in some degree the public side of the Geological Survey's work, and for that reason the list of subjects or titles follows:

Participated in discussion of technical papers at meeting of Petroleum Division, American Institute of Mining and Metallurgical Engineers, Casper, Wyo., August 28.

Address on conservation, Engineering Council of Utah, Salt Lake City, August 31.

Informal talk on coal, Lions Club, Washington, September 30.

"Heat-rich areas of United States," American Society of Mechanical Engineers, New York, November 12.

"Uncle Sam as a landlord," Maine State Society of New York, December 10.

Address on conservation, American Society of Naval Engineers, Washington, March 27.

"What makes the wheels go round?" Radio talk, Bliss Electrical School, Washington, April 8.

"Theory and practice of national self-sufficiency in raw materials," Academy of Political Science, New York, May 11.

"Our energy resources," General Federation of Women's Clubs, Atlantic City, N. J., June 2.

"A world of power," printed in Economic Geography, July.

"Safeguarding the nation's natural wealth," in Current History, August.

"Uncle Sam as a landlord," Colby Alumni, Colby College, Waterville, Me.

PUBLICATIONS

The publications of the year consisted of 74 books and pamphlets of the regular series (including 1 reprint), 128 new or revised maps, 188 reprinted maps, and numerous circulars, lists of publications, etc. The total number of pages in the book publications was 10,133. Brief notices of these publications and descriptions of the areas represented by the new maps are given below, with the special purpose of showing the scope and character of the investigative work of the Geological Survey. Owing to the variety of the subjects treated and the mass of the resulting volumes, it is impossible to comply with requests from individuals for all that the Geological Survey publishes. It is believed, however, that the descriptive notes given here will indicate the value of each volume or map to some large class of users.

In addition to the publications in the regular series, 45 brief reports were issued in mimeographed form as memoranda for the press and distributed to selected lists of journals interested in the particular subjects covered, also to individuals on application.

FORTY-SIXTH ANNUAL REPORT of the Director of the Geological Survey, for the fiscal year ended June 30, 1925; George Otis Smith, Director. ii, 91 pp., 1 pl. (map).

A detailed account of the work of the Geological Survey during the year.

PROFESSIONAL PAPER 132. Shorter contributions to general geology, 1923–24; W. C. Mendenhall, chief geologist. iv, 149 pp., 44 pls. (incl. 2 maps), 11 figs.

Contains papers on rock formations in Utah, Arizona, Wyoming, Colorado, and Pennsylvania; fossils from Montana, Texas, and Idaho; the evolution and disintegration of matter; the origin of the bog-head coals; and Aniakchak Crater, Alaska.

PROFESSIONAL PAPER 136. The flora of the Ripley formation, by E. W. Berry. i–iii, 1–94 pp., 23 pls., 6 figs.

Describes a flora of 135 species, nearly all from western Tennessee. The Ripley is the youngest Upper Cretaceous formation of the eastern Gulf region. Only brief references to its fossil plants have heretofore been published.

PROFESSIONAL PAPER 138. Mining in Colorado, a history of discovery, development, and production, by C. W. Henderson. iv, 263 pp., 1 pl. (map), 20 figs.

Contains a vast amount of information about the mining industry in Colorado, beginning with a quotation from a manuscript account of the expedition that first discovered gold in the Rocky Mountains in 1858 and carrying the history down to the end of 1923. Each of the mining counties is described in detail, and the statistics of production are given both by years and by metals. The fluctuations in production are shown graphically by means of charts. A large map of Colorado shows the relief by shading, also the location of mining districts, transmission lines, and water-power plants.

PROFESSIONAL PAPER 140–A. Geology of the Latah formation in relation to the lavas of the Columbia Plateau near Spokane, Wash., by J. T. Pardee and Kirk Bryan; Flora of the Latah formation of Spokane, Wash., and Coeur d'Alene, Idaho, by F. H. Knowlton [with a note on The fossil diatom deposit at Spokane, by Albert Mann]. 85 pp., 31 pls. (incl. 1 map), 3 figs.

Describes a series of beds near Spokane, Wash., that consist mostly of clay and shale and contain abundant fossil plants of Miocene age. These beds, which attain a maximum thickness of 1,500 feet, rest on granitic and schistose rocks and are overlain by Tertiary basalt and Pleistocene gravel. The fossils are unusually well preserved and afford evidence bearing on the geologic age of the vast lava flows that form the Columbia Plateau of Oregon, Washington, and Idaho.

PROFESSIONAL PAPER 140–B. Fossil Proboscidea and Edentata of San Pedro Valley, Ariz., by J. W. Gidley. 15 pp., 13 pls., 1 fig.

A fourth report on the collection of fossil vertebrates obtained in San Pedro Valley in 1920 and 1921, describing two mastodons and a glyptodont, all new species, and giving a somewhat fuller discussion of the geology of the fossil-bearing beds than has previously been published.

PROFESSIONAL PAPER 140–C. Pleistocene plants from North Carolina, by E. W. Berry. 25 pp., 14 pls. xlv–lvii, 2 figs.

Researches in Pleistocene geology in North America have been confined almost entirely to glaciology, and little study has been given to the Pleistocene deposits south of the terminal moraines. The present paper is offered in the hope that it may stimulate interest in this neglected field of research and form part of the evidence upon which future more comprehensive conclusions may be based.

PROFESSIONAL PAPER 140–D. Shore phases of the Green River formation in northern Sweetwater County, Wyo., by W. H. Bradley. 13 pp., 5 pls. (incl. 1 map), 2 figs.

Records the results obtained from a field and office study of shore phases of the Green River formation on the northeastern margin of the Green River Basin and presents a brief summary of the writer's conclusions regarding the origin of the Green River oil shale.

PROFESSIONAL PAPER 140–E. Correlation of the Eocene formations in Mississippi and Alabama, by Wythe Cooke. 5 pp.

Points out the equivalencies of formations of different facies but of the same age in the two States. In Eocene time the site of the boundary between these States lay in the transition zone between the Mississippi embayment and the Gulf of Mexico, and the deposition in the two regions was of different types.

PROFESSIONAL PAPER 140–F. Correlation of the basal Cretaceous beds of the Southeastern States, by Wythe Cooke. 11 pp. (incl. title-page, contents, list of illustrations, and index to volume).

Reviews the evidence for the early correlation of the Cretaceous deposits that fringe the inner margin of the Coastal Plain from Alabama to North Carolina and gives the basis for the conclusion that these deposits are Upper Cretaceous.

PROFESSIONAL PAPER 143. Paleontology and stratigraphy of the Castle Hayne and Trent marls in North Carolina, by L. B. Kellum. iii, 56 pp., 11 pls. 1 fig.

Report on a paleontologic investigation undertaken to clear up certain doubtful relations in the Tertiary section of North Carolina. Through the study of fossils collected at many localities a material revision of the areal geology and stratigraphic succession has been possible.

PROFESSIONAL PAPER 145. Geology and oil and coal resources of the Oregon Basin, Meeteetse, and Grass Creek Basin quadrangles, Wyo., by D. F. Hewett. iv, 107 pp., 32 pls. (incl. 4 maps), 10 figs.

Presents the results of an investigation of an area of about 660 square miles along the west side of the Big Horn Basin, in northwestern Wyoming, in which the principal purpose was to study the nature and structure of the rocks and any other features of the region that might yield a conclusion concerning the possible presence of petroleum. When the investigation began no drilling had been done in this region, but of the twelve well-defined anticlinal folds discovered all but one have now been explored, two have become productive oil fields, and four others have yielded considerable gas. The region also contains coal in many beds that cover wide areas, but the grade and thickness do not justify extensive exploitation.

PROFESSIONAL PAPER 146. Mississippian formations of San Saba County, Tex., by P. V. Roundy, G. H. Girty, and M. I. Goldman. iv, 63 pp., 33 pls., 1 fig.

Among the methods used by progresive oil producers for studying and correlating the strata penetrated by the drill the study of fossils found in drill cuttings and the comparison of such fossils with those found in known formations at their surface exposures is of great service in many fields and in exploratory work. This paper contains descriptions of the microscopic and larger fossils found in the Mississippian formations of an area in the Mid-Continent field and a discussion of the petrology of the contact between two limestones of Ordovician and Mississippian age in the same area. The paper is the first of a projected series that will give such information for different parts of the Mid-Continent field.

BULLETIN 760. Contributions to the geography of the United States, 1923–24; M. R. Campbell, geologist in charge. iv, 130 pp., 32 pls. (incl. 3 maps), 16 figs.

Contains papers on pedestal rocks, the physical features of central Massachusetts, and erosion by solution and fill.

BULLETIN 766. Spirit leveling in California, 1896–1923; C. H. Birdseye, chief topographic engineer. ii, 748 pp., 2 pls. (incl. 1 map), 50 figs.

A consolidation of chapters already issued separately, each covering one degree of latitude and longitude.

BULLETIN 767. Geology and coal resources of the Gallup-Zuni Basin, N. Mex., by J. D. Sears. v, 53 pp., 17 pls. (incl. 3 maps), 4 figs.

The Gallup-Zuni Basin is of both economic value and geologic interest. Its commercial importance is now centered in the Gallup coal district, in which mining has been carried on for nearly half a century and which now ranks second in production among the coal districts of New Mexico. The natural wealth of the rest of the basin has been almost untouched. This report describes the geology and mineral resources of the whole basin in a general way and the coal resources in greater detail.

BULLETIN 768. Geology and oil resources of the Puente Hills region, southern California, by W. A. English, with a section on the chemical character of the oil by P. W. Prutzman. v, 110 pp., 14 pls. (incl. 9 maps), 3 figs.

Report on an area 25 miles square lying 10 miles east of Los Angeles, of which about a third is hilly or mountainous and the remainder is highly cultivated valley land including some of the most valuable citrus land in the State. This area contains nine productive oil fields, whose combined output is normally a third of the State's total. The purpose of such reports is to lead to the more efficient development of known resources and to aid wildcatters in finding new pools with a minimum of unsuccessful drilling.

BULLETIN 771. Ore deposits of the Saddle Mountain and Banner mining districts, Ariz., by C. P. Ross. vii, 72 pp., 17 pls. (incl. 4 maps), 6 figs.

Describes an area of about 56 square miles in Pinal and Gila Counties, Ariz., which contains ores of copper, lead-silver, zinc, gold, and vanadium. Over 550,000 tons of copper ore has been shipped from this area; the output of the other ores has been small.

BULLETIN 773–D. Petroleum on Alaska Peninsula: Mineral resources of the Kamishak Bay region, by K. F. Mather; The Cold Bay-Katmai district, by W. R. Smith; The outlook for petroleum near Chignik, by G. C. Martin. 63 pp., 3 pls. (maps).

Three papers describing the geography and geology of parts of Alaska Peninsula, with special reference to the occurrence of oil.

BULLETIN 773–E. Geology and gold placers of the Chandalar district, Alaska, by J. B. Mertie, jr. 52 pp., 1 pl., 4 figs.

Describes an area of about 4,000 square miles including most of the valley of Chandalar River, north of the Arctic Circle, covered by a geologic study of about 75 days in 1923. Gold is the only metal mined in this area and is obtained from placers. The total production to the end of 1923 amounted to nearly $300,000.

BULLETIN 773. Mineral resources of Alaska, report on progress of investigations in 1923, by A. H. Brooks and others. iii, 267, 15 pp., 6 pls. (maps), 11 figs.

Contains nine papers on mineral deposits in different parts of Alaska. This bulletin is the twentieth annual volume of the Alaskan series.

BULLETIN 774. The copper deposits near Salmon, Idaho, by C. P. Ross. iv, 44 pp., 5 pls. (incl. 1 map), 7 figs.

Describes the geology of a district that contains a number of copper deposits in which the ore is of moderate to high grade and the geologic and topographic conditions are rather favorable to mining on a small scale. The author concludes that the copper was deposited by solutions emanating from the magma of the great granite batholith of central Idaho.

BULLETIN 776. The Mesozoic stratigraphy of Alaska, by G. C. Martin. xii, 493 pp., 13 figs.

Mesozoic fossils found by Russian explorers on the Alaska Peninsula before the middle of the nineteenth century were the first features of geologic interest definitely recognized in Alaska. With the progress of areal geologic surveys during the last 25 years it has come to be recognized that the Mesozoic rocks, because of their wide distribution and the great range in the periods of their deformation and intrusion, afford the most important clues to the geologic history of the Territory. The deciphering of the Mesozoic history also has a direct bearing on the mineral resources of Alaska. This bulletin summarizes the results obtained by two score geologists in investigations covering more than 20 years.

BULLETIN 777. Pre-Cambrian rocks of Gunnison River, Colo., by J. F. Hunter. vi, 94 pp., 15 pls. (incl. 1 map), 5 figs.

Gives a detailed description of the pre-Cambrian complex of metamorphic and igneous rocks that wall the canyons of Gunnison River and its larger tributaries.

BULLETIN 778. Chemistry of deposition of native copper from ascending solutions, by R. C. Wells. ii, 71 pp., 2 figs.

Presents the results of an investigation made to determine the chemical changes involved in the deposition of native copper in the Lake Superior district. The investigation was made in connection with a geologic study of the ore deposits and covered a problem concerning which little or no information was available. It included 165 chemical experiments, which are set forth in detail in this report. Much of the information is suggestive for other conditions and districts.

BULLETIN 779. Guides to ore in the Leadville district, Colo., by G. F. Loughlin, iii, 37 pp., 7 pls. (incl. 1 map), 4 figs.

Presents in brief form the data of most value to mine operators and their engineers from the exhaustive report on the Leadville mining district just sent to press, in order to focus attention more sharply on the problems of ore hunting. The general geology is summarized, and the occurrence and significance of the guides now available in the search for ore are set forth. Some "guides" that may be more aptly termed "detour signs" are also described.

BULLETIN 780–B. Geology of a part of western Texas and southeastern New Mexico, with special reference to salt and potash, by H. W. Hoots. 99 pp. 15 pls. (incl. 2 maps), 1 fig.

A report on the progress made in the search for potash in the vast salt deposits of the Southwest, which extend over a region several hundred miles in length and at least 200 miles in width. The information already obtained indicates the existence in this region of potash reserves of probable commercial value within practicable reach from the surface. The investigation so far has been largely haphazard and carried on principally by examination of samples from wells drilled for oil. The surprising results obtained from such work justify systematic field investigations that will test the region thoroughly.

BULLETIN 780–C. Platinum near Centennial, Wyo., by F. L. Hess. 11 pp., 1 fig.

Commercially valuable deposits of platinum are rare, and this paper sets forth the results of a brief investigation made because of press reports of platinum discoveries near Centennial. The author concludes that although platinum metals are undoubtedly present on Centennial Ridge they occur in very small quantities.

BULLETIN 780–D. Antimony and quicksilver deposits in the Yellow Pine district, Idaho, by F. C. Schrader and C. P. Ross. 39 pp. (incl. title-page, contents, list of illustrations, and index to volume), 2 pls. (incl. 1 map), 4 figs.

The Yellow Pine district contains considerable deposits of antimony and quicksilver, but owing to the inaccessibility of the region and the lack of adequate development the output has been small. The showings so far made, however, are sufficiently favorable to justify further development, and this paper gives a summary of the available information on the district.

BULLETIN 781–A. Paleozoic formations penetrated by wells in Tishomingo County, northeastern Mississippi, by M. N. Bramlette; with Notes on Paleozoic rocks encountered in a well near Florence, Ala., by H. D. Miser. 14 pp., 1 pl.

Reports on a detailed study of drill cuttings from three wells drilled for oil, giving information that is of great value to the oil prospector.

BULLETIN 781–B. Geology of the Baxter Basin gas field, Sweetwater County, Wyo., by J. D. Sears. 22 pp. (incl. title-page, contents, list of illustrations, and index to volume), 5 pls. (incl. 1 map), 1 fig.

The discovery of gas in commercial quantity in Baxter Basin, the structurally highest part of the Rock Springs anticline, brought a demand for further information concerning the structure and extent of the field, the relation of the gas to the structure, and the possibility of the occurrence of oil. This report presents the results of a detailed study undertaken to obtain information on these subjects.

BULLETIN 781. Contributions to economic geology (short papers and preliminary reports), 1925, Part II, Mineral fuels; W. T. Thom, jr., geologist in charge. iii, 29 pp., 6 pls. (incl. 1 map), 1 fig.

Contains papers on Paleozoic formations penetrated by wells in Mississippi and Alabama and the Baxter Basin gas field, Wyoming.

BULLETIN 783–A. Mineral industry of Alaska in 1924 and Administrative report, by P. S. Smith; Selected list of Survey publications on Alaska. 58 pp.

The first chapter of the annual volume on the Geological Survey's work in Alaska. The total value of the mineral output to the end of 1924 is given as more than $535,000,000, of which more than $500,000,000 is in gold and copper. Alaska's minerals form less than half the total wealth of the Territory, which is shown to be really a treasure box and not the liability which some people suppose it to be.

BULLETIN 785–A. Recent developments in the Aspen district, Colorado, by Adolph Knopf. 30 pp., 1 pl. (map), 6 figs.

The Aspen district was mapped and studied with great detail 30 years ago. Mining in the area then surveyed has come to a standstill, but recent exploratory work a little farther south has led to a demand for a southward extension of the early survey. This report sets forth the results obtained in an investigation designed to meet that demand. It contains a geologic map of the district, including the southern area, in which the recent work has been done.

BULLETIN 785–B. Potash investigations in 1924, by W. B. Lang. 17 pp., 1 pl. (map), 2 figs.

Progress report on the investigations made by the Geological Survey in the Southwest, mainly in Texas, in search of potash in the Permian salt beds. Records some notable contributions to knowledge that serve to strengthen the conviction that the presence of commercial beds of potash in this region will eventually be proved.

WATER-SUPPLY PAPER 499. The Papago country, Arizona, a geographic, geologic, and hydrologic reconnaissance, with a guide to desert watering places, by Kirk Bryan. xviii, 436 pp., 27 pls., 41 figs.

The Papago country, which lies south of Gila River, between Tucson and Yuma, until recently has been rarely visited by white men, for it has seemed waterless and formidable—a desert that has perhaps taken a larger toll of human life than any other arid section of the United States—yet for unknown generations it has provided a home and livelihood for a simple-hearted, peace-loving tribe of Indians. In recent years the Papago country has become much more accessible through the use of automobiles, the establishment of a mining camp, and the building of a railroad. This report contains a vast amount of information, in large part original, obtained by the author in the field. It includes a brief but vivid historical sketch, by F. L. Ransome, which goes back to the era of Spanish exploration. The report is as nearly a complete physical geography as it is possible to write. The main emphasis, however, is placed on the water resources of this region, which are described in much detail. A guide to watering places includes road logs giving measured distances, supplemented by descriptive notes.

WATER-SUPPLY PAPER 520. Contributions to the hydrology of the United States, 1923–24; N. C. Grover, chief hydraulic engineer. iv, 129 pp., 12 pls. (incl. 2 maps), 11 figs.

Contains papers on run-off and floods in the Rocky Mountain region; water supplies for Enid, Okla.; power resources of Snake River, Oreg.-Idaho; base exchange in ground water; artesian-water supply of the Dakota sandstone in North Dakota; and temperature of water available for industrial use.

WATER-SUPPLY PAPER 522. Surface water supply of the United States, 1921, Part II, South Atlantic slope and eastern Gulf of Mexico basins; N. C. Grover, chief hydraulic engineer; A. H. Horton, G. C. Stevens, and W. E. Hall, district engineers. iv, 72 pp., 2 pls.

WATER-SUPPLY PAPER 526. Surface water supply of the United States, 1921, Part VI, Missouri River basin; N. C. Grover, chief hydraulic engineer; W. A. Lamb, Robert Follansbee, E. D. Burchard, R. C. Rice, and E. L. Williams, district engineers. vii, 331 pp., 2 pls.

WATER-SUPPLY PAPER 529. Surface water supply of the United States, 1921, Part IX, Colorado River basin; N. C. Grover, chief hydraulic engineer; Robert Follansbee, A. B. Purton, and R. C. Rice, district engineers. v, 181 pp., 2 pls.

WATER-SUPPLY PAPER 533. Surface water supply of the United States, 1921, Part XII, North Pacific slope drainage basins: B, Snake River basin; N. C. Grover, chief hydraulic engineer; G. C. Baldwin, G. L. Parker, C. G. Paulsen, A. B. Purton, and F. F. Henshaw, district engineers. vi, 292 pp., 2 pls.

WATER-SUPPLY PAPER 534. Surface water supply of the United States, 1921, Part XII, North Pacific slope drainage basins: C, Lower Columbia River basin and Pacific slope drainage basins in Oregon; N. C. Grover, chief hydraulic engineer; F. F. Henshaw and G. L. Parker, district engineers. v, 171 pp., 2 pls.

Five of the annual reports on stream gaging, covering the year ending Sept. 30, 1921.

WATER-SUPPLY PAPER 542. Surface water supply of the United States, 1922, Part II, South Atlantic slope and eastern Gulf of Mexico basins; N. C. Grover, chief hydraulic engineer; A. H. Horton, W. R. King, and W. E. Hall, district engineers. iv, 74 pp., 2 pls.

WATER-SUPPLY PAPER 543. Surface water supply of the United States, 1922, Part III, Ohio River basin; N. C. Grover, chief hydraulic engineer; A. H. Horton, Lasley Lee, H. E. Grosbach, W. R. King, and W. E. Hall, district engineers. vi, 262 pp., 2 pls.

WATER-SUPPLY PAPER 544. Surface water supply of the United States, 1922, Part IV, St. Lawrence River basin; N. C. Grover, chief hydraulic engineer; S. B. Soulé, A. H. Horton, Lasley Lee, C. C. Covert, A. W. Harrington, and C. H. Pierce, district engineers. iv, 140 pp., 2 pls.

WATER-SUPPLY PAPER 545. Surface water supply of the United States, 1922. Part V, Hudson Bay and upper Mississippi River basins; N. C. Grover, chief hydraulic engineer; W. A. Lamb, S. B. Soulé, E. D. Burchard, J. B. Spiegel, H. E. Grosbach, and E. L. Williams, district engineers. v, 197 pp., 2 pls.

WATER-SUPPLY PAPER 546. Surface water supply of the United States, 1922, Part VI, Missouri River basin; N. C. Grover, chief hydraulic engineer; W. A. Lamb, Robert Follansbee, J. B. Spiegel, and E. L. Williams, district engineers. vii, 349 pp., 2 pls.

WATER-SUPPLY PAPER 547. Surface water supply of the United States, 1922, Part VII, Lower Mississippi River basin; N. C. Grover, chief hydraulic engineer; E. L. Williams and Robert Follansbee, district engineers. iv, 106 pp., 2 pls.

WATER-SUPPLY PAPER 548. Surface water supply of the United States, 1922, Part VIII, Western Gulf of Mexico basins; N. C. Grover, chief hydraulic engineer; C. E. Ellsworth, district engineer. iv, 124 pp., 2 pls.

WATER-SUPPLY PAPER 552. Surface water supply of the United States, 1922, Part XII, North Pacific slope drainage basins: A, Pacific basins in Washington and upper Columbia River basin; N. C. Grover, chief hydraulic engineer; G. L. Parker and W. A. Lamb, district engineers. v, 203 pp., 2 pls.

Eight of the annual reports on stream gaging for the year ending September 30, 1922.

WATER-SUPPLY PAPER 556. Water power and flood control of Colorado River below Green River, Utah, by E. C. LaRue, with a foreword by Hubert Work, Secretary of the Interior. x, 176 pp., 79 pls. (incl. 42 maps), 1 fig.

The drainage basin of Colorado River covers 244,000 square miles and lies in seven States and Mexico, and the problems of developing the resources of the river are of interstate and international interest. No other river on this continent affords such enormous opportunities for the use of its water for both irrigation and water power. The canyon section of the river contains the second largest concentration of water-power sites in the United States. Although dams in the canyon would create stretches of slack water, nowhere would any appreciable part of the beautiful canyon walls be submerged. Irrigation is already practiced to a considerable extent in the upper part of the basin, in Wyoming, Colorado, and Utah, and below the canyon section there are great areas of fertile land that can be made productive if irrigated. The most urgent need of the basin is flood protection for cities, towns, and large irrigated areas on the lower river. The complexity of the problems involved in the development of the vast resources of this basin requires a knowledge of the essential engineering facts to serve as a guide. Such a knowledge this paper is intended to afford. Colorado River has been under observation, survey, and study since the end of the Civil War, and the Geological Survey's investigations have covered many years. The author prepared the first comprehensive report on the river, issued in 1916, and has since worked almost continuously on studies within the basin, having made boat trips on the river and its tributaries aggregating nearly 2,000 miles and taken over a thousand photographs. The paper contains also a brief geologic report on the inner gorge of the Grand Canyon, by R. C. Moore.

WATER-SUPPLY PAPER 558. Preliminary index to river surveys made by the United States Geological Survey and other agencies, by B. E. Jones and R. O. Helland. iv, 108 pp., 2 pls. (maps).

A compilation prepared primarily for the use of Government bureaus to afford information concerning the rivers on which surveys have been made by Federal, State, semipublic, and private agencies and concerning the character of the available maps based on such surveys. The list is arranged by States and drainage basins.

WATER-SUPPLY PAPER 560-D. Preliminary report on the geology and water resources of the Mud Lake basin, Idaho, by H. T. Stearns and L. L. Bryan. 55 pp. (incl. title-page, contents, list of illustrations, and index to volume), 2 pls. (maps), 2 figs.

Report on an investigation made to afford a basis for intelligent decision regarding numerous land and water filings in a region whose water supply had never been adequately determined and had within the last 25 years notably increased.

WATER-SUPPLY PAPER 560. Contributions to the hydrology of the United States, 1925; N. C. Grover, chief hydraulic engineer. iii, 134 pp., 2 pls.

Contains papers on water power and irrigation in the Madison River basin, Mont.; the chemical character of ground waters of the northern Great Plains; and the geology and water resources of the Mud Lake basin, Idaho; also an index of analyses of natural waters in the United States.

WATER-SUPPLY PAPER 561. Surface water supply of the United States, 1923, pt. 1, North Atlantic slope drainage basins; N. C. Grover, chief hydraulic engineer; C. H. Pierce, A. W. Harrington, O. W. Hartwell, and A. H. Horton, district engineers. vi, 294 pp., 3 pls.

WATER-SUPPLY PAPER 562. Surface water supply of the United States, 1923, Part II, South Atlantic slope and eastern Gulf of Mexico basins; N. C. Grover, chief hydraulic engineer; A. H. Horton, W. E. Hall, and W. R. King, district engineers. iv, 86 pp., 3 pls.

WATER-SUPPLY PAPER 563. Surface water supply of the United States, 1923, Part III, Ohio River basin; N. C. Grover, chief hydraulic engineer; A. H. Horton, Lasley Lee, H. E. Grosbach, W. R. King, and W. E. Hall, district engineers. vi, 258 pp., 3 pls.

WATER-SUPPLY PAPER 567. Surface water supply of the United States, 1923, Part VII, Lower Mississippi River basin; N. C. Grover, chief hydraulic engineer; E. L. Williams, H. C. Beckman, Robert Follansbee, and H. B. Kinnison, district engineers. iv, 122 pp., 3 pls.

WATER-SUPPLY PAPER 572. Surface water supply of the United States, 1923, Part XII, North Pacific slope drainage basins: A, Pacific basins in Washington and upper Columbia River basin; N. C. Grover, chief hydraulic engineer; G. L. Parker and W. A. Lamb, district engineers. v, 193, li pp., 3 pls.

Five of the annual reports on stream gaging for the year ending September 30, 1923.

MINERAL RESOURCES OF THE UNITED STATES, 1922. Parts I and II.

MINERAL RESOURCES OF THE UNITED STATES, 1923. 4 advance chapters.

MINERAL RESOURCES OF THE UNITED STATES, 1924. 7 advance chapters.

GEOLOGIC FOLIO 220. Gillespie-Mount Olive, Ill., by Wallace Lee. 14 folio pages of text, 4 maps, 16 figs.

Describes the geology of an area of 463 square miles in west-central Illinois, a part of the Till Plains section of the Central Lowland physiographic province. The ice sheets that covered this area filled many depressions with drift and rounded the irregularities of the surface, leaving a fairly smooth plain, which has since been moderately dissected by stream erosion. The area is well but not thickly settled and is crossed by eight railroads. The bedrocks are of sedimentary origin and consist of nearly horizontal beds of shale, sandstone, limestone, and coal, which are almost entirely concealed by unconsolidated surficial deposits. The chief mineral resource of this area is coal, of which about 8,000,000 tons was produced in 1924. The area has also yielded small quantities of oil and gas.

TOPOGRAPHIC AND OTHER MAPS as follows. The maps marked with an asterisk (*) were published also with green overprint showing woodland.

Alabama

* GRAVELLY SPRINGS: Latitude, 34° 45′ to 35°; longitude, 87° 45′ to 88°. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Lauderdale and Colbert Counties, in the Highland Rim Plateau, whose upland surface stands about 600 to 900 feet above sea level. Tennessee River flows across the area in a shallow valley with a flood plain a mile wide that lies 400 feet above the sea. The southeastern half of the area is gently rolling, with broad, shallow valleys and with more or less nearly level land on the divides. There are numerous sink holes and larger depressions without surface drainage, and a number of them contain small ponds. The northwestern part is more rugged, having been rather completely dissected by streams that flow in valleys 200 to 400 feet deep, with narrow flood plains.

Alaska

ALASKA (map showing distribution of mineral deposits). Scale, 1 inch=approximately 80 miles. Size, 19 by 26 inches.

Revised edition of a map of Alaska showing, by colored symbols, the known or suspected distribution of coal deposits and the location of metalliferous mines, marble quarries, petroleum seepages, etc.

Arizona

STATE OF ARIZONA (relief map). Scale, 1 inch=approximately 8 miles; no contour lines. Size, 56 by 44 inches.

Shaded relief map in which the physical features are brought out by an overprint in shades of brown. The water features are shown in blue. The map displays clearly the difference in altitude and relief between the northeastern half of the State, which is part of the Colorado Plateaus, and the southwestern half, which is part of the Basin and Range province. The Grand Canyon and the canyons of several smaller streams are conspicuous features in the northwestern part, and the broad, nearly level plains that occupy the valleys between the numerous small mountain ranges are equally conspicuous in the southwestern part. San Francisco Mountain, somewhat north of the center of the State, although the highest point in Arizona, rises so little above the Coconino Plateau, on which it stands, that it is not conspicuous on the shaded map. The Roosevelt Reservoir, near Phoenix, a wholly artificial lake, stands out strikingly in a region notable for its general aridity.

California

* ALHAMBRA: Latitude 34° to 34° 6′; longitude, 118° 6′ to 118° 12′. Scale, 1 inch=2,000 feet; contour intervals, 5 and 25 feet.

Map of part of Los Angeles County, just east of the city of Los Angeles. A range of irregular hills, separated by transverse gulches 200 to 400 feet deep, extends southeastward across the area. The altitude of the summits ranges from 550 to 882 feet. The relief of the lower slopes of the hills is shown by 5-foot contours, but above 500 feet the contour interval is 25 feet, and the map thus gives the upper slopes of the hills a deceptive appearance of flatness, as compared with the lower slopes. The northeastern part of the area has a rolling surface, nearly all of which lies less than 500 feet above sea level and has a general easterly slope. The southwestern part has a similar rolling surface, mainly less than 300 feet above the sea, which descends southward, toward the coast. There are no permanent streams in the area, and the only bodies of water are a few small reservoirs.

*ARTESIA: Latitude, 33° 48′ to 33° 54′; longitude, 118° to 118° 6′. Scale, 1 inch=2,000 feet; contour interval, 5 feet.

Map of a small part of Los Angeles County, in the coastal plain of southern California. Only the northwest half of the Artesia quadrangle is shown. Most of the area is a plain whose surface descends gently from 88 to 17 feet above sea level and is trenched slightly by the channels of San Gabriel River and other small wet-weather streams. In the northeast corner low outliers of the Puente Hills reach an altitude of 190 feet.

* BELL: Latitude, 33° 54′ to 34°; longitude, 118° 6′ to 118° 12′. Scale, 1 inch=2,000 feet; contour interval, 5 feet.

Map of part of Los Angeles County, in the coastal plain of southern California, whose gently rolling surface ranges in altitude from 75 to 200 feet. There are no permanent streams, but the area is crossed by Los Angeles and San Gabriel Rivers and Rio Hondo, all intermittent streams, parts of whose courses have been straightened and confined between levees.

CARUTHERS: Latitude, 36° 30′ to 36° 37′ 30″; longitude, 119° 45′ to 119° 52′ 30″. Scale, 1 inch=½ mile; contour interval, 5 feet.

Map of part of Fresno County, in San Joaquin Valley, between San Joaquin and Kings Rivers. The area is a slightly irregular plain that descends from 280 to 225 feet above sea level. The most striking features of the topography are numerous small, irregular southeastward-trending depressions whose bottoms are 5 to 15 feet below the general level and whose origin has not been determined. A line of deeper depressions that appears to mark a former overflow of Kings River trends southwestward across the southern part of the area. There are no permanent streams, but the area is crossed by several irrigation ditches.

* CLEARWATER: Latitude, 33° 48′ to 33° 54′; longitude, 118° 6′ to 118° 12′. Scale, 1 inch=2,000 feet; contour interval, 5 feet.

Map of part of Los Angeles County, in the coastal plain of southern California, whose gently rolling surface descends from 80 to 15 feet above sea level. The area is crossed by a range of low hills which culminate in Signal Hill, 360 feet above sea level, at the southern margin. The area includes a portion of the famous Signal Hill oil field.

HELM: Latitude, 36° 30′ to 36° 37′ 30″; longitude, 120° to 120° 7′ 30″. Scale, 2 inches=1 mile; contour interval, 5 feet.

Map of part of Fresno County, in San Joaquin Valley, between San Joaquin and Kings Rivers. The area is a nearly flat plain lying 180 to 210 feet above sea level and marked by small, irregular mounds and hollows 5 to 10 feet above or below the general level. In the eastern part are a few low alluvial ridges formed by distributaries of Kings River, the former channel of which, occupied when the river flowed to the San Joaquin, crosses the area in a northwesterly direction.

HOLLYWOOD: Latitude, 34° to 34° 6′; longitude, 118° 18′ to 118° 24′. Scale, 1 inch=2,000 feet; contour intervals, 5 and 25 feet.

Map of an area in Los Angeles County, including the west-central part of the city of Los Angeles. The northwest corner lies on the southern slope of the Santa Monica Mountains, and a little of the southern part lies in the Baldwin Hills. The highest point is on a spur of the Santa Monica Mountains at 1,025 feet above sea level. The southern and western parts of the area are occupied chiefly by a rolling plain, whose surface slopes gently from the base of the surrounding hills to less than 100 feet above sea level along the streams. Much of the more densely built-up portion of Los Angeles lies on a terrace at a little more than 200 feet above sea level. The north-central part of the area is occupied by the famous La Brea oil field, in which are the asphalt pits from which so many interesting remains of extinct animals have been exhumed. The relief of the parts of the area that lie more than 500 feet above sea level is shown by 25-foot contour lines, which give a deceptive appearance of flatness to the higher slopes.

* LONG BEACH: Latitude, 33° 44′ to 33° 48′; longitude, 118° 5′ to 118° 12′. Scale, 1 inch=2,000 feet; contour interval, 5 feet.

Map of part of Los Angeles County, along the coast of San Pedro Bay at the east end of the San Pedro Hills. The greater part of the area is occupied by irregular hills, culminating in Signal Hill, 360 feet above sea level. The eastern part, which lies in the coastal plain of southern California, is less than 20 feet above sea level and is largely occupied by marshes and lagoons along the course of San Gabriel River. As shown by underwater contours, the flat surface of the plain extends southward beneath the Pacific. A part of the famous oil field of Signal Hill lies at the northern margin.

RAISIN: Latitude, 36° 30′ to 36° 37′ 30″; longitude, 119° 52′ 30″ to 120°. Scale, 1 inch=½ mile; contour interval, 5 feet.

Map of an area in Fresno County, in San Joaquin Valley. The surface descends very gently from 245 to 195 feet above sea level and is almost featureless, except for many small, irregular knolls and hollows, whose origin is problematical.

SAN JOAQUIN: Latitude, 36° 30′ to 36° 37′ 30″; longitude, 120° 7′ 30″ to 120° 15′. Scale, 1 inch=½ mile; contour interval, 5 feet.

Map of part of Fresno County, in San Joaquin Valley. The area is a flat, almost featureless valley floor that lies 165 to 185 feet above sea level throughout most of the area but rises gently to 245 feet in the southwest corner. A small stream called Fresno Slough flows across the area, and several irrigation canals lead from it to the adjacent territory.

* SAWTELLE: Latitude, 34° to 34° 6′; longitude, 118° 24′ to 118° 30′. Scale, 1 inch=2,000 feet; contour intervals, 5 and 25 feet.

Map of a small area in Los Angeles County, extending from the south slope of the the Santa Monica Mountains to Venice and Santa Monica Bay. The lowlands in the southern part of the area are represented with a contour interval of only 5 feet; the northern part, where the surface is more rugged, is represented with a contour interval of 25 feet. This change of interval gives to the lower country the appearance of greater relief and to the mountain area the appearance of less relief than it really has. The altitude ranges from sea level on Santa Monica Bay to 1,600 feet in the mountains. The map shows excellently the flat-bottomed arroyos that are so characteristic of erosion in the soft sediments composing the mountain slopes.

*WHITTIER: Latitude, 33° 54′ to 34°; longitude, 118° to 118° 6′. Scale, 1 inch=2,000 feet; contour interval, 5 and 25 feet.

Map of part of Los Angeles County at the base of the Puente Hills, which reach an altitude of 1,387 feet. The change of contour interval at the 500-foot level causes the higher slopes of these hills to appear less steep than they really are. A lower range of hills crosses the southern part of the area. The rest of the area lies in the coastal plain of southern California, at 80 to 150 feet above sea level. Its northwest corner is crossed by the channel of San Gabriel River, an intermittent stream. The map shows a large group of oil wells in the Puente Hills and another in the western part of the area.

WILMINGTON: Latitude, 33° 42′ to 33° 48′; longitude, 118° 12′ to 118° 18′. Scale, 1 inch=2,000 feet; contour interval, 5 feet.

Map of an area in Los Angeles County, situated on the coast and chiefly in the coastal plain of southern California. The western margin lies on the eastern slope of the San Pedro Hills, which rise 300 feet above sea level at one point in the reservation of Fort McArthur, back of Point Fermin. In the northern part of the area the surface slopes gently southeastward from 45 feet above sea level to the shore. Along the coast a belt 1 to 2 miles wide lies but a few feet above sea level and is so nearly flat that part of it is marshy. The artificial harbor of Los Angeles, which lies within this area, adjoining San Pedro, has been constructed largely by excavating and dredging in this low belt. Under-water contour lines show that the adjacent sea bottom in San Pedro Bay and the Pacific Ocean is very flat and slopes gently southeastward in continuation of the slope of the coastal plain on the land.

California-Oregon

KLAMATH RIVER. Plan and profile of Klamath River, Calif.-Oreg. (below Keno). Scale, 1 inch=4,000 feet; contour intervals, on land 25 feet, on river surface 5 feet; vertical scale of profiles, 1 inch=40 feet. Size, 19 by 21 inches. 16 sheets (9 plans, 7 profiles).

Sheets A to I show the course of Klamath River and its principal tributaries—Scott, Trinity, and Salmon Rivers—and part of South Fork of Smith River, the relief of the immediately adjacent slopes, and the position of bridges, ferries, dam sites, roads, and settlements. Sheets J to P show the profiles of the streams throughout the stretches mapped. Comparison of the profiles with the plans shows the relation of the stream grade to the width of the valley bottom, the extent of alluviation, and the character of the bordering slopes.

District of Columbia

[See Maryland-Virginia-District of Columbia]

Hawaii

* KAHULUI: Latitude, 20° 45′ to 21°; longitude, 156° 15′ to 156° 30′. Scale, 1 inch=1 mile; contour interval, 50 feet.

Map of the north-central part of Maui, mainly on the northwest slope of the great volcanic cone of the island. The western part of the area includes the neck that joins the two parts of the island and a portion of the south shore. The southeast corner stands 7,700 feet above sea level, and the surface slopes northward and westward to the shore. The ravines that furrow the northern slope are notably deeper and sharper than those on the western slope because of the heavier rainfall on the north side.

* LAHAINA: Latitude, 20° 47′ 30″ to 21° 2′ 30″; longitude, 156° 30′ to 156° 42′ 30″. Scale, 1 inch=1 mile; contour interval, 50 feet.

Map of part of the Island of Maui, including all the peninsula west of the isthmus that joins it to the main island. The whole land area consists of the summit and slopes of the volcano Puukukui, whose highest point is 5,788 feet above sea level. Several other prominent peaks stand at altitudes of 4,000 to 5,000 feet on the slopes of the central mass, which is deeply furrowed by ravines radiating in all directions to the coast. The rimless Eke Crater, on the northern slope of Puukukui, 2 miles from the summit, has a level marshy floor 4,480 feet above sea level.

Idaho

SALMON RIVER. Plan and profile of Salmon River, Salmon to Stanley. Scale, 1 inch=½ mile; contour intervals, on land 25 feet, on river surface 5 feet; vertical scale of profiles, 1 inch=40 feet. Size, 19 by 20 inches. 7 sheets (4 plans, 3 profiles).

Sheets A to D show the course of the river, the location of dam sites and bridges, and the highways adjacent to the stream. The contour lines bring out the contrast between the wide, flat-bottomed valley with low bordering slopes where the river is flowing across a plain, and the narrow, steep-sided valley where the river is flowing through the foothills. Sheets E to G show the profile of the river throughout the stretch mapped.

Illinois

[See also Kentucky-Illinois and Missouri-Illinois]

* CARLINVILLE: Latitude, 39° 15′ to 39° 30′; longitude, 89° 45′ to 90°. Scale, 1 inch=1 mile; contour interval, 10 feet.

Map of an area in Macoupin County, in the Till Plains. The general surface is a rolling prairie that descends gently from 690 to 620 feet above sea level. A small eminence called Coops Mound, 5 miles northeast of Carlinville, rises 60 feet above the prairie. Several creeks flow southwestward in small valleys 40 to 60 feet deep with narrow flood plains in which lie a few small abandoned meanders.

*ELGIN: Latitude, 42° to 42° 15′; longitude, 88° 15′ to 88° 30′. Scale, 1 inch=1 mile; contour interval, 10 feet.

Map of an area about 30 miles west of Chicago that lies mainly in McHenry and Kane Counties but includes a small part of Cook County. The general aspect of the area is that of a plain at an altitude of about 900 feet, above which stand ridges and irregular masses of morainic drift. The principal ridge rises to 1,060 feet. Fox River, which flows south along the east margin of the area, has cut a trench in the plain nearly 200 feet deep. This trench contains several abandoned meanders, the most perfect of which is a complete loop just below West Dundee. Meander scars back of Carpentersville and near Meadowdale School show that the river formerly flowed in a very much more crooked course.

*HARRISBURG: Latitude, 37° 30′ to 37° 45′; longitude, 88° 30′ to 88° 45′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Saline, Pope, Williamson, and Johnson Counties, partly in the Till Plains and partly in the upland of southern Illinois. The northern part is occupied mainly by groups of low irregular hills that rise 500 to 600 feet above sea level, with slopes much furrowed by small ravines. The groups of hills are separated and more or less surrounded by flat, prairie-like valleys that lie 300 to 400 feet above sea level. South Fork of Saline River and several smaller streams flow through the valleys in courses so devious that at many places they have been artificially straightened to improve the drainage. The southern part is a closely dissected hilly tract in which the hilltops stand 700 to 860 feet above sea level and the small narrow valleys have been cut to a depth of 100 feet or more.

* HAVANA: Latitude, 40° 15′ to 40° 30′; longitude, 90° to 90° 15′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Fulton and Mason Counties, in the Till Plains, whose general surface lies 600 to 680 feet above sea level. Considerable level upland still remains on the main divides, but near the larger valleys the margins of the upland are much dissected by small ravines 40 to 100 feet deep. Illinois River crosses the area in a valley 3 miles wide with a floor so flat that it is subject to inundation, and the streams crossing it are largely confined between levees. The part of the area southeast of Illinois River is a broad terrace 40 to 60 feet above the stream, on which stand numerous irregular knolls 20 to 60 feet high that have the appearance of old sand dunes.

* MARION: Latitude, 37° 30′ to 37° 45′; longitude, 88° 45′ to 89°. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Williamson and Johnson Counties, partly in the Till Plains and partly in the upland of southern Illinois. The greater part lies in the upland, a region of irregular hills and sinuous ridges, whose summits stand 550 to 800 feet above sea level. The hills are separated by valleys 50 to 150 feet in depth. Some of these valleys are narrow and V-shaped; others have flood plains as much as a mile in width, on which the streams meander, in small loops. The northwest corner is a till plain whose rolling surface stands 400 to 500 feet above sea level.

* YORKVILLE: Latitude, 41° 30′ to 41° 45′; longitude, 88° 15′ to 88° 30′. Scale, 1 inch=1 mile; contour interval, 10 feet.

Map of an area in Kendall, Will, and Du Page Counties, in the Till Plains close to their northeastern margin. The surface is a rolling plain 600 to 680 feet above sea level, across which Fox River flows in a sinuous trench 50 to 100 feet deep. A belt of morainal hills, whose summits stand 750 to 800 feet above sea level, extends across the west-central part of the area, and a similar but lower belt extends along the east side. Part of the city of Aurora lies just within the northern part of the area.

Kentucky

* SPRING LICK: Latitude, 37° 15′ to 37° 30′; longitude, 86° 30′ to 86° 45′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of parts of Butler, Ohio, and Grayson Counties, in the Highland Rim Plateau, whose general surface stands 600 to 700 feet above sea level and descends gently westward. The upland is rather completely dissected by valleys 250 to 300 feet deep, most of which are V-shaped or have narrow flood plains, but the valleys of Green River and Caney Creek have flood plains nearly a mile wide, which lie 400 to 450 feet above sea level.

Kentucky-Illinois

CAVE IN ROCK: Latitude, 37° 15′ to 37° 30′; longitude, 88° to 88° 15′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Crittenden, Livingston, and Caldwell Counties, Ky., and Hardin County, Ill., in the low hilly upland that borders the Highland Rim Plateau on the northwest. The upland surface, which is so much dissected that there is almost no level land on the divides, stands 600 to 700 feet above sea level, and a few summits rise to nearly 800 feet. The valleys are cut 100 to 300 feet below the upland, and Ohio River flows across the area in a valley 1 to 2 miles wide whose nearly flat floor is 340 feet above sea level. Small lime sinks, some of which contain ponds, are abundant in part of the area, especially on the Illinois side of the river. Earlier editions of this map showed only the part in Illinois. Published also with gray overprint showing the relief by shading.

Maine

*ATTEAN: Latitude, 45° 30′ to 45° 45′; longitude, 70° 15′ to 70° 30′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Somerset County, in northwestern Maine. The Canadian boundary crosses the northwest corner of the area, and the part that lies in Canada is not shown. The surface is a mountainous plateau that ranges in altitude from 1,157 to 3,168 feet. A number of summits stand 2,200 to 2,800 feet above sea level. The area has been heavily glaciated and is characterized by drift-choked valleys, most of which are partly occupied by ponds and swamps, and by the strikingly unsystematic and unadjusted drainage pattern, which is well shown by the erratic course of Moose River. The Canadian Pacific Railway and the main highway from central Maine to Quebec cross the area, which is densely forest-covered and is almost uninhabited except for a few small villages along or near the railroad and scattered houses along the highway.

* BURNHAM: Latitude, 44° 30′ to 44° 45′; longitude, 69° 15′ to 69° 30′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Waldo, Kennebec, and Somerset Counties, whose rather irregular surface is diversified by numerous small hills and groups of hills that stand 50 to 300 feet above the general surface. The northwest corner of the area is occupied by a broadly rolling upland whose highest point is 440 feet above sea level, and the southeastern third is a rough, hilly tract whose culminating points reach 600 to 900 feet. Between the two upland areas lies a lowland belt 6 miles wide, which trends southwestward across the middle of the area. Its general surface, largely covered by bogs and swampy meadows, lies about 175 feet above sea level, but numerous small hills and ridges rise 20 to 150 feet higher.

Maryland

LAUREL: Latitude, 39° to 39° 15′; longitude, 76° 45′ to 77°. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Howard, Prince Georges, Montgomery, Anne Arundel, and Baltimore Counties, just northeast of the District of Columbia. The northwest half is in the Piedmont Upland, whose general surface declines gently southeastward from 600 to about 400 feet above sea level. Patapsco, Patuxent, and Little Patuxent Rivers and other southeastward-flowing streams have cut valleys 100 to 200 feet deep in the upland, and the tributary streams have also considerably dissected it, though some fairly level tracts remain on the divides. The southeastern part of the area is in the Atlantic Coastal Plain, whose surface stands 260 feet or more above sea level along its northwest margin and declines gently southeastward. The main streams flow across the plain in broad valleys about 100 feet deep with flood plains half a mile or more in width. The upland and the plain are separated by the Fall Belt escarpment, in which the surface descends 200 to 400 feet. Here the main rivers have cut gorges whose depth is about the same as the height of the scarp, and numerous small streams that rise near the top of the scarp and flow down the slope have furrowed it rather deeply. Along the base of the scarp is the Fall Line, where the streams pass from the crystalline rocks of the Piedmont to the soft sediments of the Coastal Plain. In the Laurel area the Fall Line is not marked by any considerable falls or rapids, but there is a rather striking change from narrow V-shaped gorges to wide, shallow, flat-bottomed valleys.

Maryland-Virginia

* INDIAN HEAD: Latitude, 38° 30′ to 38° 45′; longitude, 77° to 77° 15′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Charles and Prince Georges Counties, Md., and Fairfax and Prince William Counties, Va. The area is in the Coastal Plain, whose surface descends gently from 300 to 100 feet above sea level. The estuary of Potomac River, 1 to 3 miles in width, crosses the area in a sinuous course, and much of the surface bordering the estuary and the tidal bays and creeks tributary to it lies only 20 to 40 feet above sea level. At some places, however, the shore is bordered by bluffs, which at Gunston Hall, Fort Humphreys, and Mount Vernon are 100 feet high and at Fort Washington 160 feet high. At other places the line of bluffs stands 2 miles or more back from the shore and has the characteristic concave outlines of meander scars, showing that the river at one time flowed in a more meandering course and at a higher altitude. The lower ground along the river is largely the flood plain of that earlier time. Mount Vernon stands on a cut-off meander spur, separated from the main upland on the Virginia side by a broad oxbow valley, whose floor now lies at an altitude of about 40 feet. The form of the bed of the Potomac estuary and its tributaries is shown by under-water contour lines. A map of this quadrangle, issued in 1913, showed only the part in Maryland. The culture of that part has been revised for this edition.

Maryland-Virginia-District of Columbia

WASHINGTON AND VICINITY (road map). Latitude, 38° 30′ to 39° 30′; longitude, 76° 30′ to 77° 30′. Scale, 1 inch=4 miles.

Shaded relief map of the District of Columbia and parts of Maryland and Virginia, including a large section of the Piedmont Upland from Catoctin Mountain on the northwest to the Fall Belt on the southeast and of the Coastal Plain between the Fall Belt and the west shore of Chesapeake Bay. This map does not show contour lines, but the topography is brought out by the shading. The main roads and other improved roads about Washington and Baltimore are indicated by a red overprint. This edition shows a number of changes in roads since the map was first issued in 1923. On the back of the sheet is a brief description of some of the chief geographic, geologic, and historic features of the area.

Missouri

* CLARKDALE: Latitude, 39° 45′ to 40°; longitude, 94° 30′ to 94° 45′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Andrew, De Kalb, and Buchanan Counties, in the Dissected Till Plains. The area is a rolling upland whose general surface stands about 1,100 feet above sea level on the ridges and is cut down to about 850 feet in the main valleys, which have flat floors half a mile or more wide. The upland is rather completely dissected, and little level surface remains on the divides. Platte River flows through the area in a course marked by many small meanders and oxbow lakes.

* DARLINGTON: Latitude, 40° to 40° 15′; longitude, 94° 15′ to 94° 30′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of parts of Gentry and DeKalb Counties, in northwestern Missouri. Only the southern half of the area bounded by the parallels and meridians indicated is shown. The area is in the Dissected Till Plains section of the Central Lowland and is a rolling upland whose surface lies 1,000 to 1,100 feet above sea level and is cut by small flaring valleys 100 feet deep. Grand River crosses the area in a rather winding course in a flat-bottomed valley that is at places a mile wide.

* GILMAN: Latitude, 40° to 40° 15′; longitude, 93° 45′ to 94°. Scale, 1 inch= 1 mile; contour interval, 20 feet.

Map of an area in Daviess and Grundy Counties (only the southern part of the Gilman quadrangle), in the Dissected Till Plains. The surface stands 940 to 980 feet above sea level on the main divides, where it is little dissected and there is still considerable level land. The main valleys are cut to a depth of about 100 feet, and a few of the larger ones have narrow flood plains.

* GOWER: Latitude, 39° 30′ to 39° 45′; longitude, 94° 30′ to 94° 45′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Buchanan, Clinton, Platte, and De Kalb Counties, in the Dissected Till Plains. The general surface is a rolling upland 1,000 to 1,100 feet above sea level, across which Platte River and its tributaries have cut valleys about 100 feet deep. The upland is thoroughly dissected, and the slopes are everywhere cut by small ravines. The valley of Platte River has a flood plain more than a mile wide at some places, but most of the valleys are V-shaped, with narrow floors. The course of Platte River through most of the area is strongly meandering, and the positions of abandoned meanders are shown by oxbow lakes and sloughs.

* PATTONSBURG: Latitude, 40° to 40° 15′; longitude, 94° to 94° 15′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Daviess, Gentry, and De Kalb Counties, in the Dissected Till Plains. Only the southern half of the area outlined has been mapped. The general surface is a rolling upland that descends gently southeastward from 980 to 860 feet above sea level and is dissected by broad flaring valleys 100 to 150 feet deep. Grand River flows across the area in a tortuous course, part of which is on a flood plain several miles wide, with oxbow lakes and abandoned channels.

* STANBERRY: Latitude, 40° to 40° 15′; longitude, 94° 30′ to 94° 45′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of parts of Andrew, Gentry, and De Kalb Counties, in northwestern Missouri. Only the southern half of the area bounded by the parallels and meridians indicated is shown. The area lies in the Dissected Till Plains section of the Central Lowland and is a rolling upland whose surface is 1,000 to 1,100 feet above sea level and is cut by small flaring valleys 100 feet deep. Platte River flows across the area in a flat-bottomed valley 2 miles wide, where its tortuous channel has been artificially straightened to improve the drainage.

Missouri-Illinois

*ALTENBURG: Latitude, 37° 30′ to 37° 45′; longitude, 89° 30′ to 89° 45′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of parts of Perry and Cape Girardeau Counties, Mo., and Jackson and Union Counties, Ill., in the southeastern part of the Ozark Upland. The upland surface, which is almost completely dissected by small gullies leading to the broader valleys, stands in general 550 to 650 feet above sea level but exceeds 700 feet at several points along a line of irregular hills that lie 2 to 4 miles west of Mississippi River. Apple Creek and one or two smaller streams flow across the area to the Mississippi in tortuous valleys with narrow flood plains. The Mississippi flows in a valley several miles wide but hugs the west side of the valley, which is lined by bluffs that rise at places more than 100 feet. Opposite Wittenberg and Grand Tower there are bluffs on the east side of the river also. Sink holes are abundant in some parts of the area, and some of the largest occupy many acres and are 60 to 100 feet deep.

New York

* DEPOSIT: Latitude, 42° to 42° 15′; longitude, 75° 15′ to 75° 30′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Delaware, Broome, and Chenango Counties, in the Allegheny Plateau, which is here so deeply dissected that almost none of the original surface remains and its character as a plateau is not easily distinguishable. The highest hilltops stand 2,300 feet above sea level in the eastern part of the area, but the altitude decreases to 2,000 feet in the western part. Delaware River flows across the area in a sinuous trench about 1,000 feet deep, which has a narrow flood plain in most places. Susquehanna River crosses the northwest corner in a broader valley partly filled with glacial deposits. The area has been strongly glaciated, and several small lakes near the heads of streams high among the hills appear to lie in cirques.

* WALTON: Latitude, 42° to 42° 15′; longitude, 75° to 75° 15′. Scale, 1 inch= 1 mile; contour interval, 20 feet.

Map of part of Delaware County, in the Catskill Plateau, which is here so thoroughly and deeply dissected by narrow, gorgelike valleys that its plateau character is almost wholly obliterated. The position of the former surface is probably shown approximately by the small rounded or conical summits of the higher hills, which stand 2,400 to 2,600 feet above sea level in a belt across the middle of the area but are somewhat lower in the northern and southern parts. The East and West Branches of Delaware River flow across the area in sinuous valleys more than 1,000 feet deep, with narrow strips of flood plain along the streams. Several small ponds high among the hills in the southern part of the area occupy hollows that appear to be glacial cirques. The area is striking because of the massiveness of its topographic features, the steepness of its slopes, and the very small proportion of level land. Because of these facts most of the settlements and roads are in the bottoms of the V-shaped valleys.

North Carolina

[See Virginia-North Carolina]

North Carolina-Tennessee

PROPOSED GREAT SMOKY MOUNTAINS NATIONAL PARK: Latitude, 35° 20′ to 38°; longitude, 83° to 84°. Scale, 1 inch=2 miles; contour interval, 100 feet.

Map of a part of North Carolina and Tennessee, including the Great Smoky Mountains proper, between Pigeon River, Little Tennessee River, the Chilhowee Mountains, and a part of the Plott Balsams Range. The proposed park includes the wildest part of the southern Appalachians and some of the grandest scenery. Many of the mountain summits stand more than 5,000 feet above sea level, and Clingmans Dome, the highest peak, is only 31 feet lower than the summit of Mount Mitchell, the highest point in the eastern United States. Mount Guyot, Mount Collins, Jones Knob, and several peaks without names exceed 6,000 feet. The northwestern part of the area, which lies in the valley of east Tennessee, is traversed by the winding courses of Tennessee and French Broad Rivers, and the city of Knoxville is at the extreme northwest corner. The southern and eastern parts lie in the mountain region of western North Carolina but include some partly cleared and settled intermontane valleys.

North Dakota

EDGELEY: Latitude, 46° to 46° 30′; longitude, 98° 30′ to 99°. Scale, 1 inch=2 miles; contour interval, 20 feet.

Map of an area in Dickey and La Moure Counties, partly in the Missouri Plateau and partly in the Lake Plains. The western third is an upland tract about 2,000 feet above sea level. The upland is broken by small, irregular ridges and knolls, some of which stand 100 feet above the surrounding area, and by irregular, shallow depressions, some of which contain swamps or ponds. At its eastern margin the surface descends 200 to 300 feet in a mile or so to the western margin of the Lake Plains; the escarpment so formed is known as the Coteau de Missouri. The eastern two-thirds of the area is occupied by a fairly smooth plain, which slopes gently eastward from the base of the Coteau to less than 1,500 feet above sea level and which is well drained, although mainly by intermittent streams.

Ohio

* DELAWARE: Latitude, 40° 15′ to 40° 30′; longitude, 83° to 83° 15′. Scale, 1 inch=1 mile; contour interval, 10 feet.

Map of an area in Delaware, Marion, and Morrow Counties, in the Till Plains. This map, which is based upon a survey made in 1924, supersedes the edition of October, 1903. The upland surface, which is extremely flat, stands between 930 and 970 feet above sea level, and in the southwestern part of the area a hardly perceptible morainal ridge rises to nearly 1,000 feet. Scioto and Olentangy Rivers, which flow southward across the area, have cut narrow valleys 50 to 100 feet below the till plain, and in the southern part of the area the sides of these valleys are furrowed by many small ravines.

* EAST COLUMBUS: Latitude, 39° 45′ to 40°; longitude, 82° 45′ to 83°. Scale, 1 inch=1 mile; contour interval, 10 feet.

Revised map of an area in Franklin, Fairfield, Pickaway, and Licking Counties, based upon a new survey. The northwest corner includes part of the city of Columbus. The greater part of the area is occupied by a rolling plain whose surface descends from 850 to 700 feet above sea level. Several large creeks cross this plain in winding trenches cut 10 to 50 feet below it. The northeast and southeast corners of the area are occupied by hilly uplands on which several summits stand more than 1,100 feet above sea level.

* WEST COLUMBUS: Latitude, 39° 45′ to 40°; longitude, 83° to 83° 15′. Scale, 1 inch=1 mile; contour interval, 10 feet.

Revised map of an area in Franklin, Pickaway, and Madison Counties, in the Till Plains, based upon a new survey. The northeast corner includes part of the city of Columbus. The area is a rolling upland whose surface stands 850 to 950 feet above sea level on the broad, flat divides and is cut down to less than 700 feet in the main valleys, which have flat floors about a mile wide on which the rivers meander in broad swings. The valley sides are rather closely furrowed with many small ravines, but a considerable part of the upland surface is only slightly dissected.

Oregon

[See also California-Oregon]

ROGUE RIVER. Plan and profile of Rogue River from mouth to National Creek. Scale, 1 inch=½ mile; contour intervals, on land 20 feet, on river surface 5 feet; vertical scale of profiles, 1 inch=20 feet (except sheet L, on which 1 inch=80 feet). Size, 21 by 27 inches. 14 sheets (7 plans, 7 profiles).

Sheets A to G show the course of Rogue River and its tributaries with their rapids, islands, and sand flats and the contour of the immediately adjacent slopes. Sheets H to N show the profiles of these streams.

* STAYTON: Latitude, 44° 45′ to 45°; longitude, 122° 45′ to 123°. Scale, 1 inch=1 mile; contour interval, 25 feet.

Map of an area in Marion and Linn Counties, in the foothills of the Cascade Mountains at the eastern margin of the Puget Trough. Part of the area is occupied by groups of hills whose summits stand 800 to 1,000 feet above sea level and part by an upland whose rolling dissected surface stands at 600 to 700 feet. In the south-central part is a flat-floored intermontane basin that lies 300 to 400 feet above sea level. The northwestern part lies in the east side of the Willamette Valley, at 100 to 200 feet above sea level.

* WALDO LAKE: Latitude, 43° 30′ to 44°; longitude, 122° to 122° 30′. Scale, 1 inch=2 miles; contour interval, 100 feet.

Map of an area in Lane and Klamath Counties, in the Cascade Mountains. The whole area is mountainous, with many peaks standing 4,000 to 8,750 feet above sea level. Several streams flow westward to Willamette River in canyons 2,000 to 4,000 feet deep. The eastern part is an irregular upland about 5,500 feet above sea level, which has been glaciated and is dotted by numerous small ponds and two fair-sized lakes. Hanging valleys are abundant on the westward-facing slopes, and some of them head in glacial cirques containing small ponds.

Pennsylvania

[See also West Virginia-Pennsylvania]

* BRADFORD: Latitude, 41° 45′ to 42°; longitude, 78° 30′ to 78° 45′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of part of McKean County, just south of the New York State boundary, in the Allegheny Plateau. The surface stands about 2,200 feet above sea level in the southern part of the area and rises a little toward the north. In the northern part the plateau is dissected by sharp valleys 500 to 800 feet deep with narrow flood plains; here the nearly level plateau surface remains only as rather narrow strips on the principal divides. In the southern part broad tracts of the plateau surface still remain, and the settlements and main roads are on the plateau instead of in the valleys. To reach the plateau the Buffalo, Rochester & Pittsburgh Railway and the Bradford branch of the Erie Railroad are forced to make a steep and tortuous climb from the valley of the East Branch of Tunungwant Creek. Having gained the plateau, the Buffalo, Rochester & Pittsburgh follows a main divide, but the Erie crosses the deep valley of Kinzua Creek on the Kinzua Viaduct, one of the highest railroad bridges in the country. The famous Bradford oil field occupies much of the northern part of the area, and the southern part lies within the northern margin of the bituminous coal field of western Pennsylvania.

* CAMBRIDGE SPRINGS: Latitude, 41° 45′ to 42°; longitude, 80° to 80° 15′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of parts of Erie and Crawford Counties, chiefly in the Allegheny Plateau. The general surface stands 1,500 to 1,600 feet above sea level in most of the area but descends to about 1,200 feet in the northwestern part, at the crest of the sloping escarpment facing toward Lake Erie. The plateau is trenched by several valleys 200 to 400 feet deep and as much as a mile wide, which are partly choked by glacial drift and have swampy floors at some places. Although the area is within a few miles of Lake Erie the greater part of it is drained to Allegheny River and thence to the Gulf of Mexico. The divide between the Mississippi and St. Lawrence drainage basins crosses the area not far south of the crest of the escarpment.

* MEADVILLE: Latitude, 41° 30′ to 41° 45′; longitude, 80° to 80° 15′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of part of Crawford County, in the Allegheny Plateau, whose upland surface descends gently from 1,600 to 1,300 feet. The main valleys are 200 to 400 feet deep, and most of them have flat floors half a mile or more wide, some of which are marshy. Some fairly level surface remains on the divides. The valley sides are generally rather steep and are furrowed by small ravines. Some of the valleys are partly choked by glacial moraines.

* TOWANDA: Latitude, 41° 45′ to 42°; longitude, 76° 15′ to 76° 30′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of part of Bradford County, in the Allegheny Plateau, whose general surface stands 1,600 feet above sea level in the northern part of the area and descends gently southward but is so completely dissected that almost no level land remains. Susquehanna River cuts across the extreme northwest corner, flowing southward, then swinging eastward reenters the area and flows across its southwest corner in a sinuous trench with a flat floor about a mile wide that lies a little more than 700 feet above sea level. The valleys of the chief tributary streams are narrow and V-shaped and 300 to 600 feet deep. Evidences of glaciation are seen in the overdeepened cols and the small swamps and ponds on or near the upland divides.

Tennessee

[See North Carolina-Tennessee]

Texas

BUCK HILL: Latitude, 29° 45′ to 30°; longitude, 103° 30′ to 103° 45′. Scale, 1 inch=1 mile; contour interval, 50 feet.

Map of an area in Brewster County, in the southern part of the trans-Pecos region. The central part is occupied by a broad plain that descends gently from 3,800 to less than 3,600 feet above sea level. The smoothness of the plain is broken by several small buttes at 3,900 to 4,200 feet. The southeast corner is occupied by a hilly region, whose highest points rise to about the same altitude as the buttes. There are other tracts of hilly country in the northern part of the area, and in the northwest corner are two large mesas with summits about 5,000 feet above sea level and bounding escarpments 600 feet or more in height.

* CORPUS CHRISTI: Latitude, 27° 45′ to 28°; longitude, 97° 15′ to 97° 30′. Scale, 1 inch=1 mile; contour interval, 6 feet.

Map of an area on the coast of Texas in San Patricio and Nueces Counties. It includes Nueces Bay, at the mouth of Nueces River, and a large part of Corpus Christi Bay. The surface is part of the Gulf Coastal Plain, which rises gradually from about 25 to 60 feet above sea level. Corpus Christi Bay is separated from the Gulf of Mexico by an extensive barrier beach that lies east of this area, and from Nueces Bay by spits or hooks built out from both sides. The features about the bays give evidence of a recent uplift of the land; hence the bays are generally bounded by low cliffs instead of marshes, and the shores are regular in outline. Corpus Christi, which faces Corpus Christi Bay on a point of land south of Nueces Bay, is the largest town in the region. It has railroad connection with many points in the interior, and its connection with the Gulf through Aransas Pass has made it a seaport of considerable importance.

OIL AND GAS FIELDS of the State of Texas. Scale, 1 inch=about 12 miles. 2 sheets, each 58 by 38 inches.

New edition of map showing the location and names of the oil and gas fields, salt domes, oil refineries, and pipe lines. The approximate location of the Balcones fault zone is also shown.

* OSO CREEK: Latitude, 27° 30′ to 27° 45′; longitude, 97° 15′ to 97° 30′. Scale, 1 inch=1 mile; contour interval, 5 feet.

Map of parts of Nueces and Kleberg Counties, in the Gulf Coastal Plain of southwestern Texas, on the shore of Corpus Christi Bay and Laguna Madre. The surface is very flat and nowhere stands more than 40 feet above sea level. Ranges of low dunes form the backbone of Padre Island, which separates Laguna Madre from the Gulf of Mexico, and a small group of dunes stands just west of Flour Bluff Point, at the angle between Laguna Madre and Corpus Christi Bay. Other small dunelike knolls occur along the shores of the estuary of Oso Creek, which is almost cut off from Corpus Christi Bay by a narrow barrier beach.

* ROBSTOWN: Latitude, 27° 45′ to 28°; longitude, 97° 30′ to 97° 45′. Scale, 1 inch=1 mile; contour interval, 5 feet.

Map of an area a few miles west of Corpus Christi, in Nueces and San Patricio Counties, near the extreme southern point of Texas. The upland surface consists of a very perfect plain that slopes from 100 to 45 feet above sea level. This plain is continuous except for the valley of Nueces River, which has an average width of about 3 miles and ranges in altitude from sea level to about 15 feet. The valley bottom is generally swampy, and the river wanders widely but with poorly developed meanders. Instead of entering the bay at its extreme head the river hugs the south bluffs and enters about 4 miles from the bay head, at a point just east of this area.

Utah

* ACORD LAKES: Latitude, 38° 45′ to 39°; longitude, 111° 15′ to 111° 30′. Scale, 1 inch=1 mile; contour interval, 50 feet.

Map of an area in Sevier and Emery Counties, at the southeast margin of the Wasatch Plateau, whose surface stands 8,300 to 9,000 feet above sea level and includes parts of several platforms. The margin of the plateau is cut by flaring canyons 3,000 feet in depth. The southeastern part of the area lies in Castle Valley, an interior or basin plateau, whose floor lies 6,300 to 6,500 feet above sea level and is crossed in broad, shallow valleys by the streams that flow from the higher plateau.

* CASTLE DALE: Latitude, 39° to 39° 15′; longitude, 111° to 111° 15′. Scale, 1 inch=1 mile; contour interval, 50 feet.

Map of an area in Emery County, the eastern half of which lies in Castle Valley. The valley floor slopes gently eastward from an altitude of more than 6,000 feet to about 5,600 feet and is broken by a few small hills and escarpments 300 to 500 feet high. The western part is occupied by outliers of the Wasatch Plateau at different levels. The highest point is The Cap, at 9,600 feet. The plateau is bounded by an escarpment 1,500 to 2,000 feet high, at the base of which lies a belt of much broken country, whose surface descends several hundred feet more to the valley.

DUCHESNE RIVER. Plan and profile of Duchesne River and tributaries. Scale, 1 inch=½ mile; contour interval, 20 feet; vertical scale of profiles, 1 inch=160 feet. Size, 21 by 27 inches. 6 sheets (3 plans, 3 profiles).

Sheets A to C show the upper courses of Duchesne River and several of its principal tributaries as they flow out from the foothills of the Uinta Mountains. The locations of bench marks, gaging stations, and proposed dam sites are shown, and the relief of belts half a mile to 1 mile wide adjacent to the stream is shown by contour lines. Sheets D to F show the profiles of the streams.

* HIAWATHA: Latitude, 39° 15′ to 39° 30′; longitude, 111° to 111° 15′. Scale, 1 inch=1 mile; contour interval, 50 feet.

Map of an area in Emery and Carbon Counties, mainly in the Wasatch Plateau, whose surface reaches 9,600 to 9,800 feet above the sea and is cut by canyons several thousand feet deep. The summits of a range of mountains along the west side of the area stand more than 10,000 feet above sea level. In the southeast corner the surface descends across a broad belt of broken country to an altitude of about 6,000 feet at the edge of Castle Valley.

* SCOFIELD: Latitude, 39° 30′ to 39° 45′; longitude, 111° to 111° 15′. Scale, 1 inch=1 mile; contour interval, 50 feet.

Map of an area in Carbon, Emery, and Sanpete Counties, at the eastern margin of the Wasatch Plateau, which is so thoroughly dissected in this area that hardly any remnants are left. The area is mountainous, and the principal summits stand more than 10,000 feet above sea level; the highest is Monument Mountain, at 10,443 feet. The main valleys, most of which are narrow and canyon-like, are cut to a depth of 3,000 feet or more. At the east side of the area is a part of Castle Valley, an interior or basin plateau, whose floor stands 7,000 to 7,300 feet above sea level and is trenched by several small canyons 300 to 500 feet deep.

Vermont

* JAY PEAK: Latitude, 44° 45′ to 45°; longitude, 72° 30′ to 72° 45′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Franklin, Orleans, and Lamoille Counties, extending to the Canadian boundary, a short distance north of the 45th parallel. Most of the area lies in the western range of the Green Mountains. The mountains are rather massive, and a number of peaks stand more than 3,000 feet above sea level. The highest is Jay Peak, which reaches 3,861 feet. Between the mountains lie narrow-bottomed valleys 2,000 to 3,000 feet deep, whose sides are so steep at many places that they merit the name of canyons. Missisquoi River flows across the area in a valley with a flat floor half a mile wide and less than 500 feet above sea level. The area has been heavily glaciated. Some of the drift-choked mountain valleys contain swampy stretches, and little ponds lie high on the mountain slopes.

* MEMPHREMAGOG: Latitude, 44° 45′ to 45°; longitude, 72° to 72° 15′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Orleans County, extending to the Canadian boundary, a short distance north of the 45th parallel. This area lies in the upland of Vermont and is largely occupied by bold hills and small mountains, whose summits stand 1,500 to 2,900 feet above sea level. Scattered among the hills are small patches of rolling upland at 1,300 to 1,400 feet. The upland is cut by valleys 300 to 600 feet deep, some of which have flat floors 1,000 to 2,000 feet wide. The south end of Lake Memphremagog occupies the northwest corner of the area, and several large ponds are situated in the broader valleys. Remnants of kame terraces and possibly of glacial lake beaches are preserved here and there on the hillsides. Several main automobile roads, shown by red overprint, cross the area and meet in the town of Newport, at the head of Lake Memphremagog.

Virginia

[See also Maryland-Virginia-District of Columbia and West Virginia-Virginia]

STATE OF VIRGINIA. Scale, 1 inch=8 miles.

Revised base map of the State of Virginia, printed in two colors. Shows names and boundaries of counties and national forests, towns and most of the smaller settlements, and the railroads (in black), rivers and other water features (in blue).

STATE OF VIRGINIA (power map). Scale, 1 inch=8 miles.

Revised edition of map of Virginia showing by red overprint the location of the hydroelectric and fuel-consuming power-generating stations and transmission lines used in public service in 1925 and the stream-gaging stations.

Virginia-North Carolina

* DANVILLE: Latitude, 36° 30′ to 36° 45′; longitude 79° 15′ to 79° 30′. Scale 1 inch=1 mile; contour interval, 20 feet.

Map of parts of Pittsylvania County, Va., and Caswell County, N. C., in the Piedmont Upland. The surface descends gently from somewhat more than 800 feet to somewhat less than 600 feet above sea level. Dan River flows eastward across the southern part of the area in a sinuous valley 150 feet deep, which at places has a flat bottom half a mile wide. The tributary streams have cut valleys somewhat less deep, and they also have narrow flood plains at some places. The northwestern part of the area is crossed by Whiteoak Mountain, several points on whose crest reach altitudes of a little more than 1,100 feet. Danville, in the south-central part, is the principal city.

* MARTINSVILLE: Latitude, 36° 30′ to 36° 45′; longitude, 79° 45′ to 80°. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Henry County, Va., and Rockingham County, N. C., in the Piedmont Upland, which is here deeply dissected. A little level land remains on the divides here and there, marking the surface of the original upland, which now stands about 1,000 feet above sea level. A few low knobs stand above the general level, and the valleys are cut 100 to 300 feet below it. Smith River flows across the area in a tortuous course. Its valley through most of the area is V-shaped, with no flood plain, but in some places the valley floor has been widened a little.

Virginia-West Virginia

PROPOSED SHENANDOAH NATIONAL PARK: Latitude, 38° to 39°; longitude, 78° to 79°. Scale, 1 inch=2 miles; contour interval, 100 feet.

Map of the region including the proposed Shenandoah National Park, Va., which will cover the part of the Blue Ridge extending from Chester Gap, southeast of Front Royal, to Rock Fish Gap, southeast of Waynesboro. In this part of the Blue Ridge more than 50 summits stand 3,000 feet or more above sea level, and Hawks Bill and Stony Man, the highest peaks, exceed 4,000 feet. Many wild and picturesque gorges cut both slopes of the ridge, which is neither straight nor even-crested. The southern part of the area shown on the map lies in the Piedmont Upland and includes the low ridge of Southwestern Mountain, extending from Orange to Charlottesville. The area is crossed by the Shenandoah Valley, which is diversified by Massanutten Mountain, extending for miles between North Fork and South Fork of Shenandoah River. The northwest corner is crossed by several of the Appalachian Ranges, which are separated by narrow linear valleys. The area thus includes a wide diversity of topographic form, and most of the principal features are visible on a clear day from the higher peaks within the proposed park.

* WARM SPRINGS: Latitude, 38° to 38° 15′; longitude, 79° 45′ to 80°. Scale, 1 inch=1 mile; contour interval, 50 feet.

Map of an area in Pocahontas and Greenbrier Counties, W. Va. Only the part of the quadrangle lying in West Virginia has been mapped. The area is situated in the Appalachian Valley and Ranges and is occupied by several parallel northeastward-trending ridges, whose crests stand 2,400 to 4,000 feet above sea level. The ridges are separated by valleys 1,000 to 2,000 feet deep, which have narrow strips of flood plain throughout most of their length. Most of the area is forested.

Washington

SCHRAG: Latitude, 47° to 47° 15′; longitude, 118° 45′ to 119°. Scale, 1 inch=1 mile; contour interval, 25 feet.

Map of an area in Adams and Grant Counties, in the northern part of the Columbia Plateaus. The area lies on a lava plateau, which is so much dissected that its plateau character is largely obscured. The general upland surface stands from less than 1,500 to 1,800 feet above sea level. The principal valleys are 250 to 300 feet deep, with fairly steep side slopes, much trenched by ravines, and flat floors one-fourth to one-half mile wide. Although the plateau is so much dissected the present streams are all intermittent.

WASHTUCNA: Latitude, 46° 45′ to 47°; longitude, 118° 15′ to 118° 30′. Scale, 1 inch=1 mile; contour interval, 25 feet.

Map of part of Adams County, in the Walla Walla Plateau, whose surface stands about 1,800 feet above sea level. The central and northeastern parts of the area are a nearly level upland slightly trenched by the channels of glacial streams. The southeastern and northwestern parts have a relief of several hundred feet and are rather intricately dissected into a maze of small ridges and ravines which in a great part of the area have a common southwest trend. Several terraces, probably of glacial outwash, are well developed in the valley northeast of Washtucna.

WHEELER: Latitude, 47° to 47° 15′; longitude, 119° to 119° 15′. Scale, 1 inch=1 mile; contour interval, 25 feet.

Map of part of Grant County, in the Walla Walla Plateau, whose surface stands from 1,150 to nearly 1,700 feet above sea level. The northern and eastern parts have a moderate relief and are crossed by several channels formed in part by glacial streams. The southern and western parts are nearly level but descend slightly southward and are diversified by a few small sand dunes and undrained hollows. A westward-facing scarp 75 to 150 feet high at the west edge of the area is the eastern wall of the Grand Coulee.

West Virginia

[See also Virginia-West Virginia]

BLUEFIELD: Latitude, 37° 15′ to 37° 30′; longitude, 81° to 81° 15′. Scale, 1 inch=1 mile; contour interval, 50 feet.

The Bluefield quadrangle lies in Mercer County, W. Va., and Bland and Giles Counties, Va., but only the part in West Virginia is shown on this map. The area lies mainly in the Kanawha Hills section of the Allegheny Plateau and is a region of rugged, rather steep-sided hills, many of which have fairly broad, smooth summits 2,300 to 2,600 feet above sea level. Some of the more rugged hills have narrow ridgelike crests that rise to 3,000 feet or more. The most conspicuous is Black Oak Mountain, in the west-central part. The southern part of the area extends to the crest of East River Mountain, the first of the Appalachian Ranges, which stands 3,600 feet above sea level at some points. The main valleys in the plateau

are cut to a depth of 300 feet or more. Bluestone River flows cross the area in an incised meandering valley with narrow strips of flood plain. The area is crossed by the Norfolk & Western and Virginian Railways, and the two chief towns, Bluefield and Princeton, are the concentration points where long trains of coal are made up for shipment to Norfolk. This map was originally issued in 1916. The culture has been revised for this edition.

CENTERPOINT: Latitude, 39° 15′ to 39° 30′; longitude, 80° 30′ to 80° 45′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Doddridge, Harrison, Wetzel, and Tyler Counties, in the Allegheny Plateau, whose upland surface stands 1,400 to 1,600 feet above sea level but is so completely dissected that practically none of the original plateau remains. The area is a maze of winding sharp-topped ridges separating narrow V-shaped valleys 300 to 600 feet deep. A few of the larger streams have narrow strips of flood plain. Much of the area is a producing oil field, and oil wells are especially numerous about Salem. This map was originally issued in 1903. The culture has been revised for this edition.

CLARKSBURG: Latitude, 39° 15′ to 39° 30′; longitude, 80° 15′ to 80° 30′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Harrison, Marion, and Wetzel Counties, in the Allegheny Plateau. A few remnants of the original plateau stand 1,500 to 1,600 feet above sea level, but in most of the area the surface has been completely dissected by erosion into hogback ridges and sharp-topped hills, separated by narrow V-shaped valleys several hundred feet in depth. Traces of old, high-level valleys with floors half a mile or so in width are preserved in the valleys of West Fork River and its larger tributaries. This map was originally issued in 1902. The culture has been revised for this edition.

FAIRMONT: Latitude, 39° 15′ to 39° 30′; longitude, 80° to 80° 15′. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of an area in Taylor, Marion, Harrison, and Barbour Counties, in the Allegheny Plateau, which is so thoroughly dissected that little of the original surface remains. If the valleys were filled to the level of the hilltops the surface would stand about 1,800 feet above sea level. Tygart River flows across the area in a sinuous trench about 600 feet deep with narrow strips of flood plain in a few places. The other valleys are V-shaped with steep side slopes. Traces of a former drainage system at a higher level are preserved in the terraces at Fairmont and elsewhere along the main valleys. This map was first issued in 1902. The culture has been revised for this edition.

* LOBELIA: Latitude, 38° to 38° 15′; longitude, 80° 15′ to 80° 30′. Scale, 1 inch=1 mile; contour interval 50 feet.

Map of an area in Greenbrier, Pocahontas, Webster, and Nicholas Counties, at the south end of the Allegheny Mountains section of the Allegheny Plateau. Across the Greenbrier Plateau, whose rather irregular surface stands 2,200 to 2,400 feet above sea level, Greenbrier River flows in a winding trench 200 feet or more deep, with a narrow flood plain. The greater part of the area is distinctly mountainous. It contains a number of peaks that reach an altitude of more than 4,000 feet, of which the highest is an unnamed peak at 4,524 feet. The northwestern half of the area is rough, densely forested, and uninhabited except at a few lumber camps. The southeastern part is more generally cleared and settled but contains no large towns.

* MARLINTON: Latitude, 38° to 38° 15′; longitude, 80° to 80° 15′. Scale, 1 inch=1 mile; contour interval, 50 feet.

Map of parts of Pocahontas and Greenbrier Counties, chiefly in the Appalachian Valley and Ranges. The northwest corner is in the Yew Mountains, a rugged part of the Allegheny Plateau, which reaches an altitude of 4,625 feet at one point on Black Mountain. Greenbrier River flows southwestward across the area in a narrow winding trench cut 300 feet or more below the general surface of the Greenbrier Plateau. Traces of abandoned high-level meanders remain here and there along the walls of the trench. The southeastern half of the area is occupied by several parallel mountain ranges separated by narrow valleys 1,000 to 1,500 feet deep. Points along the crest of Middle Mountain stand more than 3,500 feet above sea level, and the culminating points of the other ranges are only a little lower.

* MINGO: Latitude, 38° 15′ to 38° 30′; longitude, 80° to 80° 15′. Scale, 1 inch=1 mile; contour interval, 50 feet.

Map of an area in Pocahontas, Randolph, and Webster Counties, at the eastern margin of the Allegheny Plateau. The greater part of the area is occupied by massive irregular mountains with more or less flat-topped ridges and spurs that stand 4,600 to 4,800 feet above sea level in the southern and eastern parts of the area and about 1,000 feet lower in the northwestern part. The main valleys, some of which have narrow strips of flood plain, are 1,000 to 2,000 feet deep. The southeast corner of the area is crossed by Greenbrier River, and a few square miles in this corner lies on the Greenbrier Plateau at an altitude of 2,600 to 2,700 feet.

West Virginia-Pennsylvania

BLACKSVILLE: Latitude, 39° 30′ to 39° 45′; longitude, 80° to 80° 15′. Scale, 1 inch=1 mile; contour interval 20 feet.

Map of an area in Monongalia and Marion Counties, W. Va., and Greene County, Pa., in the Allegheny Plateau, which is here so deeply dissected that practically none of the original surface remains. The highest hilltops, which probably repre-

sent nearly the position of the old plateau, stand 1,500 to 1,600 feet above sea level in the southern part of the area and somewhat lower in the northern part. The narrow V-shaped valleys are cut to a depth of 500 to 800 feet. The valley of Dunkard Creek, along the State line, contains remnants of an old valley floor lying about 60 feet above the present stream. This is a new edition of the Blacksville map showing revised culture for the part in West Virginia.

MANNINGTON: Latitude, 39° 30′ to 39° 45′; longitude, 80° 15′ to 80° 30′. Scale, 1 inch=1 mile; contour interval 20 feet.

Map of parts of Marion, Monongalia, and Wetzel Counties, W. Va., and Greene County, Pa., in the Allegheny Plateau. The plateau surface has been so completely dissected by the many small, sharply incised valleys and ravines that almost none of it remains, but if it were to be restored by filling the valleys to the height of the hilltops it would stand 1,500 to 1,600 feet above sea level. Some of the larger valleys are 500 to 600 feet deep and have narrow strips of flood plain. Many oil wells are scattered through the central and southern parts of the area. This map was originally issued in 1905. The culture has been revised for this edition.

West Virginia-Virginia

BRAMWELL: Latitude 37° 15′ to 37° 30′; longitude, 81° 15′ to 81° 30′. Scale, 1 inch=1 mile; contour interval, 50 feet.

Map of an area in McDowell, Wyoming, and Mercer Counties, W. Va., and Tazewell County, Va. This area includes the heart of the celebrated Pocahontas coal field, which was first opened at the town of Pocahontas, but development was soon carried across the ridge to the main field on the head of Elkhorn Creek. The field is served by the Norfolk & Western, Virginian, and Louisville & Nashville Railroads. It lies mainly in the Plateau province, but the southeastern part is in the Appalachian Valley, a region of folded rocks, which, because of the folding, is characterized by ridges trending northeast. Usually the passage from the Appalachian Valley to the Plateau province requires a climb of several hundred feet, but at a point about 5 miles southwest of Pocahontas it is necessary to descend about 300 feet to reach the bottoms of the valleys in the coal field. The coal field was once a sloping plateau whose surface ranged in altitude from about 3,500 feet to about 2,300 feet, but the streams have cut so vigorously that they have destroyed most of the level surface, leaving hills and ridges whose summits are nearly at the level of the old plateau and whose bases are from 800 to 1,500 feet lower. A map of this area was issued in 1911 as the "Pocahontas special." The culture has been revised for this edition.

Wisconsin

* GAYS MILLS: Latitude, 43° 15′ to 43° 30′; longitude, 90° 45′ to 91°. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of parts of Vernon and Crawford Counties, in the Driftless Area. The general upland stands about 1,200 feet above sea level, and a few low knobs and ridges are about 100 feet higher. Considerable nearly level land remains on the main ridges, whose flanks, however, are rather sharply dissected by many small ravines. The larger valleys are cut to a depth of 400 to 500 feet and have flood plains half a mile wide, on which the streams meander in wriggling curves and which are marked by a number of small oxbow lakes.

* LA FARGE: Latitude, 43° 30′ to 43° 45′; longitude, 90° 30′ to 90° 45′. Scale, 1 inch= 1 mile; contour interval, 20 feet.

Map of parts of Vernon, Richland, and Monroe Counties, in the Driftless Area. The general upland stands 1,200 to 1,300 feet above sea level. The tops of the main ridges are more or less level, but their flanks are dissected by many small ravines. The larger valleys are cut to a depth of 300 to 400 feet and have flood plains less than half a mile wide, on which the streams meander in small curves.

* VIROQUA: Latitude, 43° 30′ to 43° 45′; longitude, 90° 45′ to 91°. Scale, 1 inch=1 mile; contour interval, 20 feet.

Map of parts of Vernon, Monroe, and La Crosse Counties, in the Driftless Area. The general upland stands 1,200 to a little more than 1,300 feet above sea level. Considerable nearly level land remains on the main divides, especially that traversed by the railroad and highway connecting Viroqua and Cashton. The main valleys are cut to a depth of 400 to 500 feet and have flood plains less than half a mile wide. Most of the side valleys and ravines are small and V-shaped.

Wyoming

OIL AND GAS FIELDS of the State of Wyoming. Scale, 1 inch=8 miles (approximately). Size, 41 by 54 inches.

Base map of the State of Wyoming on the scale of 1 to 500,000, without contours, showing, by overprints in several colors, the location of the oil fields, gas fields, anticlinal axes, oil refineries, and trunk pipe lines. The names of most of the anticlines are shown on the map, and an index at the margin gives the location of the named anticlines by townships and ranges and the source of the information.

GEOLOGIC BRANCH

SCOPE AND ORGANIZATION OF WORK

The work of the geologic branch was performed throughout the fiscal year by only two coordinate divisions, the division of mineral resources having been transferred to the Department of Commerce at the end of the last fiscal year. The general organization during the year has been as follows:

Geologic branch: W. C. Mendenhall, chief geologist.
Division of geology: W. C. Mendenhall, geologist in charge.
Division of chemistry and physics: George Steiger, chief chemist, in charge.

APPROPRIATIONS

The acts carrying Geological Survey appropriations for the fiscal year ending June 30, 1926, provide the following amounts for the direct work of the geologic branch:

Geologic surveys	$325,000
Scientific assistants in the District of Columbia	18,600
Chemical and physical research	40,000
	383,600

In addition the geologic field work requisite for the classification of mineral lands was done by means of an appropriation made for the classification of the public lands at a total cost of $41,800.

DIVISION OF GEOLOGY

ORGANIZATION AND PERSONNEL

The division of geology includes the nine sections indicated below:

Geology of metalliferous deposits, G. F. Loughlin, geologist in charge.
Paleontology and stratigraphy, T. W. Stanton, geologist in charge.
Glacial geology, W. C. Alden, geologist in charge.
Geology of iron and steel metals, E. F. Burchard, geologist in charge.
Coastal Plain investigations, L. W. Stephenson, geologist in charge.
Areal geology, Sidney Paige, geologist in charge (resigned February 28, 1926).
Geology of nonmetalliferous deposits, G. R. Mansfield, geologist in charge.
Geology of fuels, W. T. Thom, jr., geologist in charge.
Petrology, C. S. Ross, geologist in charge.

In addition to the units of administrative organization the division includes two advisory committees—the committee on geologic names, T. W. Stanton, chairman, and the physiographic committee, M. R. Campbell, chairman. These committees consider in detail all problems falling within their respective fields and advise the chief geologist of their findings as a basis for administrative action.

The division also exercises technical supervision over the section of geologic map editing, through G. W. Stose, geologist in charge, and administrative control over the observatory at the Volcano House, Hawaii, of which T. A. Jaggar, jr., is in charge.

At the beginning of the fiscal year the division included 108 geologists of various grades. During the year 4 resigned, 2 died, 4 were transferred, and 5 were added to the staff, so that the number on the rolls at the end of the year was 103. The division included 4 draftsmen (1 temporary) and 5 preparators of fossils. In the cleri-

cal and messenger force there was 1 accession and 4 separations, leaving a total of 28 at the end of the year (26 permanent and 2 temporary).

David White was on leave without pay from July 8 to the end of the fiscal year, with the exception of brief periods in November and June, to act as chairman of the division of geology and geography of the National Research Council.

Sidney Paige, who had charge of the section of areal geology, resigned February 28 to accept a position with the Amerada Corporation for work in South America.

F. L. Hess was transferred on August 10 to the Bureau of Mines.

W. T. Lee died June 16, 1926.

J. B. Woodworth died August 4, 1925.

H. D. Miser was granted a furlough beginning August 29 for the remainder of the fiscal year to take over the duties of State geologist of Tennessee.

E. F. Burchard was granted leave without pay for four months from July 6, 1925, to examine deposits of iron ore in Argentina for the Argentine Government.

Arthur Keith was on leave without pay for two months from March 17, delivering a course of lectures at the University of Texas.

Edward Sampson, having joined the geologic staff at Princeton University, was placed in a per diem status September 27.

Geologists D. F. Hewett, Julia Gardner, M. I. Goldman, E. O. Ulrich, and H. G. Ferguson attended the Fourteenth International Geological Congress at Madrid, Spain.

ALLOTMENTS AND EXPENDITURES

The funds available for the work of the division of geology for the fiscal year were as follows:

Geologic surveys	$325,000
Classification of lands	41,800
Scientific assistants	14,600
Search for potash deposits (allotted from appropriation for chemical and physical research)	3,850
Repayments from other departments	970
Repayments from States and cities	3,240
	389,460

The expenditures from these funds may be classified by subjects approximately as follows:

Hawaiian volcanology	$11,650
Geology of metalliferous deposits	60,000
Geology of nonmetalliferous deposits	11,000
Geology of fuels (oil, gas, coal)	79,000
Scientific researches not directly connected with economic geology, etc	128,960
Supervision, administration, services of clerical, technical, and skilled-labor forces, etc	96,350
Budget reserve and unexpended balance	2,500
	389,460

Of the amounts available for geologic work approximately $95,000 was used directly to pay field expenses. About 73 per cent of this amount was expended for work west of the one-hundredth meridian and about 27 per cent for work east of it.

COMMITTEE ON GEOLOGIC NAMES

The committee on geologic names, under the chairmanship of T. W. Stanton, reviews the geologic manuscripts submitted for publication, advises authors and other inquirers as to established nomenclature, and through its systematic accumulation of records of the use of geologic names performs an essential service in preventing confusion in this vexing field. Under the direction of the chairman the secretary of the committee, Miss M. G. Wilmarth, has prepared a number of charts indicating the current ideas of correlation in particular regions. These charts have been photolithographed and distributed widely to working geologists, to whom they have been of much assistance in the solution of local problems and in the use of the voluminous existing literature.

PHYSIOGRAPHIC COMMITTEE

The physiographic committee, under the chairmanship of M. R. Campbell, continued to review the manuscripts of papers dealing with geography and physiography and the use of technical terms therein, and to accumulate material for a revision of the physiographic divisions of the United States. It also is the source of information supplied to inquirers on geomorphic subjects and on the particular topographic maps that are best suited for use in teaching.

THE WORK IN GENERAL

In numberless ways, many of them most obvious, others but obscurely discernible, the Nation is still feeling the surge of the World War. One of the less widely recognized, perhaps, of these many after-effects is the recognition of the value of science which has spread through industry in recent years. Scientists and industrial leaders became acquainted by working side by side in a common cause through 1917 and 1918. Each learned to respect the contribution that the other made to the solution of the acute and vital problems of the time. When the crisis was over, many leaders of industry went home with a greatly enhanced respect for "research" and for the men engaged in it. They had found that these men were human beings, with no special endowments, perhaps, but with special knowledge and training and a surprising capacity to use them in practical ways. The more alert among the business leaders promptly utilized this experience, and as a result industrial laboratories and scientific staffs in industry have greatly multiplied since the war. Furthermore, these leaders are now manifesting a sympathy with research in general and a desire to foster it, with full confidence that the results will be of value. Prior to this experience science and scientists had been to them vague terms. connoting something queer and impractical, to be tolerated perhaps because an inscrutable power for some mysterious reason had placed them on earth but not entering at all into everyday affairs.

For the time being, at least, that state of mind has passed. Science and research are in demand. But the demand is often em-

barrassing. The understanding acquired by the industrial leaders is not complete. There is still something of the commercial tendency to order a piece of research by telegraph for delivery next day—to expect the scientist to answer on the instant a question that he may be able to answer after a year or a lifetime of work. Yet scientific results are wanted—more generally and more intelligently and more insistently than a decade ago.

The Geological Survey recognizes and would like to respond to this changed and changing attitude. In its field it continues, with the staff and the means available to it, to endeavor to do sound work and to follow sound principles. In geology three main trends may be recognized in its endeavors, although these may all merge in individual projects. First, it seeks to devote some of its energies to the establishment of principles and the discovery of new generalizations and new laws of wide applicability. These new discoveries may be made in the field of petroleum geology, or the geology of the metals, or glaciology, or paleontology, or seismology. But, once established, they are sure to have wide applicability either in industry or in the more general field of man's intelligent adaptation to his environment. Second, it endeavors continually to make known new facts. These may take the form of a geologic map, which thereafter becomes the guide of the metal miner or the petroleum engineer or the teacher. Or they may be set forth in a report describing and illustrating the extinct life of a past epoch, and this enables the commercial geologist to determine the relative ages of the rocks with which he has to deal. To an oil-company geologist or a mining engineer such a report may be like a road map to a tourist. These are perhaps indirect services to the mining industry, but finally it also endeavors to serve this industry directly in its economic reports, which may describe in detail the character, quality, and exact position of deposits of rock phosphate, or coal, or building stone, or petroleum. Such reports are immediate guides to mining and are the basis for the detailed work in local areas of the company geologist or engineer.

In none of these three lines of endeavor is the Geological Survey doing all the work that, as a long established scientific bureau, it should do or is expected to do. The multiplication of commercial geologists who are applying the science in industry multiplies the demands for fundamental science to apply. More paleontology is wanted, more sound geologic mapping, more and better bases for correlation, more understanding of the processes of ore deposition, more broad structural studies, more knowledge of the geologic reasons underlying earthquake activity. Something, but by no means enough, is done in these various fields which the Geological Survey is properly expected by the scientific and the lay public to occupy. The work of the year is outlined below in some detail by States, but a few of its salient features may be summarized here.

The preparation of State geologic maps, usually in cooperation with the State organizations, continues. The map of Alabama, prepared in cooperation with Dr. E. A. Smith, State geologist, for publication by the State, was in press at the end of the year; and those of Oklahoma and New Mexico were completed and are in

process of publication by this organization. Systematic progress is being made on the map of Texas, with the cooperation of the State Geological Survey and the active geologists in the State. All these State maps will contribute to a new geologic map of the United States, which is planned for issue eventually.

Guides to ore in the Leadville district, Colorado, by G. F. Loughlin, was issued as Bulletin 779. It contains a summary of the results of the work of Emmons, Irving, and Loughlin that will appear in full in Professional Paper 148, which went to the Public Printer in May. This short report attempts to present briefly and succinctly the facts and the suggestions of most value to operators that have resulted from the studies of the past.

A study of the deeper workings in the Mother Lode district of California that have been opened since the earlier investigations of that district by Lindgren and Ransome was completed during the year by Adolph Knopf. The report, prepared in cooperation with the State mineralogist and embodying the results of these investigations, is in hand. Another important report in the metalliferous field, completed during the year, is one by B. S. Butler and W. S. Burbank on the copper deposits of Michigan. This report embodies the results of several years' intensive study by Mr. Butler, at first under private auspices but later under the direction of the Geological Survey.

Detailed studies of western coal fields, including the North Sheridan field in Montana, the Wasatch Plateau fields in Utah, and the Hanna and Carbon Basin fields in Wyoming, were continued.

The structural and economic studies in the Goodsprings, La Vegas, and Walker Lake regions of the Great Basin were advanced. Similar work was done in Idaho on phosphate deposits and in Cooke City, Mont., on metalliferous deposits. A reconnaissance of the promising manganese deposits of the Olympic Peninsula, Wash., was made and a brief report prepared.

The region of the Montana earthquake of June 27, 1925, was examined geologically, and a report on it is in press. A brief press statement has also been issued summarizing the results of field studies of the New England earthquakes of 1924 and 1925.

The examination of cuttings from oil wells in western Texas and eastern New Mexico has continued as a part of the search for commercial potash deposits. A Federal appropriation of $100,000 was made toward the end of the year for core drilling in areas that may be recommended as a result of the work of the United States Geological Survey during the last decade and more, so that quantitative data may soon be expected to supplement the merely qualitative information heretofore available.

Suggestive papers have been prepared by Messrs. Van Orstrand and Thom on the structural significance of earth temperatures measured by Mr. Van Orstrand in some of the western oil fields. The oil industry is interested in this subject, and work by the Geological Survey is likely to be supplemented in the future by work done under private auspices.

In the physical laboratory Mr. Nutting suggested to the oil operators of Bradford, Pa., a modification of the water drive by the introduction of a soda solution which, under laboratory conditions,

separates the oil from the sand grains and results in a clean drive and a full recovery of oil. The experiment is now being tried in the field, and the results will be watched with great interest.

E. O. Ulrich studied many of the European Paleozoic sections in July, August, and September, 1925, in consultation with European geologists and paleontologists. This work was done in connection with his studies of the North American Paleozoic, especially for the light it might throw on his proposed Ozarkian and Canadian systems.

The work at the Hawaiian Volcano Observatory was continued throughout the year, and Congress made provision for the expansion of this work during the next fiscal year. Kilauea Volcano was quiescent during the year, but a spectacular eruption of Mauna Loa took place in April, 1926.

COOPERATION

Cooperation with a number of State surveys and other official organizations continued throughout the year.

The Colorado Metal Mining Fund cooperated in a survey of the deeper levels at Cripple Creek and entered into an agreement for more extensive cooperation in a general geologic survey of the known and possible mineralized areas of the States.

Cooperation with the State geologist of Florida was effected for the purpose of revising the geologic map of the State and the report on its geology and water resources. The Geological Survey also cooperated with the Smithsonian Institution in an investigation of reported prehistoric human remains in Florida.

The revision of the geologic map of Alabama and the preparation of the accompanying text were undertaken jointly by members of the State and Federal survey staffs. The work was nearing completion at the end of the year.

The systematic cooperation with the State geologist of Kansas on oil and gas problems and on the preparation of a State map was continued, and similar relations were maintained with the Texas State Survey.

The California Mother Lode report, the field work on which was cooperative, was submitted at the end of the year.

Progress was made on the Pend Oreille and other cooperative reports in Idaho, and minor cooperation was effected with Connecticut and Pennsylvania. Other cooperation was carried out with the National Academy of Sciences, the Hawaiian Research Association, the Office of Indian Affairs, the Bureau of Mines, and the cities of Detroit, Mich., and Clifton Forge, Va.

WORK OF THE YEAR BY STATES

ALABAMA

Charles Butts prepared a paper embracing a statement of new discoveries in the Devonian rocks of Alabama for presentation before the Geological Society of Washington and publication in a scientific journal. A press bulletin was prepared by Mr. Butts on the extent of the Montevallo coal bed of the southern part of the Cahaba coal field, to settle the identity of the coal bed mined at the Straven mine, Straven, Shelby County, and he revised the economic portion of the Bessemer-Vandiver folio. The geologic map of Alabama and accompanying descriptive text prepared in cooperation with the

State Geological Survey have been completed and will soon be ready for distribution by the State. Mr. Butts, L. W. Stephenson, and C. W. Cooke, representing the United States Geological Survey, mapped the Paleozoic, Tertiary, and Quaternary formations, and G. I. Adams, representing the State, mapped the crystalline rocks. Mr. Cooke prepared a paper on the correlation of the Eocene formations of Mississippi and Alabama. G. H. Girty continued the preparation of a paper on the Carboniferous fauna from the town of Trinity.

Publications: Bulletin 781–A; Professional Paper 140–E; Press Notice 5989, "The extent of the Montevallo coal bed of the southern part of the Cahaba coal field, Ala."

ARIZONA

M. N. Short completed an article on ore deposition and enrichment at the Magma mine, Superior, Ariz., of which I. A. Ettlinger is coauthor, for publication in the Transactions of the American Institute of Mining and Metallurgical Engineers. The Permian of Arizona and New Mexico was the subject of a paper by N. H. Darton prepared for publication in the Bulletin of the American Association of Petroleum Geologists. F. E. Matthes wrote an article on the map of Grand Canyon National Park, in collaboration with R. T. Evans, of the topographic branch, which was published in the Military Engineer. A paper on structural studies in southern Nevada and western Arizona, by C. R. Longwell, was presented at the annual meeting of the Geological Society of America and offered for publication by that society.

Publications: Bulletin 771; Professional Paper 140–B; Press Notices 6332, "Mastodons and glyptodonts in San Pedro Valley," and 2119, "Aravaipa and Stanley mining districts."

ARKANSAS

L. W. Stephenson continued the preparation of a report on the stratigraphy of the Upper Cretaceous formations of Texas, Oklahoma, and Arkansas and presented at the Dallas meeting of the American Association of Petroleum Geologists a paper on this subject, which was subsequently revised for publication in the bulletin of that association. J. B. Reeside, jr., examined and reported on a small collection of fossil ammonites from the Brownstown marl for Mr. Stephenson. The Cretaceous rocks in southwestern Arkansas, embracing parts of Sevier, Little River, Howard, Hempstead, Clark, Nevada, and Pike Counties, were mapped by C. H. Dane, assisted by Paul D. Torrey, after a preliminary reconnaisance of the area with L. W. Stephenson and H. D. Miser. Later Mr. Stephenson and Mr. Dane made a field trip for the purpose of reviewing the geology of the area and correlating the formations with those of northeastern Texas. Mr. Dane began a report on the areal geology and stratigraphy of the oil-bearing Cretaceous formations of southwestern Arkansas and prepared a press notice on the stratigraphy. H. D. Miser, C. S. Ross, and L. W. Stephenson continued work on a report on the volcanic rocks in the Upper Cretaceous of southwestern Arkansas, northeastern Texas, and southeastern Oklahoma. Messrs. Miser and Ross prepared a note on the discovery of pre-Cambrian rhyolite in a well in northwestern Arkansas, for publication in the Bulletin of the American Association of Petroleum Geologists. A report on the fauna of the lower Boone at Batesville, Ark., was completed by G. H. Girty.

CALIFORNIA

Field work in the Alleghany mining district, Calif., was completed by H. G. Ferguson, assisted by R. W. Gannett, and some progress was made on a report on the geology and ore deposits of the district; F. H. Knowlton reported on the Miocene plants. F. E. Matthes made a physiographic reconnaissance of the Kings and Kaweah drainage basins, including the Sequoia National Park. Mr. Matthes revised his professional paper on the origin of Yosemite Valley, continued work on his report on the physiography of the upper San Joaquin basin, completed a paper on the glaciation of San Jacinto Peak for publication in Science, and prepared an article on Kings River canyon and Yosemite Valley for publication in the Bulletin of the Sierra Club. Plants of the Burnham Chemical Co., American Trona Corporation, and Inyo Chemical Co. and deposits of borax and bentonite near Shoshone were visited by G. R. Mansfield and L. F. Noble, and Mr. Mansfield also visited the Red Mountain

magnesite mine, east of Livermore. Mr. Noble continued field and office study of the San Andreas rift and of the nonmetalliferous minerals of the southern part of the State. He prepared papers on the borate deposits at Kramer, Kern County, and a colemanite deposit near Shoshone, with a sketch of the geology of a part of Amargosa Valley. Adolph Knopf completed his report on the resurvey of the Mother Lode district. C. P. Ross visited quicksilver mines in California. W. P. Woodring and P. V. Roundy continued work on their report on the geology and oil resources of the Elk Hills district, and Mr. Woodring prepared an article on Pliocene *Viviparus*-like opercula from California for publication in Nautilus. H. W. Hoots completed field work on the Wheeler Ridge oil field and adjacent areas at the south end of San Joaquin Valley and has submitted a partial report on these areas to the conservation branch. Mr. Hoots also did structural mapping in the Salinas Valley, in Monterey County, and submitted a report to the conservation branch. W. S. W. Kew prepared an article on the geology of the San Pedro Hills, based on work done while he was a member of the Geological Survey, for publication by the Los Angeles Chamber of Mines and Oil. T. W. Stanton identified Cretaceous fossils from southern California for the San Diego Museum of Natural History and reported on Cretaceous invertebrates for R. B. Steward.

Publication: Bulletin 768.

COLORADO

G. F. Loughlin, assisted by J. C. Beam and T. S. Lovering, studied the deep mines in the Cripple Creek district, and Mr. Loughlin completed a report on "Guides to ore in the Leadville district" (Bulletin 779). B. S. Butler and Mr. Lovering prepared for a study of the mining geology of Colorado, to be commenced in the next fiscal year in cooperation with the Colorado Metal Mining Fund. E. S. Larsen, assisted by John W. Vanderwilt, reviewed the geology of a portion of the San Juan Mountains. The manuscript of a report on the Quaternary geology and physiography of the San Juan region by W. W. Atwood and K. F. Mather was completed. Mr. Atwood prepared an article on the utilization of a rugged mountain region, based on a survey of the San Juan Mountains, for publication in Economic Geography. Stratigraphic work on the Book Cliffs and Grand Mesa was done by E. M. Spieker and J. B. Reeside, jr., as part of a study of the Mesozoic and Tertiary formations exposed along the Book Cliffs between Woodside, Utah, and Palisade, Colo. Mr. Reeside examined Cretaceous and Tertiary fossils collected in the Book Cliffs and adjacent regions, Utah and Colorado, by Mr. Spieker and himself in 1925; late Pierre fossils for Prof. J. Harlan Johnson, of the Colorado School of Mines; and Cretaceous fossils collected in 1924 in northeastern Colorado by K. F. Mather and party. A report on the oil and gas resources of northeastern Colorado, by Mr. Mather, James Gilluly, and R. G. Lusk, was completed and transmitted for publication.

Stratigraphic work in connection with coal and oil land classification in western Colorado (Montrose County) and southeastern Utah was done by W. T. Lee, assisted by Paul Torrey, W. W. Boyer, and George Hansen. Mr. Lee and W. T. Thom, jr., studied critical sections within this area. F. H. Knowlton reported on Cretaceous plants from western Colorado for Mr. Lee. A press notice on oil possibilities of southwestern Colorado and southeastern Utah was prepared by Messrs. Thom, Lee, Boyer, and Gilluly. W. H. Bradley, assisted by R. D. Ohrenschall, made stratigraphic studies of the Green River oil-bearing shale in eastern Utah and northwestern Colorado and continued the preparation of reports on the stratigraphy of the Green River formation in Colorado and Utah and on the alga reefs and oolites of the Green River formation. M. R. Campbell, assisted by N. W. Bass and during June, 1926, by K. K. Landes, continued structural and stratigraphic work in the Daton Peak, Pilot Knob, and Mount Harris quadrangles and in Routt County, as a basis for the continuation of the report on the eastern Yampa coal field begun by J. B. Eby. Mr. Campbell prepared reports on oil-prospecting applications for lands in southern Routt County, and N. W. Bass a report on coal in the Pilot Knob quadrangle, for the conservation branch. Mr. Bass gathered data relative to development on the Hamilton, Iles, and Morapos domes and in the Florence, Boulder, Fort Collins, and Wellington oil fields and Wray gas field. He made geologic examinations for the conservation branch as to oil possibilities in T. 5 N., R. 58 W., near Fort Morgan; and in T. 5 S., R. 42 W. W. C. Alden made field studies of the physiography and glacial geology of parts

of Jackson and Routt Counties. A paper on cancrinite as a high-temperature hydrothermal mineral from Colorado was written by E. S. Larsen and W. F. Foshag for publication in the American Mineralogist. C. E. Erdmann, assisted by W. D. Johnston, jr., C. J. Peterson, Seth Ritchey, and O. R. Sherman, under the direction of C. E. Dobbin, began a field study of the stratigraphy and structure of the coal and oil shale along the Book Cliffs in the vicinity of Grand Junction.

Publications: Bulletins 757, 777, 779, and 785–A; Professional Paper 138; Press Notices 2205, "Coal resources in Moffat County," 6332, "History of the metal-mining industry in Colorado," and 6064, "Possibility of finding oil in southeastern Utah and southwestern Colorado."

CONNECTICUT

Mrs. E. B. Knopf began a field and office study of the crystalline schists in northwestern Connecticut in cooperation with the Connecticut State Geological and Natural History Survey.

DISTRICT OF COLUMBIA

M. R. Campbell, C. K. Wentworth, C. W. Cooke, and Laurence LaForge studied terrace deposits and underlying sedimentary deposits of the District of Columbia, and Arthur Keith and Mr. LaForge studied and obtained geologic data from excavations being made in Washington.

FLORIDA

Julia Gardner completed her report on the Tellinacea, Solenacea, Mactracea, Myacea, and Molluscoidea of the Alum Bluff group of Florida and prepared a paper on the nomenclature of the superspecific groups of *Corbula* in the lower Miocene for publication in Nautilus. W. C. Mansfield collected fossil material from the Choctawhatchee formation between Ocklockonee and Choctawhatchee Rivers and south and southwest of Tallahassee, determined the stratigraphic relations and geographic extent of the formation, and continued office work on his report. C. W. Cooke studied the occurrence and stratigraphic position of vertebrate fossils near Melbourne, on the east coast, and near St. Petersburg, on the west coast, in cooperation with the Smithsonian Institution, and prepared a paper on the occurrence of fossil man and Pleistocene vertebrates in Florida for publication in the American Journal of Science. He also did field work for a revision of the report on the geology and water resources of the State and the State geologic map, in cooperation with the Florida Geological Survey.

GEORGIA

C. W. Cooke collected fossil vertebrate remains from the Ocala limestone, near Cordele, Ga., for the National Museum.

IDAHO

Preparation of the cooperative report on the Pend Oreille district, Idaho, was continued by Edward Sampson and J. L. Gillson, and Mr. Gillson wrote a paper for unofficial publication on the granodiorites of the district. The report on the Wood River region of the Hailey quadrangle, by C. P. Ross, L. G. Westgate, and J. B. Umpleby, with a description of the Minnie Moore and neighboring mines, by D. F. Hewett, was completed. Mr. Ross, assisted by W. H. Newhouse and later by C. H. Behre, continued field investigations in the Casto quadrangle and began a report covering these investigations. G. R. Mansfield, assisted by W. B. Lang, studied the geology and mineral resources of the Paradise Valley, Portneuf, and Ammon quadrangles. While in this area they made a trip to Mackay and the Craters of the Moon National Monument; visited the Anaconda Copper Mining Co.'s phosphate mine at Conda, near Soda Springs; and made a trip to King Hill and vicinity to see a reported nitrate deposit. Mr. Mansfield has nearly completed a paper on the geology and phosphate deposits of the Portneuf quadrangle. Reports on collections of fossils from Idaho were made by Messrs. Girty, Kirk, Knowlton, W. C. Mansfield, Roundy, and Stanton.

Publications: Bulletins 774 and 780–D; Professional Paper 140–A; Press Notices 4088, "Promising Idaho copper district," and 6332, "Antimony and quicksilver in central Idaho."

ILLINOIS

C. E. Siebenthal accompanied H. A. Buehler, State geologist of Missouri, and J. E. Spurr, of the Engineering and Mining Journal-Press, on a reconnaissance trip during which the lead, zinc, and fluorspar deposits of southern Illinois were studied in company with R. C. Allen and John T. Fuller.

Publication: Geologic Folio 220.

INDIANA

Frank Leverett extended his glacial studies in Ohio Valley to the vicinity of Madison, Ind. G. F. Loughlin spent 10 days in the Bedford-Bloomington region, studying the latest developments in the Indiana oolitic limestone quarry industry, and continued work on his Indiana limestone report.

IOWA

In company with Prof. G. F. Kay, State geologist of Iowa, and Paul MacClintock, of the University of Chicago, Frank Leverett made a reconnaissance of the several glacial drift sheets of Iowa. Mr. Leverett prepared a paper on the present status of the Iowan problem for the American Association for the Advancement of Science. W. T. Thom, jr., made a reconnaisance examination of the oil possibilities in the vicinity of Hamburg. M. R. Campbell examined some coal mines in Taylor County. G. H. Girty and P. V. Roundy spent three days in field work on the Permian of Iowa; Mr. Girty continued office studies of the Kinderhook fauna, and Mr. Roundy continued studies of outcrop material in connection with his studies in micropaleontology. W. W. Rubey spent a brief period in Iowa and Nebraska, examining outcrops along Missouri River near Sioux City, the type locality of the Dakota sandstone.

KANSAS

N. W. Bass continued cooperative work in Kansas and revised the report on oil and gas possibilities in the western part of the State, with special reference to Ellis and Hamilton Counties, to be published as Bulletin 11 of the Kansas Geological Survey, also papers on the asymmetry of Kansas stream valleys, structure and limits of the Kansas salt beds, and geologic structure of the Dakota sandstone. He also studied the results of recent drilling, examined well cuttings from western Kansas, and collected and compiled data relating to subsurface conditions in eastern Kansas, especially as regards the structure of the surface of the Mississippian limestone. In continuation of the cooperative work with the Kansas Geological Survey, Mr. Bass compiled data on Cowley County for use in an investigation of its oil and gas possibilities, which involved field mapping of the geology, plotting logs of wells, and holding conferences with R. C. Moore, State geologist, and oil-company men. Well cuttings and outcrop material from Kansas were examined by P. V. Roundy, and Carboniferous material by G. H. Girty. Messrs. Girty and Roundy spent seven days in field work on the Permian of eastern Kansas.

KENTUCKY

Frank Leverett continued his studies of the Pleistocene geology of Kentucky for the Kentucky Geological Survey, examining glacial drift and associated deposits near Camp Knox and making a study of deposits in Hart County in company with the State geologist. C. E. Siebenthal accompanied H. A. Buehler, State geologist of Missouri, and J. E. Spurr, of the Engineering and Mining Journal-Press, on a reconnaissance trip, during which the lead, zinc, and fluorspar deposits of western Kentucky were studied in company with R. C. Allen and John T. Fuller.

LOUISIANA

C. H. Dane made stratigraphic studies in northern Louisiana, collected development data in the Monroe gas field, the Urania field in T. 10 N., R. 2 E., and the Lockport area in T. 10 S., R. 9 W., and prepared reports on these areas for the conservation branch. P. D. Torrey examined tracts in the Cotton Valley field for land classification. T. W. Stanton reported on Cretaceous fossils from deep wells in Caddo Parish for A. F. Crider.

MAINE

Office work on the folio covering the Portland quadrangle was continued by Laurence LaForge.

MARYLAND

G. R. Mansfield examined a deposit of diatomaceous earth on Patuxent River west of Dunkirk, Md. Field and office work in connection with reports prepared cooperatively with the Maryland Geological Survey for Carroll and Frederick Counties was continued by Miss A. I. Jonas. C. K. Wentworth, accompanied a part of the time by M. R. Campbell, examined terraces and gravel deposits of Pliocene and Pleistocene age in Maryland. W. C. Mansfield spent a few days in the vicinity of Langleys Bluff examining Miocene and Pleistocene deposits. He has in preparation a short paper on spiral forms collected by L. W. Stephenson from Langleys Bluff and a paper on Pleistocene mollusks from Wailes Bluff and Langleys Bluff.

MASSACHUSETTS

The field mapping of the Greylock and Berlin quadrangles, Mass., was continued by L. M. Prindle, who made some progress in the preparation of the Taconic folio, covering these quadrangles. Mrs. E. B. Knopf was in the field a few days collaborating with Mr. Prindle. The Boston folio was completed by Laurence LaForge.

MICHIGAN

Field work on the Michigan copper district was completed by B. S. Butler, assisted by W. S. Burbank, and the report on it was transmitted. F. E. Matthes was detailed to make an investigation of geologic formations in the vicinity of Detroit in order to advise the Detroit City Department of Water Supply regarding the construction of a new intake tunnel. G. H. Girty reported on Carboniferous fossils from Michigan.

MINNESOTA

A report on the surface geology of Minnesota and adjacent districts was completed by Frank Leverett. T. W. Stanton identified Cretaceous invertebrates from Minnesota.

MISSISSIPPI

L. W. Stephenson and C. W. Cooke revised the manuscript and map of a cooperative report on the ground waters of Mississippi. A paper on the correlation of the Eocene formations of Mississippi and Alabama, for publication by the Geological Survey, and one entitled "New species of the Eocene mollusks from Jackson," for publication in the Journal of the Washington Academy of Science, were prepared by Mr. Cooke.

Publication: Bulletin 781–A.

MISSOURI

C. E. Siebenthal accompanied H. A. Buehler, State geologist of Missouri, and J. E. Spurr, of the Engineering and Mining Journal-Press, on a reconnaissance trip visiting the pegmatite in Camden County, the lead-zinc mines of the Tri-State district, the outcrops of igneous rocks and copper prospects at Eminence, the iron deposits at Iron Mountain and Pilot Knob, the old Silver mine with gangue carrying wolframite, the lead-copper-cobalt-nickel deposits at Fredericktown, the disseminated lead deposits of the St. Joseph Lead Co. at Bonne Terre, and the barytes workings and mill at Old Mines. R. D. Mesler studied collections of Upper Cambrian and Lower Ordovician fossils from Missouri. G. H. Girty worked on a report on a sink-hole fauna from Missouri and examined Carboniferous fossil material.

MONTANA

A. A. Baker, assisted by C. E. Erdmann, A. J. Bauerschmidt, H. H. Chen, J. M. Dunning, Harry Burnsides, and J. C. Beam, continued a field study of the geology and coal resources of the part of the northern extension of the Sheridan coal field, Big Horn and Rosebud Counties, Mont., east of Tongue

River, and revised a previously written report thereon, incorporating results of the field work of 1925. He prepared for the conservation branch reports covering a number of townships east of Tongue River. W. T. Thom, jr., reviewed the structure of the Cat Creek field, collected geologic data from oil companies in Billings, made a reconnaissance of the structure north, west, and south of the Crazy Mountains, and with J. B. Reeside, jr., devoted a little time to work on the Bearpaw-Lance stratigraphic relations near Wyola. Mr. Thom revised a structure contour map of eastern Montana prepared jointly with C. E. Dobbin and wrote an abstract of a paper on the origin of the structural features of eastern Montana, which was presented at the meeting of the Geological Society of America in December, 1925. A. J. Collier, assisted by J. M. Dunning, examined and classified coal land southeast of the Bearpaw Mountains, north of Missouri River; examined the Bowes dome, south of Chinook, and the gas well 25 miles northeast of Chinook, in T. 35 N., R. 21 E.; and reexamined the south side of the Bowdoin dome, Phillips and Valley Counties. Assisted by J. C. Beam, Mr. Collier worked in the Little Rocky Mountains, reviewing the geology and constructing a topographic map of the part of the mountains not covered by the Fort Belknap Indian Reservation. In the office Mr. Collier began the revision of a report on the oil and gas possibilities of the Kevin-Sunburst district and of the Sweetgrass arch, prepared a revised press notice on this field, and wrote an informal report on the coal south of Bearpaw Mountains and north of Missouri River, for the conservation branch.

In connection with a study of the earthquake of June 27, 1925, and the bringing up to date of the report by D. D. Condit and E. H. Finch on the phosphate deposits in the Three Forks-Yellowstone Park region, J. T. Pardee examined an area of about 7,500 square miles south and west of Bozeman and between Great Falls and Bozeman; wrote a report for official publication on the Montana earthquake of June 27, 1925, an abstract of which was submitted for publication in the Special Bulletin of the Seismological Society of America and also Science Service; and began a paper on post-Tertiary faults of southwestern Montana. An examination of Tps. 1 N. and 1 S., R. 7 E., Gallatin County, for coal classification was made by Mr. Pardee, who prepared reports for the conservation branch. R. S. Knappen revised his report on the oil resources of the northern Big Horn Basin. A report on the New World (Cooke City) mining district, Park County, was completed by T. S. Lovering. Frank Reeves continued his work on the areal and structural geology of the Bearpaw Mountains and revised a report on the Cat Creek and Devils Basin oil fields. W. W. Rubey prepared geologic and topographic maps of portions of the Broadus, Ridge, and Ericson quadrangles for inclusion in his report on the Black Hills rim, and wrote informal reports for the conservation branch on pending cases in southeastern Montana. Mr. Rubey devoted some time to the revision of the report on the Ingomar dome, by K. C. Heald. T. W. Stanton reported on Jurassic fossils from the Big Snowy Mountains for the Absaroka Oil Development Co., and G. H. Girty studied Carboniferous fossils from Montana.

Publications: Press Notice 4655, "The Kevin-Sunburst oil field."

NEBRASKA

G. H. Girty and P. V. Roundy made a short field study of the Permian in Nebraska and began office preparation of the material collected. Mr. Roundy studied outcrop material and well cuttings from the State in connection with his studies in micropaleontology. W. W. Rubey spent a day in Nebraska examining outcrops along Missouri River near Sioux City, Iowa, the type locality of the Dakota sandstone.

NEVADA

A field study of the areal and economic geology of the Hawthorne and Tonopah quadrangles, Nevada, was continued by H. G. Ferguson, assisted by Gordon H. White, and some progress was made in the preparation of a report thereon. T. W. Stanton made preliminary studies of the Jurassic and Triassic invertebrates from these quadrangles and determined the stratigraphic succession of the faunas. Mr. Ferguson completed his report on Camp Gilbert; a paper on the ore deposits of Nevada, for presentation to the Geological Society

of Washington; and a paper on late Tertiary and Pleistocene faulting in western Nevada, for presentation to the Geological Society of America. C. P. Ross examined quicksilver mines in Nevada. C. R. Longwell, assisted by C. E. Erdmann, resumed geologic mapping in the Las Vegas quadrangle. G. R. Mansfield, with L. F. Noble, examined land near Silver Peak on which applications for potash leases had been filed. A report on the geology and ore deposits of the Goodsprings mining district was nearly completed by D. F. Hewett, who also prepared a paper entitled "Progress in the survey of the Ivanpah quadrangle," for the Geological Society of America. F. C. Schrader continued work on his report on the mining districts in the Carson Sink region. Work on the Pioche report was continued by L. G. Westgate and J. L. Gillson. Mr. Gillson wrote a paper on conechalcite from the Bristol mine, Lincoln County, for publication in the American Mineralogist. Carboniferous material from Nevada was studied by G. H. Girty.

NEW MEXICO

J. B. Reeside, jr., and N. H. Darton completed field work on the Permian of southern New Mexico, and Mr. Reeside studied the earlier Mesozoic near Thoreau. Mr. Darton revised and combined his reports on the geology of New Mexico and the "Red Beds" and associated formations of New Mexico and added the results of last season's field work in the Guadalupe region. He prepared a report on the Permian of Arizona and New Mexico for publication in the Bulletin of the American Association of Petroleum Geologists, and in association with J. B. Reeside, jr., a paper on the Guadalupe group for the Geological Society of America. In connection with investigations of the occurrence and nature of potash deposits W. B. Lang watched drilling operations and collected samples from wells in the potash area of southeastern New Mexico. Three press notices were prepared by G. R. Mansfield on the Texas-New Mexico potash area. W. W. Boyer wrote a press notice concerning the Bloomfield Mesa field, San Juan County, and reports on the eastern part of the Sierra Blanca coal field and the La Ventana coal field, for use in classification. A report on the Lake Valley fauna was continued by G. H. Girty. A scientific article on the occurrence of tetradymite at Hachita is in preparation by M. N. Short. Collections of fossils from New Mexico were identified by F. H. Knowlton, J. B. Reeside, jr., and P. V. Roundy. A. C. Spencer continued work on his Santa Rita report.

Publications: Bulletins 767, 780–B; Press Notices 5134, "The Gallup-Zuni Basin," 4548, "The Bloomfield Mesa oil and gas field, San Juan County," 5077 and 5134, "Potash in Texas and New Mexico," and 6331, "Important potash finds in New Mexico and Texas."

NEW YORK

Progress was made on the Taconic geologic folio, covering portions of the Hoosick and Berlin quadrangles, N. Y., by L. M. Prindle, who also made a study of material collected during a geologic trip through the talc-mining districts of New York. In connection with field examinations in the Bradford oil district, Paul Torrey collected well records and made a study of sand samples and production records in the New York fields. Reconnaissance mapping in a study of the pre-Cambrian crystalline schists in the area north of the Hudson River Highlands was carried on by Mrs. E. B. Knopf in the Milbrook, Copake, Clove, Carmel, and Poughkeepsie quadrangles, and office study of the material collected was begun.

NORTH CAROLINA

A paleontologic paper on additions to the invertebrate fauna of the Upper Cretaceous of the Carolinas was continued by L. W. Stephenson, in connection with which he made a supplementary collection of Cretaceous and Eocene fossils from pits near Rocky Point, Pender County, and collected Miocene fossils near Goldsboro, Wayne County. W. C. Mansfield has in preparation a cooperative report on the Great Lake well No. 2, near Havelock, and a report on the Pliocene and Pleistocene fossils along Neuse River. He identified Miocene, late Tertiary, and Quaternary fossil material from the State. E. W. Berry reported on fossils from North Carolina submitted by Mr. Mansfield.

Publication: Professional Paper 140–C.

OHIO

Frank Leverett made a study of the surface geology of part of southeastern Ohio and the adjacent border of West Virginia, to determine the relation of the silt deposits and sand and gravel to the several stages of glaciation and to drainage modifications. The field expenses were paid by a grant from the Joseph Henry fund by the National Academy of Sciences. A manuscript on Quaternary geology for the Cleveland folio was revised by Mr. Leverett.

OKLAHOMA

Data relative to the oil development on Deer Creek, Okla., were collected by H. W. Hoots for inclusion in the report on Grant County begun by R. S. Knappen. A report on volcanic rocks of the Cretaceous of southwestern Arkansas, southeastern Oklahoma, and northeastern Texas is being prepared by H. D. Miser, L. W. Stephenson, and C. S. Ross; Mr. Miser has completed his portion. Mr. Stephenson is writing a report on the stratigraphy of the Upper Cretaceous formations of Texas, Oklahoma, and Arkansas, and read a paper on this subject at the Dallas meeting of the American Association of Petroleum Geologists, which was subsequently revised for publication in the bulletin of that association. G. H. Girty continued work on his reports on the occurrence of *Martinia* in the Pennsylvanian rocks of Oklahoma, on the Mayes fauna, and on the Moorefield fauna. Well cuttings and outcrop material from Oklahoma were examined by P. V. Roundy in connection with his studies in micropaleontology. H. D. Miser and Miss M. G. Wilmarth prepared a correlation table for a report by C. N. Gould on the geology of Oklahoma. Mr. Roundy, C. H. Dane, P. D. Torrey, and Miss A. M. Farrell were in attendance at the Geological Survey's exhibit at the International Petroleum Exposition and Congress, held at Tulsa October 1–10, 1925, and Mr. Roundy attended the sale of Osage leases at Pawhuska to advise the Office of Indian Affairs regarding adequacy of bids. A revised oil and gas map of Oklahoma was prepared by G. B. Richardson. C. E. Siebenthal continued work on the Wyandotte report.

OREGON

G. R. Mansfield examined diatomite deposits at Terre Bonne, Oreg. W. C. Mansfield prepared a report on fresh-water fossils, probably of Pliocene age, collected by H. T. Stearns from lake beds near Lakeview.

PENNSYLVANIA

Paul Torrey began field work in the Bradford district, Pennsylvania, which included the study of factors influencing water and oil movement through the sand, collection of production data of flood wells, traverses, collection of fossils and water samples, examination of sand samples from wells, study of acre yields and composite decline curve of natural production, measurement of samples, and structural mapping. He also made observations of the erosional effects of an ice gorge. W. C. Mendenhall, Charles Butts, W. T. Thom, jr., and P. G. Nutting visited Bradford during the year for conferences with the operators and Mr. Torrey on field problems in the district. Mr. Butts did field work in the Bradford quadrangle and reported on fossil collections from this quadrangle for Mr. Torrey. A press notice on getting more oil from oil-field sands, based partly on the work of P. G. Nutting on Bradford sands, was written by David White. Field work in the Tyrone quadrangle was completed by Mr. Butts, and office work on the final map and text was continued. Revision of field mapping in the Bellefonte quadrangle was also completed by Mr. Butts. G. H. Girty completed his report on the Pocono fauna of the Broadtop coal field, prepared a report on Devono-Carboniferous fossil collections, and reported on Carboniferous fossils from the State. Mrs. E. B. Knopf revised the chapter on physiography in the manuscript on the geology of the Quarryville and McCalls Ferry quadrangles. P. V. Roundy studied ostracodes from Pennsylvania.

A geologic map of Pennsylvania for eventual publication by the State survey is being compiled under the direction of G. W. Stose and is in large part completed. Field work in the Middletown, Lancaster, and York quadrangles was carried on by A. I. Jonas and Mr. Stose in preparation of a folio, and

field work in the New Cumberland quadrangle was done by Mr. Stose to bring results up to date for publication by the State. Mr. Stose, as joint author with Florence Bascom, revised the Fairfield-Gettysburg folio and completed the Coatesville-West Chester folio. He also wrote a geologic report on Adams County for publication by the State survey. Work on a report on the coal and oil resources of the New Kensington quadrangle was continued by G. B. Richardson, who also prepared data for the Pennsylvania Geological Survey on coal in the Butler quadrangle and revised the text and maps of the Somerset-Windber folio. Edwin Kirk and R. D. Mesler reported on paleontologic material from Pennsylvania.

Publication: Press Notice 2156, "Experiments in getting more oil from oil-field sands."

SOUTH CAROLINA

C. W. Cooke continued work on his report on the geology of the Coastal Plain of South Carolina, which included the preparation of a geologic map of the State, and studied cuttings from deep wells in the State. He was assisted in studies of the Miocene fauna by W. C. Mansfield.

SOUTH DAKOTA

T. W. Stanton examined Cretaceous fossils from a diamond-drill core from northern Ziebach County, S. Dak., for the State geologist. W. W. Rubey examined the oil possibilities of a region near Edgemont for the conservation branch, collected fossil plants near Hot Springs, and visited the bentonite quarries near Ardmore and Belle Fourche. F. H. Knowlton reported on the distribution of supposed Dakota flora in the Black Hills region for Mr. Rubey.

TENNESSEE

H. D. Miser spent a little time reviewing the geology of the Waynesboro quadrangle, Tenn., an important iron-ore area, in cooperation with the Tennessee Geological Survey. E. W. Berry continued work on a paper on the Wilcox flora of western Tennessee. E. F. Burchard completed a report on the brown iron ores of west-middle Tennessee. G. H. Girty studied Carboniferous fossils from the State, and R. D. Mesler prepared Paleozoic fossils.

TEXAS

W. B. Lang continued to visit wells, interview drillers, obtain samples of potash, and study stratigraphic conditions in western Texas. Four press notices on the Texas potash area were prepared by G. R. Mansfield. L. W. Stephenson continued his field study of the Gulf series of the Cretaceous formations in northeastern Texas. He was accompanied for several days by H. D. Miser and C. H. Dane, the object of whose work was to cooperate in correlating the Cretaceous formations in that area with corresponding formations in Arkansas and Oklahoma. Mr. Stephenson is preparing a report on the stratigraphy of the Upper Cretaceous formations of Texas, Oklahoma, and Arkansas and read a paper on this subject at the Dallas meeting of the American Association of Petroleum Geologists, which was subsequently revised for publication in the Bulletin of that association. He also made a reconnaissance investigation of lignite deposits in the northeastern part of Morris County. N. H. Darton and J. B. Reeside, jr., completed field work on the Permian of southern New Mexico and northwestern Texas and prepared a paper on the Guadalupe group of this region for publication in the Bulletin of the Geological Society of America.

Messrs. Stephenson and Darton are gathering and compiling data for a revised geologic map of Texas in cooperation with the State Bureau of Economic Geology and Technology, Mr. Stephenson working in the Coastal Plain region and Mr. Darton in the western part of the State. In this connection Mr. Darton was engaged in reconnaissance mapping of a part of northwestern Texas and revision of mapping in Wheeler, Armstrong, Donley, Collingsworth, Childress, Cottle, Motley, and Hull Counties, and held conferences with the State geologist at Austin. An investigation of the extent and character of certain structural features in the Amarillo field, Potter County, was made by W. W. Rubey for the Bureau of Mines. Field work on the Midway formation of

Texas, in cooperation with the Bureau of Economic Geology and Technology, was continued by Julia Gardner, who also studied well cores from the Midway formation in the laboratory of the State bureau. Office work on a map of the region was begun. M. I. Goldman continued study and laboratory work relative to salt-dome cap rocks. H. D. Miser, C. S. Ross, and L. W. Stephenson continued the writing of a report on the volcanic rocks of the Cretaceous of southwestern Arkansas, southeastern Oklahoma, and northeastern Texas. An oil and gas map of the State was prepared by G. B. Richardson. T. W. Stanton reported on Comanche invertebrates and Cretaceous fossils from Texas. P. V. Roundy continued the examination of well cuttings from the State in connection with his studies in micropaleontology. Office work on reports on the Cisco fauna and on the faunas of Mississippian formations of San Saba County was continued by G. H. Girty, who examined Texas Carboniferous fossil material. Messrs. Roundy and Girty continued work on the report on the Bend fauna of Texas. W. C. Mansfield prepared a report on Eocene fossil material from the vicinity of Bastrop. F. H. Knowlton reported on supposed Cretaceous fossils for W. B. Lang.

Publications: Bulletin 780–B; Professional Paper 146; Map showing oil and gas fields of the State of Texas; Press Notices 5077 and 5134, "Potash in Texas and New Mexico," 6331, "Important potash finds in New Mexico and Texas," and 7714, "Fifteen more potash wells in Texas."

UTAH

James Gilluly, assisted by E. T. McKnight and S. S. Nye, completed areal, stratigraphic, and structural studies in the San Rafael Swell and a report on the geology and oil and gas prospects of part of the Swell. Mr. Gilluly and J. B. Reeside, jr., wrote a report on the sedimentary rocks of the San Rafael Swell and some adjacent areas in eastern Utah and also a paper on Jurassic rocks of eastern Utah, which was presented at the meeting of the Geological Society of America. A report was written by Mr. Gilluly on parts of T. 22 S., R. 8 E., Emery County, Utah, for the conservation branch. Messrs. Reeside and Gilluly studied the Wingate-Morrison sequence from the San Rafael Swell to a point near Moab and visited the Cretaceous section on the west flank of the Henry Mountains. Field and office study of the Gold Hill mining district was begun by T. B. Nolan. Mr. Nolan continued his work in the Salduro Marsh, in cooperation with the General Land Office and the Bureau of Mines. G. R. Mansfield spent one day with Mr. Nolan in this area. Mr. Nolan wrote a paper on potash brines underlying the Great Salt Lake Desert, and also a report on this same subject for the conservation branch. W. H. Bradley, assisted by R. D. Ohrenschall, continued field study of the stratigraphy of the Green River formation in eastern Utah. He is writing papers on the stratigraphy of the Green River formation in Colorado and Utah and on the alga reefs and oolites of the Green River formation.

E. M. Spieker and D. J. Fisher continued general stratigraphic work and detailed coal work in the Wasatch Plateau and Book Cliffs region. Mr. Spieker made stratigraphic and structure studies and did geologic mapping on the west flank of the Wasatch Plateau, chiefly in Manti, Sixmile, and Twelvemile Canyons and the intervening country, and, together with Mr. Reeside, studied the Mesozoic and Tertiary formations along the Book Cliffs from Woodside, Utah, to Grand Junction, Colo. He wrote a paper entitled "Post-Cretaceous orogeny in central Utah," covering the west side of the Wasatch Plateau, for presentation before the Geological Society of America, and completed the revision of his paper on the Wasatch Plateau coal field. He prepared for the conservation branch reports on coal near Crescent, Grand County, and on other small areas in the State. Mr. Fisher made progress on his report on the Book Cliffs coal field. Mr. Reeside wrote a memorandum on correlation of the Cretaceous of southern Utah for R. C. Moore and worked on a joint paper by Mr. Spieker and himself on the Upper Cretaceous shore line in Utah for presentation to the Geological Society of America. A report entitled "A section of the Kaibab limestone in Buckskin Gulch, Utah," was completed and submitted for publication by L. F. Noble. Field investigation as a basis for a report on the economic geology of the Fairfield and Stockton quadrangles was begun by Sidney Paige and continued by James Gilluly. W. C. Alden studied the glacial geology and physiography of Bear River Valley and of the Wasatch

Mountains, near Salt Lake City, and studied the region bordering the north front of the Uinta Mountains from Provo, Utah, east to Green River and Rock Springs, Wyo.

W. T. Lee, assisted by Paul Torrey, W. W. Boyer, and George Hansen, was engaged in stratigraphic work connected with coal and oil land classification in eastern Utah and western Colorado. Mr. Lee prepared a report on the continuity of formations in western Colorado and eastern Utah, which was transmitted to the open files and the conservation branch. Mr. Boyer wrote a report on coal in the Dakota (?) formation of southwestern Colorado and southeastern Utah and, for the conservation branch, a report on the stratigraphy and structure of Lisbon and East Moab Valleys, Grand and San Juan Counties. W. T. Thom, jr., and Messrs. Lee, Boyer, and Gilluly prepared a press notice on oil possibilities of southwestern Colorado and southeastern Utah. In the spring of 1926 further field study of the oil and gas possibilities of southeastern Utah was taken up by field parties in charge of A. A. Baker and E. T. McKnight, working under the general direction of C. E. Dobbin. Messrs. Gilluly and Reeside were associated with Mr. Dobbin at the beginning of the work, and S. S. Nye, N. F. Stull, G. H. Hansen, Charles Brewer, jr., and J. L. Anderson assisted in it. F. C. Calkins continued work on the report on the general geology of the Cottonwood district. B. S. Butler, assisted part of the time by Mr. Gilluly, studied late developments in this district. Edwin Kirk studied the Paleozoic formations with Messrs. Butler and Gilluly. Messrs. Reeside and Kirk, G. H. Girty, R. D. Mesler, and F. H. Knowlton reported on fossil collections from the State.

Publication: Press Notice 6064, "Possibility of finding oil in southeastern Utah and southwestern Colorado."

VERMONT

Arthur Keith studied the Taconic stratigraphy and structure of northwestern Vermont. L. M. Prindle made some progress on the Taconic folio and studied material collected by him during a geologic trip through the talc-mining districts of Vermont.

VIRGINIA

W. C. Mansfield prepared for outside publication a paper entitled "Note on the occurrence of the Choptank formation in the Nomini Cliffs, Virginia." G. H. Girty examined Carboniferous fossils from the State. E. W. Berry reported on fossils from Virginia for W. C. Mansfield. C. P. Ross made an investigation and a report on the available ground-water supplies of Arlington County, at the request of the Arlington County Water Supply Commission. C. K. Wentworth, accompanied by M. R. Campbell a part of the time, examined terraces and gravel deposits of Pliocene and Pleistocene age in Virginia. W. T. Lee, at the request of the city of Clifton Forge, made a brief examination in order to advise the city officials regarding the site for a new dam which the city proposes to build. He prepared a report on this examination. An article on the Natural Tunnel of Virginia was written by G. W. Stose for publication by the Southern Railways in an advertising pamphlet and by the Virginia Geological Survey.

Publication: Press Notice 4479, "Water supply for Arlington County."

WASHINGTON

J. T. Pardee wrote a press notice on manganese in the Olympic Mountains, Wash., and a report on manganese-bearing rocks near Lake Crescent and Humptulips, the field examination for which was made in August, 1925. Mr. Pardee and C. S. Ross contributed material for a paper by Kirk Bryan on the "Palouse soil" problem, with an account of elephant remains in wind-borne soil on the Columbia Plateau. G. R. Mansfield examined magnesite deposits at Chewelah. F. H. Knowlton continued work on a description of the flora of the Puget formation and studied the plant-bearing rocks of the Latah formation in the vicinity of Spokane.

Publication: Professional 140–A.

WEST VIRGINIA

Edwin Kirk prepared a report on Ordovician, Silurian, and Upper Devonian fossils submitted by D. B. Reger, of the West Virginia Geological Survey, and, at G. H. Girty's request, a description of a new species of crinoid from the Mississippian of West Virginia. A study of the surface geology of the portion of West Virginia adjacent to southeastern Ohio was made by Frank Leverett to determine the relation of the silt deposits and sand and gravel to the several stages of glaciation which affected the district to the north; the field expenses for this study were paid by the National Academy of Sciences from the Joseph Henry fund.

WISCONSIN

G. H. Girty and P. V. Roundy collected pre-Carboniferous fossils in Wisconsin.

WYOMING

T. S. Lovering and E. F. Burchard examined the Seminoe iron deposits, Carbon County, Wyo., and Mr. Lovering wrote a report on them. W. C. Alden continued his studies of physiography and glacial geology in Wyoming, embracing parts of Carbon and Natrona Counties, the Salt Range, the Teton Mountains, Jackson Hole, the Gros Ventre Mountains (slide of 1925), Hoback Canyon, the Green River valley and Wyoming Range, and the region of Kemmerer and Evanston. He continued work on his report on the physiography and glacial geology of Wyoming and wrote for unofficial publication a paper on the Gros Ventre landslide of June, 1925. C. D. Avery's oil scouting took him to the Garland, Byron, Lovell, Oregon Basin, Hidden Dome, and Thermopolis districts and to Casper, Cheyenne, Rawlins, and Cody. The report by C. H. Wegemann, C. E. Dobbin, and R. W. Howell on the Pumpkin Buttes coal field was revised and transmitted for publication.

J. B. Reeside, jr., and W. T. Thom, jr., made a reconnaissance study of the Piney formation between Big Horn and Parkman. Mr. Reeside wrote a report on cephalopods from the lower part of the Cody shale of Oregon Basin; examined Cretaceous fossils collected in northern Wyoming by E. Binney, jr., in the Rock River region by Mr. Dobbin, and in the Parkman region by Mr. Thom and himself; and arranged and examined lists of Pierre fossils from the western Black Hills. T. W. Stanton reported on core samples from a well at Lingle and examined cuttings from a well in the Labarge field. Edwin Kirk prepared paleontologic material from the Ordovician of Wyoming. G. H. Girty examined Carboniferous fossils from the State. Mr. Thom began work on a structure contour map of Wyoming. A. A. Baker wrote an informal report on oil possibilities of the Steele Creek anticline, in T. 46 N., R. 82 W., for the conservation branch. C. E. Dobbin, assisted by H. W. Hoots, C. H. Dane, C. D. Avery, and P. D. Torrey, reexamined the Hanna Basin coal field, Tps. 12 to 16 N., Rs. 88 to 92 W., Carbon County, and mapped the Belle and Buck Springs domes, Tps. 22 and 23 N., Rs. 88 and 89 W., and the structure in Tps. 18 and 19 N., R. 87 W.; made a reconnaissance structural examination of the west side of the Sierra Madre southward to the Colorado boundary; and checked and brought up to date information on the Rock Creek oil field previously collected by Hancock and Dobbin, extending the limits of the area mapped to cover the Cooper Cove and Dutton Creek anticlines and to connect with the mapping in the Hanna and Carbon Basins. Reports covering the examinations in the Hanna Basin, Bell Springs district, and Rock Creek district were prepared and transmitted to the conservation branch and for publication, and a report on the area west of the Sierra Madre was submitted to the conservation branch. G. B. Richardson revised the oil and gas map of Wyoming. W. W. Rubey did further field work in Weston, Crook, and Campbell Counties and continued to write his reports on the Black Hills rim. He prepared a map and memorandum for the conservation branch on an oil-lease appeal near Newcastle and a memorandum on irrigation possibilities near Moorcroft. A. A. Baker checked the mapping of the Steele Creek anticline in T. 46 N., R. 82 W., and submitted a report regarding it to the conservation branch. Mr. Thom prepared for the conservation branch two blue prints of a structure map of the Bolton Creek dome and adjacent structural features. M. R. Campbell and Mr. Reeside, assisted by Waldo S. Glock and K. K. Landes, studied part of the

Cretaceous section in the south end of the Little Snake River coal field for the purpose of correlating the coal beds with those of the Yampa field in Colorado.

Publications: Professional Papers 140–D and 145; Bulletins 780–C and 781–B.

OTHER WORK

A field and office study of the causes of earthquakes affecting New England was carried on by Arthur Keith.

C. S. Ross made an investigation of the copper deposits of the southern Appalachian States and began a report on these deposits.

F. H. Knowlton reported on Miocene plants from British Columbia for the Secretary of the Smithsonian Institution, and G. H. Girty studied Carboniferous fossils from British Columbia.

Edwin Kirk prepared a paper on a new Devonian pelecypod genus from China.

T. W. Stanton examined Cretaceous invertebrates from Cuba.

G. H. Girty worked on a report on a Carboniferous fauna in Mexico.

T. W. Stanton identified Cretaceous invertebrates from Mongolia for Barnum Brown.

J. B. Reeside, jr., examined Cretaceous fossils from Venezuela submitted by J. T. Duce for the Texas Co.

E. F. Burchard examined iron and manganese ore deposits in the State of Minas Geraes, Brazil.

W. P. Woodring continued work on his report on Miocene mollusks from Bowden, Jamaica, in cooperation with the Carnegie Institution of Washington; assembled for the National Research Council data on tectonic history and submarine topography of the Caribbean region; and determined a collection of Tertiary fossils from Porto Rico submitted by the Isabela Irrigation Service.

DIVISION OF CHEMICAL AND PHYSICAL RESEARCH

The personnel of the division of chemical and physical research, consisting of 7 chemists, 2 physicists, 1 laboratory aid, 1 clerk, and 1 laborer, as well as the organization, remained unchanged during the year. George Steiger was in charge of the work in chemistry and acted in charge of the division when necessary, and C. E. Van Orstrand was in charge of the work in physics.

WORK IN CHEMISTRY

The work in chemistry comprised the partial and complete analyses of rocks and other geologic products, the identification and analysis of minerals, the study of geochemical problems, and researches in mineralogic chemistry. During the year 6,274 specimens were examined, of which 2,621 were analyzed or mineralogically examined for the official work of the Geological Survey and 3,653 were identified for citizens. On June 30, 1926, there were awaiting attention 650 samples for analysis and 35 for identification.

W. T. Schaller's continued study of the natural history of pegmatites, in both laboratory and field (Maine, Massachusetts, Connecticut, Pennsylvania, Maryland, Virginia, and North Carolina), has amply verified the conclusion reached by him last year as a result of studies of pegmatites from California, that many of the pegmatites, as now seen, are not the original magmatic rock but are the result of later replacement processes. In consequence it seems probable that many ideas relating to the petrogenesis of igneous rocks in general may need considerable revision. A preliminary paper on this subject, entitled "The genesis of lithium pegmatites," was published, progress was made on the revision of the report on the gem tourmaline field of southern California, and papers on replacements in pegmatites, the origin of graphic granite, and the petrogenic meaning of eutectic-like structure in rocks are in preparation. Mr. Schaller lectured on the last subjects before the mineralogical clubs of Philadelphia, New York, and New Haven, attended the annual meeting of the Geological Society of America at New Haven, was elected president of

the Mineralogical Society of America, and received the first prize offered by the Geological Society of Washington for excellence in presentation of paper. Papers on purple muscovite from New Mexico and uranium minerals from Lusk, Wyo., were published in outside journals, and he continued studies on the various autunites and on the minerals in the potash field of Texas, identifying celestite (strontium sulphate).

Bulletin 778, "Chemistry of deposition of native copper from ascending solutions," by R. C. Wells, was published during the year, also a short paper on "What is an element?" and a table on the age of minerals for the "International critical tables of constants." This table gives the ages of minerals found by combining analytical data with the genetic relationships among the radioactive elements and their products arrived at by physicists. The ages thus found run up into hundreds of millions of years and allow the time for the several genetic epochs that some geologists have felt necessary to assume on other grounds. Mr. Wells also wrote a paper on the salinity of the water of Chesapeake Bay and conducted experiments on the reduction of sulphates, incidental to a study of the ashes from petroleum cokes.

Experiments with various methods for determining extremely small quantities of platinum were made by George Steiger and E. T. Erickson. The coatings on sand grains were studied chemically by Mr. Steiger with relation to P. G. Nutting's investigations of the migration of oil, and their physical and chemical properties were studied by R. C. Wells. Mr. Steiger prepared a report for the committee on sedimentation, National Research Council, on the work done in chemistry during the year which related to the problem of sedimentation, and in joint authorship with E. S. Larsen wrote a paper on the dehydration of alunogen, nontronite, and griffithite. He also made a series of experiments on the permeability of granite and other rocks.

E. T. Erickson continued a study, including laboratory experiments, on the structural organic chemistry of plant and animal remains and their decomposition products in relation to the formation of natural hydrocarbons. Mr. Erickson also studied the chemistry of the colored material of a paraffin-base petroleum and made experiments on the precipitation of copper by organic agencies.

After studies, including laboratory experiments, E. P. Henderson wrote three papers—"Polycrase from Brazil," in joint authorship with Frank L. Hess; "Topaz and associated minerals from Einstein silver mine," with C. S. Ross; and "Purple muscovite from New Mexico," with W. T. Schaller. Mr. Henderson also practically completed laboratory work which will be the basis of two papers on tetradymite from New Mexico and on triplite from the Black Hills and made laboratory experiments on the separation of columbium from tantalum.

J. G. Fairchild prepared artificial pyromorphite and autunite. In the autunite mineral the base was controlled at will by varying the composition of the brine used in its synthesis.

The laboratory tested 1,800 salts for potash, and those showing more than 1.5 per cent K_2O (642) were also quantitatively assayed. The salts came from 41 different wells distributed over 15 counties in western Texas and southeastern New Mexico. Each of the wells produced salts containing more or less potash, but the most promising were in Reagan, Crane, and Upton Counties, Tex., and Lea County, N. Mex. The Texon well No. 3, Regan County, showed two rich zones at depths of 1,450 to 1,550 feet and 1,255 to 1,310 feet, and the richest salts in these zones contained 10.22 and 11.25 per cent of K_2O, respectively. The Campbell State well, the Texon well No. 2, and the California well, all in Reagan County, yielded 23 salt samples each containing more than 3 per cent K_2O, the highest content being 13.60 per cent. Five wells in Upton County yielded 18 salt samples each containing more than 3 per cent K_2O; the richest of these was taken from the Mary Baker well No. 1 and assayed 12.72 per cent. Other wells producing rich samples of potash salts were the Cordona and Cowden wells of the Cordona Oil & Potash Co., and the Cowden well No. 1 of the Texas Development Co., all in Crane County; the Sherbino well, in Pecos County; Hill Bros. well No. 1, Midland County; Hutchings well No. 1, Ward County; and the Stevens well, in New Mexico. This group of wells produced 30 salt samples each containing more than 3 per cent of K_2O, and the richest sample contained 9.60 per cent.

The result of the year's work confirms the conclusion previously drawn that rich potash salts may be expected at relatively shallow depths, the salts analyzed during the year with the best showings having been obtained 800 to 1,600 feet below the surface. The figures given all refer to the percentages of K_2O in the sample as taken from the well and not in the soluble salt, which would be considerably higher. R. K. Bailey has improved the method of analysis, especially the qualitative test. Mr. Bailey also identified carnallite from the Crescent Eagle well, near Thompson, Utah; and sylvite from the McNutt well No. 1, Carlsbad, N. Mex.; and the first piece of white polyhalite found in the United States, which came from the Virginia-Texas well, Upton County, Tex.

WORK IN PHYSICS

The use of geophysical methods of research in pure and applied geology is an important phase of scientific development to which the geologist is gradually turning for assistance in the solution of numerous problems. Two distinct contributions in this field were made from the physical laboratory during the year—one by C. E. Van Orstrand on deep earth temperatures and one by P. G. Nutting on petroleum recovery.

The results thus far obtained in the general investigation of deep earth temperatures show that the temperatures in individual wells often reflect correctly the existence of marked subsurface conditions, and comparison of the results obtained from a group of wells in the same field shows that the highest temperatures are to be expected on the structural crests. These results are obviously of very considerable practical and theoretical significance. In order to determine the general applicability of the tentative conclusion that the highest temperatures are to be found on the structural crests, the investigation is being extended to as many fields as possible, and last summer preliminary observations were made at Fort Collins, Colo., Long Beach, Calif., and El Dorado, Ark. Incidentally a few observations were made in the Moffat Tunnel, East Portal, Colo.; and tests were made in a well at Longmont, Colo., which had reached a depth of 7,300 feet. A temperature of 212° F., the boiling point of water at sea level, was found in this well at a depth of about 6,600 feet.

In the field of petroleum recovery Mr. Nutting has devoted his time largely to investigating the movements of fluids through porous solids to determine the essential factors upon which that movement depends. This work has centered about the motion of petroleum, water, and water solutions through oil sands and the effects of pressure, porosity, adsorption, surface tension, and similar factors upon that movement.

The application of sodium carbonate solutions to the driving of petroleum from oil sands, described in a report released July 2, 1925, was followed by several conferences with producers in the Bradford field, Pa., who entered whole-heartedly into the development of the field technique of its use. Soda was introduced into many wells, and it is thought that some indications of success of the process can already be noted. However, as the ordinary water-driving period is 30 months, several years will be required to test out the process and develop the best methods of applying it in different oil fields. Laboratory research has been devoted to the details and limitations of the process, the amount of soda used up per foot of drive, the effects of rate of drive, pore space, and foreign salts in connate waters, of coatings of silicates, oxides, and hydrocarbon compounds on the sand grains, and the filtering action of some sands on some oils. Findings have been reported in a number of scientific papers. The chemical problems involved have centered about the interrelations of oil, water, and silica; the physical problems about the relative motions of fluids and solids. Considerable time has been given also to conferences with and work for geologists interested in the field, covering folding, faulting, shearing rupture, exfoliation, and related problems. Volcanologists and seismologists are also interested in laboratory research in this field.

E. B. Hill, of the topographic branch, assisted in the reduction of observations of deep earth temperatures from April 8 to the end of the fiscal year.

ALASKAN BRANCH

PERSONNEL AND EXPENDITURES

On July 1, 1925, the personnel of the Alaskan branch consisted of 1 chief Alaskan geologist, 3 geologists, 3 associate geologists, 1 assistant geologist, 3 topographic engineers, 1 supervising mining engineer, 1 coal-mining assistant, 1 metal-mining assistant, 1 draftsman, and 3 clerks; on June 30, 1926, it consisted of 1 chief Alaskan geologist, 3 geologists, 4 topographic engineers, 1 supervising mining engineer, 1 mining engineer, 1 associate mining engineer, 1 coal-mining assistant, 1 metal-mining assistant, 1 draftsman, and 3 clerks. One additional associate mining engineer was employed from July 15, 1925, to January 15, 1926, and one clerk from October 5, 1925, to June 15, 1926. The increase in the total personnel of the Alaskan branch over that of preceding years resulted from the transfer to the Geological Survey of activities formerly conducted by the Bureau of Mines in Alaska. This change added four persons to the Alaskan branch on July 1, 1925, and two others on June 30, 1926. It may be noted that the number of geologists now connected with the Alaskan branch is less than at any other time since the organization of this work in 1903.

The season for the field work of the Geological Survey in Alaska commonly extends from May to October and thus overlaps two fiscal years, but as the appropriations are made available for immediate use field work may be done at the end of a fiscal year on two appropriations simultaneously. The following statements, therefore, relate principally to the work of the field season of 1925, as just defined, and to the beginning of the field season of 1926.

The funds available in part for the fiscal year 1926 included the appropriations of $72,000, carried in the Interior Department bill, available March 3, 1925, and $50,000, carried in the Interior Department bill for the fiscal year 1927, available May 10, 1926. In addition to these sums, appropriated directly for expenditure by the Geological Survey, $22,000 was transferred to the Geological Survey from the appropriation of $33,000 for the Alaska work of the Bureau of Mines, contained in the Interior Department bill for the fiscal year 1926, and $12,300 remained from funds amounting to $75,000, which were made available to the Geological Survey by transfer from the Navy Department for the continuation of the investigation of Naval Petroleum Reserve No. 4, in northern Alaska. Three of these appropriations were legally available and were drawn on for expenses incurred in the fiscal year 1925; all four were available and used in part in the fiscal year 1926; and the unexpended greater part of the appropriation for the fiscal year 1927 is still available for expenditure during the year.

The expenditures from all these funds have been accounted for under the methods and procedure laid down by law or by the regulations of the Treasury Department, but these methods do not lend themselves to showing the costs during a single fiscal year or concerning individual projects. The labor and expense of determining the precise expenditures for the different jobs by years would far exceed the value of the resulting analysis, and therefore these expenditures have not been accurately computed. The following state-

ments give only in round figures the principal uses to which the funds were put during the fiscal year 1926. The amount expended in starting off the parties in advance of the beginning of the fiscal year in the field season of 1925 practically offset the amount used to start the parties at the end of the fiscal year 1926 to begin the work of the field season of 1926. Thus, except for the work financed by the Navy Department and the supervision of mineral leasing financed by a transfer from the Bureau of Mines, which will be analyzed separately, the funds used for the fiscal year 1926 were $72,000, expended approximately as indicated below:

Expenditures from funds directly appropriated for Geological Survey Alaska work

Branch administration	$5,500
Other technical salaries	21,450
Branch clerical and drafting salaries	5,900
Services rendered by other Survey units, including editing, duplicating-machine service, accounting, and other expenses	5,800
Office expenses, stationery, telegrams, photography, and other expenses	2,300
Field expenses	30,600
Airplane mapping by Navy Department (cooperative)	450
	72,000

The items in the table "Other technical salaries," "Field expenses," and "Airplane mapping" and $1,500 of the item for clerical salaries have been allotted for the different kinds of surveys and investigations in progress during the fiscal year 1926, as follows:

General investigations	$1,875
Geologic surveys	33,800
Topographic surveys	16,425
Statistics of mineral production	1,900
	54,000

In this table it is not possible to determine accurately the distribution of expenses to topographic and geologic surveys where combined topographic and geologic parties are concerned, and such expenses are divided equally, although the cost of the topographic surveys is thereby underestimated.

Approximate cost and distribution of work by geographic divisions for the fiscal year 1926

General investigations	$1,875
Southeastern Alaska	6,950
Prince William Sound	6,600
Matanuska region	1,675
Southwestern Alaska	6,525
Skwentna-Kuskokwim region	5,675
McKinley region	4,100
Upper Yukon and Sheenjek regions	10,525
Northern Alaska	8,175
Statistics of mineral production (including $1,500 for clerical salaries)	1,900
	54,000

The balance of $12,300 remaining from the funds made available to the Geological Survey by transfer from the Navy Department for investigation of Naval Petroleum Reserve No. 4 was expended as shown in the following table:

Allocation of funds for surveys in Naval Petroleum Reserve No. 4, northern Alaska

Administration	$1,375
Technical salaries	5,750
Clerical and drafting salaries	1,700
Field expenses	3,475
	12,300

The following table shows the progress that has been made in topographic and geologic surveys in Alaska since 1898, including the field season of 1925. Three types of surveys of different scales and of correspondingly different degrees of accuracy have been made. Wherever an overlapping of surveys of different kinds has taken place only the area mapped on the largest scale is tabulated.

Areas surveyed by Geological Survey in Alaska, 1898–1926, in square miles

Fiscal year	Areas covered by geologic surveys			Areas covered by topographic surveys		
	Exploratory (scale 1:500,000, 1:625,000, or 1:1,000,000)	Reconnaissance (scale 1:250,000)	Detailed (scale 1:62,500)	Exploratory (scale 1:500,000, 1:625,000, or 1:1,000,000)	Reconnaissance (scale 1:250,000; 200-foot contours)	Detailed (scale 1:62,500; 25, 50, or 100 foot contours)
1898–1925	75,500	140,720	5,847	55,980	180,650	4,066
1926		13,785	130		9,500	
	75,500	154,505	5,977	55,980	190,150	4,066
Percentage of total area of Alaska	40.2			42.6		

WORK OF THE YEAR

Under the heading "General investigations" in the preceding tables are included studies which relate to the broader problems of Alaskan geologic history as well as to investigations in specific fields. Among them are paleontologic studies which, through the courtesy of the geologic branch, were carried on mainly by the specialists of that branch. These studies are of the greatest importance in solving the problems connected with deposits of coal and petroleum, as well as in the study of geologic history. They include the determination of Mesozoic invertebrate fossils from the upper Yukon and the Alaska Peninsula by T. W. Stanton; of Carboniferous fossils from the upper Yukon and southeastern Alaska by G. H. Girty; of Ordovician, Silurian, and Devonian invertebrates from the upper Yukon and southeastern Alaska by Edwin Kirk; of fossil plants from the Alaska Peninsula by F. H. Knowlton; of Triassic and Cretaceous invertebrates from northern Alaska by J. B. Reeside, jr.; and of Middle Cambrian invertebrates from the upper Yukon by C. E. Resser. Analyses of potash waters were made by the water-resources branch and analyses of minerals by the chemical laboratory. Additional work was done by James McCormick on the revision of the "Geographic dictionary of Alaska," which was published in 1906 but has been out of stock for many years. This bulletin is of great value as a reference list of Alaskan geographic names.

The publications of the year consist of papers on parts of Alaska Peninsula (Bulletin 773–D) and the Chandalar district (Bulletin 773–E); the consolidated report on the progress of investigations in Alaska in 1923 (Bulletin 773); the administrative report and a report on the mineral industry of Alaska in 1924 (Bulletin 783–A); and a comprehensive summary of the Mesozoic stratigraphy of Alaska (Bulletin 776). (See p. 9.)

In the Washington office Miss Lucy M. Graves, chief clerk of the branch, acted as chief of the branch during the absence of Philip S. Smith in the field in 1925. S. R. Capps acted as branch chief from February 8 to May 21, 1926, and F. H. Moffit from May 22 to the end of the fiscal year. Miss Erma C. Nichols, statistical clerk, devoted a considerable part of her time to the collection and coordination of mineral statistics. Mrs. Marion E. Maclean was engaged in general clerical work from the time of her connection with the branch, October 5, 1925, until June 15, 1926. On June 16, 1926, she was temporarily transferred to the topographic branch. John B. Torbert, scientific illustrator, was engaged throughout the year in the preparation and drafting of topographic maps and illustrations.

FIELD SEASON OF 1925

The field work of the Alaskan branch in the fiscal year 1926 includes parts of two field seasons, 1925 and 1926. In 1925 eight field parties were at work in Alaska, comprising five geologic parties, one topographic party, and two combined topographic and geologic parties, with which were connected seven geologists and three topographers. In addition the chief Alaskan geologist inspected different field parties and carried on administrative work in Alaska.

Philip S. Smith, chief Alaskan geologist, was engaged in office work in Washington till July 12, 1925, when he left for Alaska. He spent about one week in visiting the field party in charge of A. F. Buddington at Hyder, in southeastern Alaska, and an equal time with the party under Fred H. Moffit on Prince William Sound. Most of his field season, however, was spent in Juneau, Anchorage, and Fairbanks, and in the Matanuska and Nenana coal fields in consultation with Messrs. Stewart and Corey concerning plans for carrying on the work transferred from the Bureau of Mines and in studying the mining situation.

A. F. Buddington made a reconnaissance of the west coast of Dall Island and spent the later part of the season of 1925 in detailed geologic surveys in the Hyder district at the head of Portland Canal, adjacent to one of the active Canadian silver-lead camps. A description of this work has been prepared for publication.

R. K. Lynt carried on detailed topographic surveys in Wrangell Narrows near Petersburg, in southeastern Alaska, in cooperation with the General Land Office.

Fred H. Moffit continued the investigation of the copper and other metalliferous deposits of Prince William Sound, one of the important copper-producing districts of Alaska which has also been a producer of gold and gives promise of further development. At the end of the field season on Prince William Sound he visited Chitina Valley to collect information on the progress of mining in that district.

K. K. Landes made a reconnaissance geologic survey of an area of about 335 square miles on the south side of Matanuska River, between that stream and Knik River.

R. H. Sargent, topographer, and R. S. Knappen, geologist, made topographic and geologic surveys of an area of 3,000 square miles, extending the full width of the Alaska Peninsula from Aniakchak Crater to a point 25 miles west of the Chignik Lakes. These surveys, whose primary object was to assist in developing the oil resources of the region, completed a series planned to cover the prospective oil-bearing portion of the peninsula.

S. R. Capps carried on reconnaissance geologic surveys on the northwest side of the Alaska Range in the Toklat-Tonzona district of the Mount McKinley region. An area of 2,000 square miles was covered. This survey was in part a resurvey on a larger scale of an area covered by an exploratory survey by A. H. Brooks and D. L. Reaburn in 1902.

J. B. Mertie, jr., made geologic surveys along Yukon River between the international boundary and Circle and at the end of the season spent a week in the vicinity of Fairbanks collecting statistics on mineral production. The surveys on the Yukon covered 1,500 square miles and were in part a resurvey of an area covered by exploratory surveys.

Gerald FitzGerald, topographer, and W. R. Smith, geologist, left Washington in February, 1925, to extend the surveys already made in Naval Petroleum Reserve No. 4, in northern Alaska. They traveled by dog team from Nenana down the Yukon to Norton Sound and thence north to Kotzebue, where they

obtained supplies for the summer. They then completed their winter trip up the Noatak and across the divide to the Arctic slope, arriving before the spring break-up. Their field work began late in April and resulted in exploratory and reconnaissance surveys covering 6,500 square miles, principally in the headwater region of Colville River and some of the northern tributaries of the Noatak.

FIELD SEASON OF 1926

In 1926 four parties were started into the field before the end of the fiscal year. They included three combined topographic and geologic parties and one special topographic party, comprising three geologists and four topographers. The results of their surveys will not be known till the end of the field season of 1926.

Philip S. Smith, chief Alaskan geologist, and Gerald FitzGerald, topographer, left February 8 to continue the mapping of Naval Petroleum Reserve No. 4, on the Arctic slope of Alaska. They proceeded by the same route and same means as the party of FitzGerald and W. R. Smith in 1925 and obtained their provisions at Kotzebue, reaching their field of work before the snow melted. They were beyond means of communication with the Washington office from April 10 to the end of the fiscal year.

R. H. Sargent, topographer, was detailed as special representative of the Geological Survey to accompany the party organized by the Bureau of Aeronautics of the Navy Department to carry on aerial photographic surveys in southeastern Alaska and left Washington to join the party at Ketchikan in May. The work of this expedition is the first attempt to use the aerophotographic method of mapping in Alaska.

S. R. Capps, geologist, and K. W. Trimble, topographer, left in May to carry on geologic and topographic surveys in a district which includes the headwaters of Skwentna River and the South Fork of Kuskokwim River. This district has been hitherto unmapped.

J. B. Mertie, jr., geologist, and J. O. Kilmartin, topographer, sailed for Alaska in May to carry on geologic and topographic surveys on the Sheenjek and other northern tributaries of Porcupine River in northeastern Alaska. This district also had not previously been mapped.

MINERAL-LEASING WORK

The work of the Alaskan branch was enlarged at the beginning of the fiscal year 1926 by the transfer from the Bureau of Mines of certain functions which were given up when that bureau was transferred from the Department of the Interior to the Department of Commerce. These functions include the supervision of the production of coal and oil on public lands in Alaska under the mineral-leasing acts and, by agreement with the Bureau of Mines, the supervision of mine safety and investigative work. The supervision of leased mineral lands is administered in cooperation with the conservation branch, which does the necessary office work and advises the Alaskan branch with respect to the general conduct of work in the field. The following persons connected with the work of the Bureau of Mines in Alaska and resident in the Territory were transferred to the Alaskan branch on July 1, 1925: B. D. Stewart, supervising mining engineer; J. J. Corey, coal-mining assistant; J. G. Shepard, metal-mining assistant; Ilona M. Grover, junior clerk. H. H. Townsend, associate mining engineer, was employed from July 15, 1925, to January 15, 1926. The force was enlarged in June, 1926, by the addition of N. L. Wimmler, mining engineer, and F. W. Holzheimer, associate mining engineer.

The following table shows the manner in which the funds available for the supervision of mineral leasing have been used:

Expenditures from funds transferred to the Geological Survey from the appropriation for the work of the Bureau of Mines in Alaska

Administration (services rendered by other survey units, accounting, etc.)	$540
Technical salaries	13,425
Clerical salaries	1,500
Field expenses	6,095
Budget reserve	440
	22,000

B. D. Stewart spent the major part of his time in the routine supervisory and administrative work of the office at Anchorage, in conferences with officials of the Federal Government and of the Territory, and in the preparation of official reports.

J. J. Corey inspected coal mines in different parts of Alaska, particularly in the Bering River, Matanuska, and Nenana River districts, and consulted with the operators concerning methods and plans for mining and marketing Alaskan coal.

J. G. Shepard inspected metal mines in southern and southeastern Alaska and made reports on prospects and properties.

H. H. Townsend was employed from the beginning of the fiscal year until January 15, 1926, in the examination of metal prospects and mines and the preparation of reports on them.

Ilona M. Grover handled the clerical work of the Anchorage office.

TOPOGRAPHIC BRANCH

ORGANIZATION

The organization of the topographic branch at the end of the year is shown below.

Chief topographic engineer, C. H. Birdseye.

Atlantic division, division engineer in charge, Glenn S. Smith. (In the absence of Mr. Birdseye Mr. Smith acted as chief topographic engineer.)

Central division, division engineer in charge, W. H. Herron.

Pacific division, division engineer in charge, T. G. Gerdine.

Section of inspection and editing, topographic engineer in charge, W. M. Beaman.

Section of computing, geodetic engineer in charge, S. S. Gannett.

Section of photographic mapping, engineer in charge, T. P. Pendleton.

Section of cartography, engineer in charge, A. F. Hassan.

Section of relief maps, engineer in charge, R. W. Berry.

Map information office, engineer in charge, J. H. Wheat.

Each of the three topographic field divisions was reorganized during the year to provide for four areal sections, each under the supervision of a topographic engineer.

PERSONNEL

The technical force was increased by the appointment of 3 junior topographic engineers and the reinstatement or transfer of 1 associate topographic engineer, 1 assistant topographic engineer, 2 junior topographic engineers, 1 senior engineering draftsman, and 1 printer-photographer. The force was reduced by 18 resignations, 4 transfers, and 1 retirement. With these changes the corps now includes 1 chief topographic engineer, 3 senior topographic engi-

neers in charge of divisions, 11 topographic engineers, 2 geodetic engineers, 2 topographic and geodetic engineers, 55 associate topographic engineers, 8 associate geodetic engineers, 5 associate topographic and geodetic engineers, 6 associate cartographic engineers, 24 assistant topographic engineers, 2 assistant geodetic engineers, 2 assistant topographic and geodetic engineers, 11 junior topographic engineers, 7 chief engineering field aids, 6 senior engineering field aids, 6 assistant engineering field aids, 10 apprentice engineering field aids, 1 chief engineering aid, 1 printer-photographer, 11 engineering draftsmen of various grades, and 1 junior scientist (computer), a total of 175. During the year 4 associate topographic engineers, 2 associate geodetic engineers, 3 junior topographic engineers, 1 chief engineering field aid, 2 senior engineering field aids, 1 assistant engineering field aid, and 12 apprentice engineering field aids were on furlough for the whole or a part of the year. The clerical force comprises 16 clerks of various grades, 1 of whom is a per diem employee, and 1 assistant messenger.

PUBLICATIONS

The published work of the topographic branch for the fiscal year consisted of 61 new standard topographic maps, 15 new editions of topographic maps, 43 river plans and profiles, 1 new edition of a State map (Virginia), a new edition of the Washington (D. C.) road map, special editions of topographic maps of the proposed Shenandoah and Great Smoky Mountains National Parks, advance photolithographic prints of 151 new topographic maps now in process of engraving, and 50 photolithographs of new topographic maps for which publication has not yet been otherwise provided. Additional publications were shaded relief editions of a State map of Arizona and of a standard topographic map of a quadrangle in Kentucky-Illinois.

Bulletin 766, "Spirit leveling in California, 1896–1923," a consolidation of chapters previously issued separately, was published during the year. Parts A, Administration, D, Leveling, and F, Photographic mapping, of a new bulletin to be entitled "Topographic instructions of the United States Geological Survey" were transmitted for publication. Part E, Topographic mapping, is in preparation. A three-reel film, entitled "The making of a topographic map," was prepared from field and office pictures taken in 1924–25.

APPROPRIATIONS

The Federal appropriations for topographic surveys for the fiscal year 1926 were as follows:

Topographic surveys	$558,300.00
Salaries, scientific assistants	11,000.00
Special funds for military mapping (contributed by War and Navy Departments)	13,795.19
	583,095.19

COOPERATION

Cooperation has been maintained in 24 States and 1 Territory, which contributed the following amounts:

Alabama	$6, 734. 48	New York	$11, 997. 71
Arizona	24, 898. 30	North Dakota	10, 716. 20
California	22, 911. 75	Oregon	3, 587. 97
Colorado	12, 610. 70	Pennsylvania	18, 864. 77
Delaware	12, 570. 75	Tennessee	20, 892. 24
Georgia	3, 912. 14	Texas	42, 942. 90
Hawaii	27, 122. 91	Utah	5, 609. 39
Idaho	1, 499. 87	Vermont	4, 956. 44
Illinois	47, 495. 99	Virginia	11, 897. 82
Iowa	2, 065. 33	West Virginia	936. 00
Maine	4, 884. 41	Wisconsin	12, 459. 54
Michigan	10, 796. 90		
Missouri	10, 612. 92		344, 950. 14
New Hamsphire	11, 972. 71		

In addition base-map work was executed for other Federal organizations at the following cost: For the Appalachian Park Commission, $94.18; for the National Park Service, $166.79; for the Federal Board for Vocational Education, $13.89; for the Federal Power Commission, $526.80—a total of $801.66.

The total amount expended from all sources for the work of the topographic branch was $927,846.16.

SUMMARY OF RESULTS

The condition of topographic surveys to June 30, 1926, is shown in the following table. The new area mapped during the year was 15,535 square miles, making the total area surveyed to date in the continental United States, exclusive of Alaska, 1,280,919 square miles, or 42.3 per cent of the entire country. In addition, 1,973 square miles of resurvey was completed, making a total area of surveys during the year 17,508 square miles. River surveys amounting to 507 linear miles were also made.

In connection with these surveys 5,591 linear miles of levels were run, making 317,964 miles of levels run since the authorization of this work by Congress in 1896. In the course of this work 1,643 permanent bench marks were established. Triangulation stations to the number of 153 were occupied, and 159 were permanently marked. Transit-traverse lines aggregating 5,021 miles were run, in connection with which 1,332 permanent marks were set.

In addition, 838 square miles of topographic mapping was completed in Hawaii, 3 triangulation stations were occupied, and 2 permanent marks set.

Present condition of topographic surveys of the United States and new area surveyed July 1, 1925, to June 30, 1926

State	New area mapped July 1, 1925, to June 30, 1926	Total area mapped to June 30, 1926	Percentage of total area of State mapped to June 30, 1926	State	New area mapped July 1, 1925, to June 30, 1926	Total area mapped to June 30, 1926	Percentage of total area of State mapped to June 30, 1926
	Sq. miles	*Sq. miles*			*Sq. miles*	*Sq. miles*	
Alabama	314	20,471	39.4	New Hampshire	798	5,296	56.7
Arizona	1,392	56,972	50.0	New Jersey		8,224	100.0
Arkansas		21,494	40.3	New Mexico		40,412	32.9
California	700	124,351	78.6	New York		49,245	100.0
Colorado	906	54,601	52.5	North Carolina		19,003	36.2
Connecticut		4,965	100.0	North Dakota	432	10,449	14.8
Delaware		2,370	100.0	Ohio		41,040	100.0
District of Columbia		70	100.0	Oklahoma		39,908	57.0
Florida		4,716	8.0	Oregon	991	29,551	30.6
Georgia		24,835	41.9	Pennsylvania	652	33,290	73.8
Idaho	407	29,706	35.4	Rhode Island		1,248	100.0
Illinois	899	27,791	49.0	South Carolina		13,737	44.3
Indiana	18	3,662	10.1	South Dakota		19,243	24.8
Iowa	137	12,720	22.7	Tennessee	492	22,291	53.0
Kansas		64,159	78.0	Texas	1,309	85,551	32.1
Kentucky		20,723	51.0	Utah	428	18,856	22.2
Louisiana		8,810	18.2	Vermont	283	6,940	72.5
Maine	292	11,935	36.1	Virginia	268	37,392	87.7
Maryland		12,327	100.0	Washington	297	34,439	49.8
Massachusetts		8,266	100.0	West Virginia		24,170	100.0
Michigan	336	11,489	19.8	Wisconsin	503	16,950	30.2
Minnesota		7,354	8.7	Wyoming		30,102	30.7
Mississippi		3,881	8.3				
Missouri	360	42,745	61.6	Total continental United States (exclusive of Alaska)	15,535	1,280,919	42.3
Montana		41,590	28.5				
Nebraska		27,117	35.0				
Nevada	3,321	44,462	40.2	Hawaii	838	4,990	77.4

In addition the following areas were resurveyed: Delaware, 262 square miles; Georgia, 175; Illinois, 670; New York, 587; Oklahoma, 52; Tennessee, 51; Texas, 166; total, 1,973.

NOTE.—The index map showing areas covered by topographic surveys was last published as Plate I of the Forty-sixth Annual Report and will hereafter be published only at intervals of several years. Index maps showing the progress of topographic mapping in the separate States may be obtained free on application to the Director, Geological Survey, Washington, D. C.

GENERAL OFFICE WORK

Computations for vertical and horizontal control were made, and the results were copied and cataloged by the computing section. The section of relief maps completed shaded relief maps of Arizona, Tennessee, and the Cave in Rock quadrangle, Kentucky-Illinois, and special relief maps of Oregon and Washington and a part of Idaho. The map information office was engaged in indexing and cataloging map data available in the several Federal departments and from commercial sources and in furnishing miscellaneous map information to Government offices and to the public. The compilation of a gazetteer of the lakes of New York was completed.

SECTION OF INSPECTION AND EDITING OF TOPOGRAPHIC MAPS

The section of inspection and editing of topographic maps continued to supervise the office preparation of all topographic maps and to inspect and edit them before reproduction. It also edited a number of maps submitted by other Geological Survey branches and Government bureaus.

The number of topographic maps and projects in progress in the topographic branch (exclusive of those being engraved and printed) ranged from 197 in July to 292 in December; the monthly average was 250. An average of 21 employees were engaged in this section for the year, including an average of 2 temporarily assigned for drafting.

James McCormick spent nine months of the year in work for the United States Geographic Board and in other special investigations and three months in revising the "Geographic dictionary of Alaska."

The work of this section is described further under "Publication branch" (p. 90).

SECTION OF PHOTOGRAPHIC MAPPING

Cooperative work in photographic mapping was continued with the Air Service, United States Army, and the Bureau of Aeronautics, United States Navy. Partial culture and drainage bases were prepared for surveys of 20 quadrangles in Texas, 14 quadrangles in Illinois, 5 quadrangles in New Hampshire, and 1 quadrangle in Michigan, also for the resurvey of 5 quadrangles in New York, 1 quadrangle in Illinois, and 1 quadrangle in Delaware. Eight special bases were prepared for reclamation surveys in Texas, 2 for special surveys in Illinois, 1 for military surveys in Indiana, and 1 for a large-scale map of the city of Bloomington-Normal, Ill.

SECTION OF CARTOGRAPHY

The compilation of the new wall map of the United States was continued, 90 per cent being completed. The State map of Idaho was revised and a new map of Florida was compiled. A map of the air route between Montgomery, Ala., and Columbia, S. C., was compiled for the Air Service, United States Army, and a map of the northern Great Plains was compiled for the conservation branch. The United States part of sheet G–14 of the international map was completed, and preliminary work was done on sheets K–16 and I–12 and on the United States part of sheet M–13. River survey maps of streams in Washington were drafted. Graphs were prepared for the Federal Board for Vocational Education. A metal plate for use in mechanically constructing a Lambert projection on the scale of 1:500,000 for any area of the United States was designed and made.

ATLANTIC DIVISION

Alabama.—In cooperation with the State geologist of Alabama the survey of the Barton and Samantha quadrangles was completed, 314 square miles being mapped (scale 1:62,500, contour interval 20 feet); 182 miles of levels[1] and 90 miles of transit traverse were run and 74 permanent marks set.

Delaware.—In cooperation with the State Highway Department of Delaware the resurvey of the Wyoming quadrangle was completed and the resurvey of

[1] Under the provisions of an act of Congress accurate spirit levels are run and bench marks established within all regular quadrangle areas surveyed. The levels referred to in this report (pp. 57–61), unless otherwise specified, are similar to those designated "primary levels" in previous annual reports and now designated by the Federal Board of Surveys and Maps "third-order levels."

the Deepwater quadrangle was begun (areas previously surveyed on the 1:125,000 scale as parts of the Dover and Vineland quadrangles, respectively), 262 square miles being mapped (scale 1:62,500, contour interval 10 feet); 89 miles of levels and 247 miles of transit traverse were run and 63 permanent marks set.

Georgia.—In cooperation with the State geologist of Georgia the resurvey of the Ball Ground quadrangle was begun (area previously surveyed on the 1:125,000 scale as part of the Suwanee quadrangle), 175 square miles being mapped (scale 1:62,500, contour interval 20 feet); 60 miles of levels and 68 miles of transit traverse were run and 35 permanent marks set.

Indiana.—In cooperation with Purdue University a survey of Purdue University and vicinity was made, 18 square miles being mapped (scale 1:20,000, contour interval 10 feet); 20 miles of levels and 21 miles of transit traverse were run and 20 permanent marks set.

Maine.—In cooperation with the Public Utilities Commission of Maine the survey of the Dead River and Pierce Pond quadrangles was completed and that of the Dixfield quadrangle was begun, 292 square miles being mapped (scale 1:62,500, contour interval 20 feet); 135 miles of levels were run and 29 permanent marks set.

New Hampshire.—In cooperation with the Highway Department of New Hampshire the survey of the Holderness, Penacook, and Wolfeboro quadrangles was completed and that of the Potter Place quadrangle was begun, 615 square miles being mapped (scale 1:62,500, contour interval 20 feet); 211 miles of levels, including 20 miles of "first-order levels," were run, 46 permanent marks set, and 30 triangulation stations occupied and 24 marked. In cooperation with the War Departmet the survey of the Indian Stream quadrangle was completed, 183 square miles being mapped (scale 1:62,500, contour interval 20 feet); 120 miles of levels were run and 34 permanent marks set.

New York.—In cooperation with the New York State engineer the resurvey of the Albany and Troy quadrangles was completed and that of the Coxsackie, Schenectady, and Cohoes quadrangles was begun, 587 square miles being mapped (scale 1:62,500, contour interval 20 feet); 178 miles of levels were run and 50 permanent marks set.

Ohio.—In Ohio 18 miles of levels were run and 44 permanent marks set.

Pennsylvania.—In cooperation with the Pennsylvania Department of Forests and Waters, Topographic and Geological Survey, the survey of the Mifflintown, Blossburg, Needmore, and Hawley quadrangles was completed, that of the Eagles Mere quadrangle was continued, and that of the Tidioute, Youngsville, Titusville, and Townville quadrangles was begun, 652 square miles being mapped (scale 1:62,500, contour interval 20 feet); 354 miles of levels and 352 miles of transit traverse were run and 206 permanent marks set.

Tennessee.—In cooperation with the Tennessee Department of Highways and Public Works, the survey of the Waverly-Camden and Nashville-Clarksville highway projects was completed, 198 square miles being mapped (scale 1:24,000, contour interval 10 feet); 6 miles of levels and 244 miles of transit traverse were run and 64 permanent marks set. In cooperation with the Tennessee State geologist the survey of the Gainesboro quadrangle and of the Tennessee part of the Tompkinsville quadrangle was completed, 355 square miles being mapped (scale 1:62,500, contour interval 20 feet); 196 miles of levels and 473 miles of transit traverse were run and 192 permanent marks set.

Vermont.—In cooperation with the State geologist of Vermont the survey of the Mount Mansfield quadrangle was completed and that of the Claremont and Averill quadrangles was begun, 283 square miles being mapped (scale 1:62,500, contour interval 20 feet).

Virginia.—In cooperation with the Director of the Geological Survey of Virginia the survey of the Rocky Mount quadrangle was completed and that of the Critz quadrangle was begun, 260 square miles being mapped (scale 1:62,500, contour interval 20 feet); 373 miles of levels, including 142 miles of "first-order levels," and 228 miles of transit traverse were run, 216 permanent marks set, and 14 triangulation stations occupied and 16 marked. In cooperation with the Marine Corps a survey of the Quantico Marine Reservation was made, 8 square miles being mapped (scale 1:10,000, contour interval 10 feet); 30 miles of levels and 230 miles of transit traverse were run and 12 permanent marks set.

West Virginia.—In cooperation with the State geologist of West Virginia the culture was revised for the Pineville, Pounding Mill, Glenville, Arnoldsburg, Mullens, Spencer, Ripley, Point Pleasant, and Ravenswood quadrangles, a total area of 1,812 square miles (scale 1:62,500, contour interval 50 feet).

Office work.—The drafting of 32 sheets and 2 projects was completed. Level circuits were adjusted for 68 quadrangles. Geographic positions were computed for 64 quadrangles.

CENTRAL DIVISION

Colorado.—In cooperation with the Colorado State inspector of oils the survey of the Parachute Creek quadrangle was completed, 230 square miles being mapped (scale 1:62,500, contour interval 50 feet); 218 miles of levels and 33 miles of transit traverse were run, 70 permanent marks set, and 33 triangulation stations occupied and 29 marked. At the request of the Forest Service the survey of the Glenwood Springs quadrangle was begun, 550 square miles being mapped (scale 1:125,000, contour interval 100 feet); 179 miles of levels were run and 38 permanent marks set. In cooperation with the Colorado School of Mines the survey of the Grand Valley, Highmore, and Roan Creek quadrangles was begun, 126 square miles being mapped (scale 1:62,500, contour interval 50 feet); 5 triangulation stations were occupied and permanent marks set; and for the control of the Gunnison quadrangle 84 miles of levels were run and 34 permanent marks set. In cooperation with the Colorado Metal Mining Fund control work was begun on the Saguache quadrangle, 20 miles of levels being run, 12 permanent marks set, and 4 triangulation stations occupied and 4 marked.

Illinois.—In cooperation with the Department of Registration and Education of Illinois the survey of the Brighton, Streator, Gibson City, and Galesburg quadrangles and the Illinois part of the Joppa, Paduca, and Smithland quadrangles was completed and that of the Normal and Mount Sterling quadrangles was begun, 899 square miles being mapped (scale 1:62,500, contour intervals 10 and 20 feet). The resurvey of the Springfield quadrangle was begun, 205 square miles being mapped (scale 1:62,500, contour interval 10 feet). The resurvey of the Hinsdale, River Forest, Riverside No. 4, Arlington Heights, Palos Park, and Sag Bridge quadrangles was completed and that of the Riverside No. 2, Highwood No. 2, Des Plaines No. 4, Chicago No. 2, Chicago No. 3, and Evanston No. 3 quadrangles was begun (areas previously surveyed on the 1:62,500 scale as parts of the Riverside, Highwood, Des Plaines, Chicago, and Evanston quadrangles, 468 square miles being mapped (scale 1:24,000, contour interval 5 feet); 622 miles of levels and 518 miles of transit traverse were run and 307 permanent marks set.

Iowa.—In cooperation with the Director of the Iowa Geological Survey the survey of the Albia quadrangle was completed, 137 square miles being mapped (scale 1:62,500, contour interval 20 feet); 97 miles of levels were run and 18 permanent marks set.

Michigan.—In cooperation with the Department of Conservation, Geological Survey Division, of Michigan, the survey of the De Witt and Laingsburg quadrangles was completed and that of the Corunna quadrangle was begun, 336 square miles being mapped (scale 1:62,500, contour interval 10 feet); 149 miles of levels and 610 miles of transit traverse were run and 221 permanent marks set.

Missouri.—In cooperation with the State geologist of Missouri the survey of the Cardareva and Shell Knob quadrangles was completed, and that of the Des Arc quadrangle was begun, 359 square miles being mapped (scale 1:62,500, contour interval 20 feet); 176 miles of levels and 81 miles of transit traverse were run and 79 permanent marks set.

North Dakota.—In cooperation with the State engineer of North Dakota a survey of Souris River was completed, 113 square miles being mapped (scale 1:24,000, contour intervals 5 and 10 feet), and that of the Minot, Benedict, and Coleharbor quadrangles was begun, 319 square miles being mapped (scale 1:62,500, contour interval 20 feet); 355 miles of levels and 725 miles of transit traverse were run and 330 permanent marks set.

Oklahoma.—In cooperation with the University of Oklahoma a partial resurvey of the Norman No. 2 quadrangle was made, 52 square miles being mapped (scale 1:31,680, contour interval 10 feet); 16 miles of levels were run and 12 permanent marks set.

Texas.—In cooperation with the Texas Board of Water Engineers the survey of the Mathis 2 and 3, San Roque Lake 1–a, Aspermost 4–a, Crowther 3,

Simmons 1 and 2, Tilden 1, Haskell 3–b, Roby 2–b, Snyder 1–a, Segovia 2–a and 2–c quadrangles and of the North Llano Strip was completed, and that of the Mathis 4, Cadiz 3, Segovia 3–b and 2–b, Aspermost 3–c and 1–d, Haskell 2–c and 3–c, and Quanah 3–a quadrangles was begun, 841 square miles being mapped (scale 1:62,500, contour intervals 10 and 20 feet); 117 miles of levels and 10 miles of transit traverse were run and 23 permanent marks set. In cooperation with separate interests acting through the Texas Board of Water Engineers, work was begun on the survey of Neches River, 165 miles of levels and 186 miles of transit traverse being run and 120 permanent marks set. In cooperation with the State Reclamation Department of Texas the survey of the Dalworth project, sheets A, B, and C (scale 1:24,000, contour intervals 2 and 10 feet), of the Bazzette, Bazzette extension, Porters Bluff, Porters Bluff extension, Red Bank, and Club House quadrangles of the Trinity River project No. 1 (scale 1:24,000, contour intervals 2, 5, and 10 feet), and of the Cox-Cook project on Trinity River (scale 1:12,000, contour intervals 2 and 5 feet) was completed, and that of the Upper Brazos River project, Marlin to Jones Bridge (scale 1:24,000, contour intervals 2, 5, 10, and 20 feet), and of the Bluntzer project, on Nueces River (scale 1:12,000, contour intervals 2 and 5 feet), was begun, 478 square miles being mapped; 66 miles of levels and 223 miles of transit traverse were run and 66 permanent marks set. In cooperation with Orange County, Tex., 109 miles of levels and 202 miles of transit traverse were run and 69 permanent marks set. The survey of the Bassett quadrangle was begun, 174 square miles being mapped (scale 1:62,500, contour interval 20 feet).

Wisconsin.—In cooperation with the Geological and Natural History Survey of Wisconsin the survey of the Hillsboro quadrangle was completed, and that of the Whitehall, Ferryville, Galesville, Winona, and Montana quadrangles was begun, 503 square miles being mapped (scale 1:62,500, contour interval 20 feet); 318 miles of levels and 225 miles of transit traverse were run and 135 permanent marks set.

Office work.—The drafting of 45 sheets and 3 projects was completed. Level circuits were adjusted for 101 quadrangles. Geographic positions were computed for 94 quadrangles.

PACIFIC DIVISION

Arizona.—In cooperation with the State water commissioner of Arizona the survey of the Wellton Nos. 2, 3, and 4 and Mohawk Nos. 2 and 3 quadrangles was completed, and that of the Sentinel No. 2 quadrangle was begun, 1,392 square miles being mapped (scale 1:62,500, contour interval 25 feet). For these and other quadrangles 474 miles of levels and 4 miles of transit traverse were run, 52 triangulation stations occupied, and 166 permanent marks set.

California.—In cooperation with the State engineer of California the survey of the Guernsey, Corcoran, Strathmore, Waukena, Woodville, Lemon Cove, Tipton, No. 36, and No. 42 quadrangles was completed, and that of the Stratford quadrangle was begun, 540 square miles being mapped (scale 1:31,680, contour interval 5 feet); 217 miles of levels and 251 miles of transit traverse were run and 162 permanent marks set. In cooperation with Los Angeles County the survey of the San Pedro Hills, La Brea, Reseda, and Claremont quadrangles was completed, 47 square miles being mapped (scale 1:24,000, contour intervals 5 and 25 feet). At the request of the National Park Service the survey of the Lassen Volcanic National Park was begun, 113 square miles being mapped (scale 1:62,500, contour interval 50 feet); 70 miles of levels were run and 20 permanent marks set.

Hawaii.—In cooperation with the commissioner of public lands of the Territory of Hawaii the survey of the Hoopuloa NE. ¼, NW. ¼, SW. ¼, and SE. ¼; Mauna Kea NW. ¼, NE. ¼, and SW. ¼; Mauna Loa NW. ¼, NE. ¼, SE. ¼, and SW. ¼; Kaohe NW. ¼ and SW. ¼ quadrangles and the island of Kahoolawe was completed, and that of the Waiki NE. ¼ and Kahoe SE. ¼ quadrangles was begun, 838 square miles being mapped (field scale 1:31,680, contour intervals 10 and 50 feet; publication scale 1:62,500, contour interval 50 feet); 3 triangulation stations were occupied and 2 permanent marks set.

Idaho.—At the request of the Forest Service the survey of the Casto quadrangle was continued, 330 square miles being mapped (scale 1:125,000, contour interval 100 feet). In cooperation with the Bureau of Mines and Geology of Idaho the survey of the Craters of the Moon National Monument was completed, 77 square miles being mapped (scale 1:31,680, contour interval 10

feet); 12 permanent marks were set. For the conservation branch a plan and profile of Payette River and tributaries was completed and a plan and profile survey of the Clark Fork begun, 80 square miles being mapped (scale 1:31,680, contour intervals 5, 10, and 20 feet) and 115 linear miles of river traversed; in addition 7 dam sites were surveyed (scale 1:4,800, contour interval 10 feet).

Montana.—In Montana 11 triangulation stations were occupied and 13 permanent marks set.

Nevada.—At the request of the geologic branch the survey of the Lowry Peak quadrangle was begun, 3,493 square miles being mapped (scale 1:250,000, contour interval 100 feet).

Oregon.—In cooperation with the State engineer of Oregon the survey of the Bend quadrangle was begun, 305 square miles being mapped (scale 1:125,000, contour interval 50 feet). At the request of the Forest Service the survey of the Oregon part of the Hood River quadrangle was completed and that of the Elkhorn quadrangle was begun, 630 square miles being mapped (scale 1:125,000, contour interval 100 feet); 51 miles of levels were run and 20 permanent marks set. At the request of the Carnegie Institution the survey of the Picture Gorge quadrangle was completed, 56 square miles being mapped (scale 1:48,000, contour interval 50 feet). For the conservation branch plan and profile surveys were completed for Crooked River (scale 1:12,000, contour intervals 5 and 25 feet), McKenzie River and tributaries (scale 1:31,680 and 1:4,800, contour intervals 10 and 20 feet), Siletz River and tributaries (scale 1:31,680 and 1:4,800, contour intervals 5, 10, and 25 feet) and the East Fork of Coquille River (scale 1:31,680, contour interval 10 feet), and the survey of the Middle Fork of Willamette River was begun, 202 linear miles of river being traversed; in addition 2 dam sites were surveyed (scale 1:4,800, contour interval 10 feet).

Utah.—In cooperation with Weber, Salt Lake, Davis, and Utah Counties, Utah, and the Bureau of Reclamation the survey of these counties was continued, 100 square miles being mapped (scale 1:24,000, contour interval 5 feet); 116 miles of levels were run and 32 permanent marks set. At the request of the Forest Service the survey of the east half of the Fort Douglas 30-minute quadrangle (scale 1:125,000, contour interval 100 feet) was completed, and that of the Fort Douglas Nos. 2 and 3 quadrangles (scale 1:62,500, contour interval 50 feet) was begun, 153 square miles being mapped. At the request of the geologic branch the survey of the Gold Hill quadrangle was completed, 171 square miles being mapped (scale 1:24,000 and 1:48,000, contour intervals 25 and 50 feet). In cooperation with the department of military science of the University of Utah the mapping of the Fort Douglas Military Reservation was completed, 4 square miles being mapped (scale 1:10,000, contour intervals 10 and 25 feet); 4 triangulation stations were occupied and 9 permanent marks set. For the conservation branch a plan and profile survey of San Rafael River from Castle Dale to Buckhorn Wash was completed (scale 1:31,680, contour interval 25 feet), 40 linear miles of river being traversed.

Washington.—For the Forest Service the survey of the Langille Peak quadrangle was completed, 297 square miles being mapped (scale 1:125,000, contour interval 100 feet). For the conservation branch a plan and profile survey of the North Fork and South Fork of Stilaguamish River was completed, 48 linear miles of river being traversed (scale 1:31,680, contour intervals 5 and 25 feet). In addition dam and reservoir sites were surveyed covering 22 square miles (scale 1:15,840 and 1:4,800, contour interval 5 feet).

Office work.—The drafting of 50 sheets and 19 projects was completed. Level circuits were adjusted for 44 quadrangles. Geographic positions were computed for 27 quadrangles.

WATER-RESOURCES BRANCH

ORGANIZATION

The work of the water-resources branch was conducted under the supervision of N. C. Grover, chief hydraulic engineer, and is organized in five divisions:

Division of surface water, John C. Hoyt, hydraulic engineer, in charge.
Division of ground water, O. E. Meinzer, geologist, in charge.

Division of quality of water, W. D. Collins, chemist, in charge.
Division of power resources, A. H. Horton, hydraulic engineer, in charge.
Division of land-classification investigations, N. C. Grover, chief hydraulic engineer, in charge.

PERSONNEL

During the year the technical force was reduced 12 and was increased 9, a net decrease of 3. At the end of the year the force consisted of 1 chief hydraulic engineer, 1 senior hydraulic engineer, 31 hydraulic engineers, 5 associate hydraulic engineers, 2 engineers, 7 associate engineers, 26 assistant engineers, 33 junior engineers, 2 geologists, 2 associate geologists, 2 assistant geologists, 2 chemists, and 1 assistant chemist, a total of 115. Of this number, 2 hydraulic engineers, 1 associate hydraulic engineer, 1 engineer, 3 assistant engineers, 3 junior engineers, and 1 assistant geologist were employed occasionally.

In the clerical force there were 9 separations and 7 accessions, and at the end of the year the force numbered 25. Of this number 4 have been employed only at times.

ALLOTMENTS

The appropriation for gaging streams was $165,000. In addition $56,000 of the appropriation for the classification of lands was expended for field work by the water-resources branch. Of the total appropriations 60 per cent was allotted to work in public-land States. The cooperative funds made available by State allotments have been increased in some States and decreased in others, and the changes have necessitated corresponding adjustments of this work. The amount of these funds available for the year was $307,490.98. With repayments for services rendered to other branches of the Government ($34,345.86) the total expenditures for work under the administration of this branch were $562,836.84.

Allotments of funds for gaging streams, 1925–26

Administration, general	$15, 179. 42
Branch administration	10, 865. 00
Inspection	1, 000. 00
Computations	12, 510. 00
	39, 554. 42
Surface water:	
New England	5, 000. 00
New Jersey	3, 000. 00
New York	4, 500. 00
Middle Atlantic States	3, 600. 00
North Carolina	3, 600. 00
Tennessee	3, 000. 00
Ohio	3, 500. 00
Texas	4, 300. 00
Wisconsin and Minnesota	3, 500. 00
Iowa	2, 000. 00
Illinois	1, 500. 00
Missouri	3, 600. 00
Kansas	3, 000. 00
Colorado, Wyoming, and New Mexico	5, 000. 00
Surface water—Contd.	
Montana	$4, 300. 00
Utah	4, 300. 00
Nevada	2, 500. 00
Idaho (Boise)	3, 200. 00
Idaho (Idaho Falls)	1, 100. 00
Oregon	4, 300. 00
Washington	4, 300. 00
California	4, 500. 00
Arizona	3, 300. 00
Hawaii	4, 500. 00
	85, 400. 00
Ground water	15, 665. 00
Quality of water	11, 350. 00
Power resources	7, 700. 00
General supplies	500. 00
Books for library	150. 00
Contingent	4, 680. 58
Grand total	165, 000. 00

COOPERATION

Work in the branch is largely conducted in cooperation with Federal bureaus; State, county, municipal, and other governmental agencies; and permittees and licensees of the Federal Power Commission. A major part of this cooperation is set forth below.

States.—The following amounts were expended by States from cooperative allotments. In addition, several State agencies cooperated by furnishing office quarters and occasional services in field and office.

Alabama		$60.00
Arizona:		
Stream gaging	$10,000.00	
Colorado River	7,000.00	
		17,000.00
California:		
State	23,126.52	
County and city (gaging streams)	10,022.24	
Municipal (ground water)	1,949.59	
		35,098.35
Colorado:		175.00
Hawaii:		
Territory	32,392.08	
Municipal	4,461.13	
		36,853.21
Idaho State Department of Reclamation:		
Outside of upper Snake River basin	13,016.25	
Upper Snake River basin	2,200.98	
		15,217.23
Illinois:		
State	4,163.26	
Municipal	60.00	
		4,223.26
Iowa:		
State College Engineering Experiment Station	1,558.43	
State Geological Survey	504.17	
		2,062.60
Kansas:		
State	2,148.48	
Municipal	60.00	
		2,208.48
Maine		5,106.95
Maryland		168.54
Massachusetts		3,899.11
Minnesota		292.51
Missouri		9,926.94
Montana		4,952.75
Nevada		3,664.13
New Hampshire		1,681.89
New Jersey:		
Stream gaging	11,796.59	
Ground water	7,382.73	
		19,179.32
New Mexico:		
State	5,500.00	
Municipal	75.00	
		5,575.00
New York:		
State	15,492.00	
Municipal	84.00	
		15,576.00

North Carolina:		
State	$6,296.42	
Municipal	1,741.74	
		$8,038.16
Ohio		24,684.23
Oregon		8,641.93
Pennsylvania		400.00
Tennessee		10,189.09
Texas:		
State Board of Water Engineers	35,639.24	
State Reclamation Department	685.73	
		36,324.97
Utah		6,953.46
Virginia		10,340.34
Washington:		
State	5,685.98	
Municipal	2,088.14	
		7,774.12
West Virginia		498.72
Wisconsin		6,154.41
Wyoming		4,570.28
		307,490.98

The work done under cooperative agreements with the States has been restricted to studies of stream flow, except in Arizona, New Jersey, New Mexico, North Dakota, and Pennsylvania, where ground-water investigations also have been made. (See pp. 67–69.)

Bureau of Reclamation.—The measurement of streams that are to furnish water to reclamation projects under construction was continued in cooperation with the Bureau of Reclamation. The field work was done by Geological Survey engineers, who were employed where the measurements were made, and the cost was met by the Bureau of Reclamation through transfer of funds. Geologic investigations of reservoir and dam sites were made for the Bureau of Reclamation in New Mexico, Oregon, and Washington. (See pp. 69–70.)

Office of Indian Affairs.—In accordance with authorization by the Office of Indian Affairs, stream gaging was continued in the Colville, Western Shoshone, and Walker River Reservations and on Gila and San Carlos Rivers and for a short time in the Uinta Reservation. A geologic investigation for a ground-water supply was made in the vicinity of Canton, S. Dak.

National Park Service.—Streams in the Yosemite and Yellowstone National Parks were measured during the year at stations maintained in cooperation with the National Park Service. An investigation and report were made for an enlarged water supply in the Mesa Verde National Park.

Forest Service.—A study of stream flow in the Angeles National Forest, in southern California, was continued in cooperation with the Forest Service. A report was submitted on water supplies for live stock in the Helena National Forest, Mont.

Veterans' Bureau.—Geologic investigations were made of water supplies for hospitals at Perry Point, Md.; Bedford, Mass.; and Tupper Lake, N. Y.

Weather Bureau.—Stream gaging has been done on Colorado River in Arizona in cooperation with the Weather Bureau.

Federal Power Commission.—Projects of the Federal Power Commission in Arizona and Wyoming were examined, and the examina-

tion of one in Oregon and one in Utah is in progress. The operations of 1 licensee of the commission in Arizona, 12 in California, 1 in Colorado, 1 in Idaho-Oregon, 5 in Idaho, 1 in Montana, 1 in Nevada, 6 in Oregon, 1 in Utah, and 5 in Washington were supervised by the Geological Survey, as well as the operations of 2 permittees of the commission in Arizona, 1 in Colorado, 3 in Idaho, 1 in Oregon, and 1 in Utah-Wyoming. All stream gaging by permittees of the commission is done in cooperation with the Geological Survey. Such cooperative stream gaging is in progress in Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Illinois, Indiana, Kentucky, Michigan, Minnesota, Missouri, Montana, New Mexico, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, South Carolina, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Office of the Chief of Engineers.—Stream gaging has been done in the basins of Tennessee and Cumberland Rivers in cooperation with the office of the Chief of Engineers.

PUBLICATIONS

The publications of the year prepared by the water-resources branch comprised 22 reports and 1 separate chapter. Titles and brief summaries of these publications are given on pages 11–13. At the end of the year 14 other reports were in press and 21 manuscripts were awaiting editorial work.

DIVISION OF SURFACE WATER

ORGANIZATION

The work of the division of surface water consists primarily of the measurement of the flow of rivers, but it includes also special investigations of conditions affecting stream flow and the utilization of the streams. In carrying on the work the United States is divided into 23 districts, including Hawaii. The district offices and engineers in charge are as follows:

New England: H. B. Kinnison, Customhouse, Boston, Mass.
New York: A. W. Harrington, Journal Building, Albany, N. Y.
New Jersey: O. W. Hartwell, Statehouse, Trenton, N. J.
Middle Atlantic: A. H. Horton, Washington, D. C.
Virginia: J. J. Dirzulaitis, University of Virginia, Charlottesville, Va.
South Atlantic: E. D. Burchard, Jackson Building, Asheville, N. C.
Tennessee: W. R. King, Municipal Building, Chattanooga, Tenn.
Ohio: Lasley Lee, Ohio State University, Columbus, Ohio.
Wisconsin-Minnesota: S. B. Soulé, Capitol Building, Madison, Wis.
Illinois: H. E. Grosbach, Transportation Building, Chicago, Ill.
Kansas-Iowa: J. B. Spiegel, Federal Building, Topeka, Kans.; suboffice, State Highway Commission Building, Ames, Iowa.
Missouri: H. C. Beckman, Rolla, Mo.
Montana: W. A. Lamb, Federal Building, Helena, Mont.
Colorado-Wyoming: Robert Follansbee, Post Office Building, Denver, Colo.
Utah-Nevada: A. B. Purton, Federal Building, Salt Lake City, Utah.
Idaho: C. G. Paulsen, Federal Building, Boise, Idaho.
Snake River basin: G. C. Baldwin, Federal Building, Idaho Falls, Idaho.
Washington: G. L. Parker, Federal Building, Tacoma, Wash.
Oregon: F. F. Henshaw, Post Office Building, Portland, Oreg.
California: H. D. McGlashan, Customhouse, San Francisco, Calif.; suboffice Federal Building, Los Angeles, Calif.
Arizona: W. E. Dickinson, University of Arizona, Tucson, Ariz.
Hawaii: Max H. Carson, Capitol Building, Honolulu, Hawaii.
Texas: C. E. Ellsworth, Capitol Building, Austin, Tex.

CHARACTER AND METHOD OF WORK

Field investigations necessary to the work are made from the district offices, where the results are examined and corrected, if correction is necessary, to insure their accuracy and completeness. At selected gaging stations the volume of water carried by the streams is measured and records of stage and other data are collected from which the daily flow of the streams is computed. The data thus collected are transmitted from the district offices to Washington, where they are reviewed in the computing section and prepared for publication. By this review the records obtained in different parts of the country are brought to a uniform standard, and standardization is further effected through annual conferences of the engineers.

At the end of the year 1,730 gaging stations were being maintained, including 78 in Hawaii; 290 stations were discontinued and 305 new stations established during the year. Records for about 130 additional stations were received, ready for publication, from Government bureaus and private persons, and a number of Government and State organizations and individuals cooperated in the maintenance of the regular gaging stations.

Gaging stations and cooperating parties for the year ended June 30, 1926

State or Territory	Geological Survey alone	Bureau of Reclamation	Forest Service	Indian Office	Army engineers	Weather Bureau	Other Federal bureaus	State cooperation	Municipal cooperation	Private persons	Counted more than once	Maintained at end of year	Established during year	Discontinued during year	Regular gagings during year	Miscellaneous during year
Alabama	----	----	----	----	2	----	----	1	----	8	1	10	1	4	31	4
Arizona	----	2	----	3	----	3	4	39	4	4	20	39	3	----	832	3
Arkansas	----	----	----	----	----	----	----	----	----	2	----	2	----	----	16	----
California	----	----	20	1	----	----	5	224	59	103	186	226	21	4	3,653	513
Colorado	----	2	----	----	----	----	----	30	3	7	10	32	3	3	116	40
Connecticut	----	----	----	----	----	----	----	----	----	2	----	2	----	----	8	----
Florida	----	----	----	----	----	----	----	----	----	2	----	2	2	1	6	----
Georgia	----	----	----	----	----	----	----	----	----	7	----	7	4	----	39	10
Idaho	----	6	6	----	----	2	----	113	3	211	98	243	130	135	2,381	420
Illinois	----	----	----	----	2	2	----	31	1	1	6	31	4	2	65	----
Indiana	----	----	----	----	----	----	----	1	----	2	1	2	2	----	5	----
Iowa	----	----	----	----	----	6	----	11	----	6	2	21	----	6	50	4
Kansas	----	----	----	----	----	3	----	24	1	3	7	24	----	6	77	----
Kentucky	----	----	----	----	12	----	----	----	----	14	12	14	6	5	91	----
Louisiana	----	----	----	----	----	----	----	----	----	----	----	----	----	3	6	----
Maine	----	----	----	----	----	----	----	17	----	5	5	17	1	1	81	1
Maryland	2	----	----	----	----	----	----	2	2	2	2	6	1	1	45	7
Massachusetts	----	----	----	----	----	----	----	18	----	1	1	18	----	----	123	3
Michigan	----	----	----	----	----	----	----	----	----	2	----	2	----	----	4	2
Minnesota	----	----	----	----	2	----	----	7	----	7	----	16	3	1	16	----
Missouri	----	----	----	----	1	1	----	57	----	16	18	57	4	2	337	40
Montana	6	18	2	----	----	----	15	33	----	6	14	66	2	7	229	1
Nevada	----	----	----	3	----	----	----	19	2	6	11	19	----	3	67	1
New Hampshire	----	----	----	----	----	----	----	15	----	11	11	15	----	----	52	----
New Jersey	----	----	----	----	----	1	----	36	7	5	13	36	1	1	256	87
New Mexico	----	1	----	----	----	----	----	----	----	----	----	1	----	----	2	----
New York	----	----	----	----	1	----	----	74	2	39	42	74	10	6	480	2
North Carolina	----	----	----	----	1	1	----	54	12	11	22	57	15	5	308	46
North Dakota	----	----	----	----	----	----	----	----	----	----	----	----	----	9	----	----
Ohio	----	----	----	----	5	2	----	58	13	6	1	83	16	----	290	23
Oklahoma	----	----	----	----	----	----	----	----	----	2	----	2	1	5	19	----
Oregon	----	----	1	----	----	7	----	91	27	49	84	91	14	10	710	105
South Carolina	----	----	----	----	----	----	----	----	----	4	----	4	4	1	13	8
Tennessee	----	----	----	----	50	8	----	55	----	8	66	55	13	1	392	25
Texas	----	----	----	----	----	11	5	115	17	18	51	115	1	34	1,032	98
Utah	----	1	----	5	----	----	1	54	2	17	26	54	3	----	184	22
Vermont	----	----	----	----	----	----	----	----	----	5	----	5	----	2	7	----
Virginia	----	----	----	----	----	1	----	48	----	11	12	48	22	8	128	8
Washington	1	----	3	4	----	----	2	44	22	26	44	58	5	12	366	66
West Virginia	----	----	----	----	5	----	----	5	1	13	2	22	7	4	27	----
Wisconsin	----	----	----	----	3	----	----	40	----	9	12	40	----	3	106	8
Wyoming	----	6	----	4	----	1	6	21	----	3	5	36	----	4	127	3
Hawaii	----	----	----	----	----	----	----	78	6	17	23	78	6	1	366	224
	9	36	32	20	84	49	38	1,415	184	671	808	1,730	305	290	13,143	1,774

PUBLICATIONS

For convenience and uniformity in publication, the United States has been divided into 12 primary drainage basins, and the results of stream measurements are published annually in a series of progress reports that correspond to these 12 divisions; the records for the twelfth division are published in three papers. In addition to the progress reports, special reports on hydraulic subjects have been completed for publication during the year.

DIVISION OF GROUND WATER

GENERAL FEATURES

The division of ground water investigates the waters that lie below the surface—their occurrence, quantity, quality, and head; their recovery through wells and springs; and their utilization for domestic, industrial, irrigation, and public supplies and as watering places for livestock and desert travelers. Each year surveys are made of selected areas where problems of water supply are urgent, and the results are generally published in water-supply papers that include maps showing the ground-water conditions. The investigations relating to the chemical composition of the water are made in cooperation with the division of quality of water. Projects involving large expenditures for drilling wells to develop water supplies are considered each year by the several departments of the United States Government, and the ground-water division is called upon to furnish information and advice on many of these projects. A number of investigations on the geology of reservoir sites have also been made for the Bureau of Reclamation and the Federal Power Commission. During the year more than 40 investigations relating to ground water or reservoir sites were conducted in 19 States and in the Territory of Hawaii. Twenty investigations were completed and reports thereon submitted.

In some parts of the country the demand for ground water for public or irrigation supplies has become so great that all the available water is needed, and there is grave danger of overdevelopment. In these areas exact information is demanded as to the quantity of water available and the most efficient methods for its full utilization. These demands have led to a number of intensive quantitative investigations, the most important of which now in progress are the investigations by D. G. Thompson in New Jersey, by A. G. Fiedler in the Roswell artesian basin of New Mexico, and by W. N. White in the Escalante Valley in Utah.

During the year the following general papers were completed for publication as water-supply papers or contributions to hydrology: "Methods of exploring and repairing leaky artesian wells," by John McCombs and A. G. Fiedler; and "Laboratory tests on physical properties of water-bearing materials," by Mrs. N. D. Stearns. Progress was also made by Mr. Meinzer on his paper on the origin, discharge, and quantity of ground water in the United States, and by Mrs. Stearns on her paper on thermal springs in the United States. Through hearty cooperation by the Forest Service and the Office of Indian Affairs a large number of original data on thermal springs were obtained.

Cooperation with the committee on physiography was continued through Messrs. Meinzer and Bryan. Several manuscripts were examined for the geologic branch with respect to their treatment of ground water. Mr. Meinzer cooperated with a committee of the North Dakota Well Drillers' Association on specifications for a class A farm well.

WORK OF THE YEAR BY STATES

Arizona.—Some progress was made on a report on the geology and water resources of San Pedro Valley, Ariz., by Kirk Bryan, of the Geological Survey, and G. E. P. Smith, of the Arizona Agricultural Experiment Station.

Arkansas.—Studies of the temperature and mineral composition of the water of Hot Springs National Park, Ark., were continued by Mr. Bryan in cooperation with W. D. Collins.

California.—Water levels were measured in selected wells in southern California, as in previous years, under the direction of F. C. Ebert. The record now covers a period of 22 years, with measurements of one well during a period of 34 years. Work was begun in April by H. T. Stearns, assisted by T. W. Robinson, on an investigation of ground water in the alluvial fan of Mokelumne River, in cooperation with the East Bay Municipal Utility district.

Colorado.—An examination of the water resources of the Mesa Verde National Park was made by Mr. Meinzer, who prepared a report for the National Park Service, with recommendations for enlarging the supply.

Hawaii.—The report by H. T. Stearns and W. O. Clark on the geology and water resources of the Kau district, Island of Hawaii, was nearly completed. Work on the artesian wells in the vicinity of Honolulu, by John McCombs, was conducted under the supervision of M. H. Carson, district engineer.

Idaho.—Observations were continued in the Mud Lake basin through cooperation with C. G. Paulsen, district engineer. Progress was made by Mr. Stearns on the final report on this basin. Mr. Stearns made a brief examination and report on the leakage of the Malad reservoir, collected samples of gas from the Soda Springs, and cooperated with A. M. Piper, of the Idaho Bureau of Mines and Geology, in an examination for an enlarged water supply for the city of Pocatello.

Iowa.—An examination was made by Mr. Meinzer on the ground-water resources of Sheldon, Iowa, and a report thereon was submitted to the city authorities.

Maryland.—An examination and report were made by G. M. Hall for the Veterans' Bureau on a ground-water supply for the hospital at Perry Point, Md.

Massachusetts.—An examination was made by Mr. Bryan of ground-water supplies available for a proposed veterans' hospital at Bedford, Mass., and a report with recommendations was submitted to the Veterans' Bureau.

Montana.—A report on the geology and ground water in central and southern Rosebud County, Mont., by B. C. Renick, with chemical analyses of the waters, by H. B. Riffenburg, was completed and is to be published as a water-supply paper. Some progress was made by Mr. Hall on his reports on Big Horn and Fergus Counties. A report by Mr. Bryan on water supplies in the Helena National Forest was submitted to the Forest Service.

New Jersey.—The investigation of the quantities of ground water available for public and industrial supplies in New Jersey was continued during the year in cooperation with the State Department of Conservation and Development. The work was in charge of D. G. Thompson, who was assisted by E. W. Downs. A report on ground-water conditions and problems in the State was published in the report of the State Water Policy Commission. A brief report outlining work done during the last two years and a detailed report on the Atlantic City region were submitted for publication by the State. A paper on ground-water conditions on the barrier beaches of New Jersey was presented by Mr. Thompson at the New Haven meeting of the Geological Society of America and is to be published in the bulletin of that society. Reports are in preparation by Mr. Thompson on the Camden, Asbury Park, Princeton, and Newark areas, on tidal fluctuations in wells, and on methods of measuring water levels in wells. Observations are being continued at the hydrologic experiment stations at Atlantic City and Runyon,

and water-stage recorders were in service on 16 wells at various times during the year and on 10 wells at the end of the year. About 1,000 measurements of the depth to water were made.

New Mexico.—Work was done on five ground-water investigations in New Mexico in cooperation with the State engineer. These investigations relate to the ground-water resources of Sandoval, DeBaca, and Socorro Counties, the drainage basin of Penasco River, and the Roswell artesian basin. Additional field work was done by Mr. Renick in Sandoval County, and a report with recommendations for drilling test wells was submitted to the State engineer. An examination was also made in the basin of Penasco River by Mr. Renick. A report on this basin with recommendations was submitted to the State engineer and is also to be published as a contribution to hydrology. An intensive investigation of the water supply of the Roswell artesian basin was begun by A. G. Fiedler, and measurements of underground leakage from artesian wells were made by him with an Au deep-well current meter. Preliminary field work was done by Mr. Bryan in DeBaca and Socorro Counties. An investigation was made for the Bureau of Reclamation by Messrs. Meinzer, Renick, and Bryan, of the geology of the No. 3 reservoir site of the Carlsbad project with respect to water-tightness. A report on the subject was submitted to the Bureau of Reclamation and is in press as a contribution to hydrology. Mr. Meinzer cooperated with E. H. Wells, State geologist, in an examination of the water resources in the vicinity of Silver City. A report on the subject has been submitted to the mayor of the city.

New York.—An examination and report concerning a water supply for the Veterans' Hospital near Tupper Lake, N. Y., was made by Mr. Bryan.

North Carolina.—Additional work was done by Mr. Meinzer on the investigation by the United States Public Health Service on pollution of ground water at the experiment station at Fort Caswell, N. C.

North Dakota.—A comprehensive report on the geology and ground-water resources of North Dakota, by H. E. Simpson, with a discussion of the chemical character of the water, by H. B. Riffenburg, was completed and is to be published as a water-supply paper.

Oregon.—A report by Mr. Bryan on the geology of the dam site and tunnel line for the Owyhee irrigation project, Oregon, was submitted to the Bureau of Reclamation. A paper on the petrography of the rocks of this area, by Mr. Renick, was submitted to the geologic branch. Mr. Stearns investigated the geology and ground-water conditions of certain reservoir sites on Crooked River and prepared a report thereon with recommendations for the Federal Power Commission. Messrs. Henshaw and Stearns made observations on large springs in Oregon for use in the forthcoming water-supply paper on large springs in the United States. They also made observations on the geyser wells in the vicinity of Lakeview.

Pennsylvania.—A survey of the ground waters of the State was undertaken in cooperation with the State geologist. An area of 14 counties in the southeastern part of the State was covered by Mr. Hall, who is preparing a water-supply paper on the area.

South Carolina.—Progress was made on a report on the ground water in the Coastal Plain of South Carolina, by C. W. Cooke, of the geologic branch.

South Dakota.—An investigation of the soft-water horizon in the vicinity of Canton, S. Dak., was made by Mr. Meinzer, and a report was prepared by him for the Office of Indian Affairs with recommendations concerning a soft-water supply for the Hospital for Insane Indians at Canton. A copy of the report was also furnished to the mayor of Canton because of its bearing on the public supply of the city.

Utah.—The intensive study of the intake and discharge of ground water in Escalante Valley, Utah, was continued by W. N. White. A hydrologic experiment station was maintained at Milford, and water-stage recorders were installed over several wells to ascertain the daily fluctuations in the water table produced by discharge of ground water due to transpiration of alfalfa and of certain desert plants. This method of estimating ground-water discharge was first used by G. E. P. Smith in Arizona.

Virginia.—At the request of the water commission of Arlington County, Va., a report was prepared by C. P. Ross, of the geologic branch, on ground-water conditions in that county. A preliminary study of the ebbing and flowing springs in the State was made by Mr. Meinzer, and plans were considered for making a more thorough study of these springs.

Washington.—Work was done by Mr. Bryan on a report on the geology of dam sites at Cle Elum Lake, and a paper by him on the Palouse soil problem with an account of elephant remains was transmitted to the geologic branch for publication.

DIVISION OF QUALITY OF WATER

During the year 560 samples of water were analyzed. Reports were transmitted for publication on the chemical character of water of Pecos River, Tex., the surface waters of New Jersey, and the surface waters and ground waters of Florida. Analyses of 41 samples of surface and ground waters from Rhode Island completed the analytical work for a report on the chemical character of waters of the State. Analyses of 143 samples of water were made for Mr. Hall's report on the ground water of southeastern Pennsylvania. Progress was made on studies of the surface waters of North Carolina and the ground waters of New Jersey. Analyses were made of 90 samples of water from Colorado River and its tributaries, and the quantities of silt in 70 samples were determined.

DIVISION OF POWER RESOURCES

The work of the division of power resources during the year comprised the preparation of monthly reports of the production of electricity and consumption of fuel by public-utility power plants and of a report on the developed water power of the United States.

The monthly reports are based on reports submitted by public-utility companies. About 4,000 power plants, each having a monthly output of 10,000 kilowatt-hours or more, are requested to submit reports of their production of electricity and consumption of fuel. The total capacity of the generators in these plants in March, 1926, was about 23,840,000 kilowatts. Reports received represent about 95 per cent of the total generating capacity of these plants. The following tables show the power and fuel statistics for the calendar years 1919 to 1925:

Electricity produced at public-utility power plants in the United States, 1919–1925

Year	Total		Water power			Fuel power		
	Kilowatt-hours	Change from previous year (per cent)	Kilowatt-hours	Per cent of total	Change from previous year (per cent)	Kilowatt-hours	Per cent of total	Change from previous year (per cent)
1919	38,921,000,000		14,606,000,000	37.5		24,315,000,000	62.5	
1920	43,555,000,000	+11.9	16,150,000,000	37.1	+10.6	27,405,000,000	62.9	+12.7
1921	40,976,000,000	−5.9	14,971,000,000	36.5	−7.3	26,005,000,000	63.5	−5.1
1922	47,659,000,000	+16.3	17,206,000,000	36.1	+14.9	30,453,000,000	63.9	+17.1
1923	55,674,000,000	+16.8	19,348,000,000	34.8	+12.4	36,327,000,000	65.2	+19.3
1924	59,014,000,000	+6.0	19,969,000,000	33.8	+3.2	39,044,000,000	66.2	+7.5
1925	65,870,000,000	+11.6	22,356,000,000	33.9	+11.9	43,514,000,000	66.1	+11.4

Fuel consumed in the production of electricity at public-utility plants in the United States, 1919–1925

Year	Coal		Fuel oil		Gas	
	Short tons	Change from previous year (per cent)	Barrels	Change from previous year (per cent)	M cubic feet	Change from previous year (per cent)
1919	35,100,000		11,050,000		21,406,000	
1920	37,124,000	+5.8	13,123,000	+18.8	24,702,000	+15.4
1921	31,585,000	−14.9	12,045,000	−8.2	23,722,000	−4.0
1922	34,179,000	+8.3	13,197,000	+9.6	27,172,000	+14.5
1923	38,954,000	+14.0	14,679,000	+11.2	31,433,000	+15.7
1924	37,556,000	−3.6	16,630,000	+13.3	48,443,000	+54.1
1925	40,222,000	+7.1	10,246,000	−38.4	46,521,000	−4.0

There has been a marked increase of efficiency in the utilization of coal in the production of electricity by public-utility power plants during the period covered by these power reports. In 1919 the average consumption of coal by such plants in producing 1 kilowatt-hour of electricity was 3.2 pounds; in 1925 it was 2.1 pounds. These figures indicate an increase of more than 50 per cent in efficiency. Moreover, these are only average rates. The best coal-burning plants are now producing a kilowatt-hour of electricity with but 1 pound of coal, and recently power plants using gas and oil for fuel have equaled the performance of coal-burning plants as measured in British thermal units.

Reports on the stock of coal held by electric public-utility power plants were made for inclusion in reports on commercial stocks of coal undertaken by the Bureau of the Census, Department of Commerce, September 1 and November 1, 1925; January 1, February 1, April 1, and July 1, 1926.

DIVISION OF LAND-CLASSIFICATION INVESTIGATIONS

The division of land-classification investigations performed certain technical work required for the classification of public lands with respect to their water resources. The work was done mainly by the use of funds allotted by the conservation branch. The examination of public lands for designation under homestead laws was transferred about the middle of the year to the conservation branch, and the work done during the year will be discussed in the report of that branch. The remaining work of this division comprises the examination of streams and neighboring lands for the classification of public lands with respect to their value for water power and irrigation and the preparation of reports, either for office use or for publication, on the power value of streams. The following statements indicate the work done during the year:

Arizona.—A report begun in 1924 and based on surveys and examinations made in several previous years of the potential water power and storage capacities of the dam sites on Colorado River below the mouth of the Green River was published in October as Water-Supply Paper 556, "Water power and flood control of Colorado River below Green River, Utah."

California.—An engineer was detailed to serve as a member of a committee representing the Departments of Agriculture and the Interior which investigated

and reported on applications of the Los Angeles flood-control district and the city of Pasadena, Calif., for conflicting rights of way for reservoirs in San Gabriel Canyon.

Colorado.—An investigation of the water-power resources of the upper San Juan River, Colo., begun late in the previous year has been completed, and a manuscript report thereon was practically completed at the end of the year. Work has been continued on a report on the utilization of Colorado River in Colorado and Utah to the mouth of Green River. A report has been made for office use on the application of the Denver & Salt Lake Railroad Co. for a right of way for a proposed railroad line between Orestod and Dotsero, referred to as the Dotsero cut-off; also on the power-site value of lands vacated by the Federal Power Commission in connection with the issuance of a license for project No. 149 and proposed for restoration to entry.

Idaho.—A power investigation, begun with a reconnaissance survey in the previous year, of the Payette River Basin, Idaho, in connection with river and dam-site surveys by a topographic party, has been completed, and a report on the power resources, including the classification of lands, is in progress. A report on the power resources of the Clearwater River Basin is nearing completion.

Montana.—A report on water power and irrigation in the Jefferson River Basin, Mont., based on an investigation made in the summer of 1923, has been prepared for publication as a water-supply paper.

Oregon.—A manuscript report was completed on the power resources, including the classification of lands, in the Coquille River Basin, Oreg., based on investigations made in the previous year. A similar report was completed for the Rogue River Basin. An office study of the water supply of streams in east and south-central Oregon has also been completed.

Utah.—An examination of the power value of the canyon section of San Rafael River, Utah, including the supervision of plan and profile surveys of that part of the river, was completed early in the year. A report on this investigation is to be made a part of a report, to be published as a water-supply paper, on the utilization of Green River in Wyoming, Colorado, and Utah, on which work has been continued during the year. A report has been made for office use on the power value of lands in the Uinta Basin; also one on the location of a transmission line of the Beaver River Power Co. and of the conduit of the Pioneer power plant of the Utah Power & Light Co., setting forth whether public lands are occupied in trespass by these companies. At the request of the Federal Power Commission recommendations have been made with respect to stream-gaging requirements to be inserted in licenses for which applications have been made by the Utah Power & Light Co. for certain of its constructed power plants.

Washington.—Work has been continued on river surveys and power investigations of streams draining the Olympic Range, Wash. During the year surveys and office reports have been completed for the North and South Forks of Skokomish River, Hamma Hamma, Dosewallips, and Duckabush Rivers, and Lilliwaup Creek, and surveys have been completed of Wynoochee and Quilcene Rivers.

Wyoming.—At the request of the Federal Power Commission an examination of a project to develop power on East Pine Creek, Wyo., was made and a report giving its results was prepared.

CONSERVATION BRANCH

The conservation branch, created July 1, 1925, by survey order 115, incorporates the functions and personnel of the former land-classification branch of the Geological Survey with those of the oil-leasing organization and mineral-leasing division of the Bureau of Mines, which were transferred to the Geological Survey by Interior Department order 54, issued June 25, 1925, in conformity with Executive order of June 4, 1925. Its field of work is coextensive with the public domain of the United States, including Alaska, and with the principal mineral-producing Indian reservations. Its duties include the classification of lands according to

their highest use; the protection of the public interest in undeveloped mineral, water-power, and agricultural resources; and the promotion of economical and efficient development of mineral deposits on public and Indian land.

ORGANIZATION AND PERSONNEL

At the end of the fiscal year the organization and technical personnel of the conservation branch in the District of Columbia were as follows:

Chief, Herman Stabler.
Assistant chief, J. D. Northrop.
Consulting mining engineer, H. I. Smith.
Consulting hydraulic engineer, W. G. Hoyt.
Consulting petroleum engineer, H. V. Moffat.
Attorney, G. W. Holland.
Chief clerk, Elsie Patterson.
Principal clerk, field operations, W. A. Kearney.
Mineral-classification division: J. D. Northrop, geologist, chief; C. D. Avery and N. F. Stull, geologists.
Power division: B. E. Jones, hydraulic engineer, chief; J. G. Mathers and N. J. Tubbs, hydraulic engineers; R. O. Holland, classifier.
Homestead division: A. E. Aldous, classifier, chief; J. F. Deeds and C. E. Nordeen, hydraulic engineers; L. R. Brooks, Depue Falck, E. R. Greenslet, W. L. Hopper, G. M. Kerr, R. E. Morgan, J. Q. Peterson, and O. D. Stanton, classifiers.
Mineral-leasing division: H. I. Smith, mining engineer, chief; P. G. Elder, mining engineer; H. V. Moffat and R. D. Ferguson, petroleum engineers; F. R. Parsons, oil and gas accountant.

In addition, two hydraulic engineers, R. W. Davenport and D. J. Guy, were detailed from the branch for duty with the Federal Power Commission.

During the fiscal year there were 74 separations, including 1 death, 22 resignations, 10 transfers, and 41 terminations by reason of discontinuance of work; and 25 appointments were made. On June 30, 1926, the personnel of the branch, both office and field, numbered 137, consisting of 1 chief classification engineer, 1 attorney, 4 geologists, 8 hydraulic engineers, 11 mining engineers, 29 petroleum and natural-gas engineers, 10 classifiers, 1 chemist, 10 draftsmen, 6 oil gagers, 3 accountants, 49 clerks, 1 mechanic, and 3 janitors. Of these 81 are professional and subprofessional employees and 56 are clerical.

FUNDS

The funds available for the work of the conservation branch for the fiscal year were as follows:

Classification of lands	$265,000
Supervision of oil and gas operations	240,630
Supervision of mining operations	86,920
Supervision of naval-reserve development	50,000
	642,550

CORRESPONDENCE

During the year 24,606 letters were received in the Washington office of the conservation branch. In addition, about 26,500 pieces of miscellaneous correspondence were received in the branch for its

information, transmittal to the appropriate field office, or filing. These figures show an increase of 28,613 pieces, or 127 per cent, in incoming correspondence over the fiscal year 1925, when the branch did not include the mineral-leasing work. Within the same period 19,787 letters and reports were prepared and sent out, an increase of 7,151 pieces, or 57 per cent, in outgoing correspondence compared with 1925. In addition, about 5,550 pieces of miscellaneous correspondence were sent out by the branch during the year.

SUMMARY OF LAND-CLASSIFICATION CASES

The activities of the conservation branch with respect to land classification include the preparation of reports in response to requests for data or action on specific cases, the preparation of orders of withdrawal and restoration of lands not involved in specific requests, and the promulgation of broad areal classifications. To the extent that these types of activity are subject to expression in terms of acreage and number of cases acted on the work of the branch is indicated in the following summary and in the tables accompanying the report of each division. The first table summarizes activity with respect to requests for data or action on specific cases, and the terms "gain" and "loss" signify, respectively, decrease and increase in the number of cases pending.

General summary of cases involving land classification

Class of cases	Record for fiscal year 1925–26						Record since receipt of first case	
	Pending July 1, 1925	Received during fiscal year	Total	Acted on during fiscal year	Pending June 30, 1926	Gain or loss during fiscal year	Received	Acted on
General Land Office requests:								
General	135	979	1,114	888	226	−91		
Time extensions		334	334	288	46	−46	334	288
Oil development	123	827	950	689	261	−138	1,817	1,556
Applications for classification as to mineral							3	3
Coal	3	5	8	3	5	−2	767	762
Oil	84	1,102	1,186	898	288	−204	5,454	5,166
Phosphate							35	35
Applications for mineral permits	303	5,731	6,034	5,612	422	−119	38,404	37,982
Applications for mineral leases	14	143	157	134	23	−9	994	971
Applications for patent, potassium		55	55	55			123	123
Federal Power Commission cases:								
Preliminary permits	3	5	8	2	6	−3	56	50
Licenses	1	10	11		11	−10	22	11
Determinations under section 24	7	40	47	36	11	−4	128	117
Applications for reclassification as to water resources	3	19	22	16	6	−3	657	651
Applications for rights of way	29	175	204	167	37	−8	5,796	5,759
Irrigation project reports	6	3	9	9		+6	892	892
Applications under enlarged-homestead acts	195	346	541	395	146	+49	55,739	55,593
Applications under stock-raising homestead act	1,429	2,960	4,389	3,117	1,272	+157	115,545	114,273
Applications under ground-water reclamation act	27	25	52	32	20	+7	829	809
Indian Office requests for information	1	7	8	6	2	−1	9,502	9,500
Cases in national forests		6	6	4	2	−2	305	303
	2,363	12,772	15,135	12,351	2,784	−421		

MINERAL-CLASSIFICATION DIVISION

The work of the mineral-classification division involves the withdrawal, classification, and restoration of public lands according to their mineral value and the determination of all questions of geologic fact or inference arising prior to the issuance of a prospecting permit or a lease for publicly owned mineral lands or mineral deposits. It includes also the planning and execution, chiefly through the geologic branch, of field investigations required to provide the basis for appropriate action or recommendation. The results of its work take the form of mineral classifications, of orders of withdrawal, modification, and restoration, and of reports concerning the mineral character of specific lands for the information and guidance of Government bureaus and departments charged with the administration of the public land and Indian land laws.

Because of small personnel and the volume and pressure of demands in connection with the administration of the mineral leasing laws, the branch made little headway during the year in classifying the vast areas throughout the West that are still embraced in mineral withdrawals. The results accomplished include, however, net decreases of 313,754 acres in the total area of outstanding coal withdrawals, of 137,904 acres in the total area of outstanding petroleum withdrawals, and of 480 acres in the total area heretofore classified as oil-shale land. Phosphate withdrawals were increased 160 acres, in Florida, and potash withdrawals were increased 7,418,437 acres, in New Mexico.

The gross areas already classified as valuable for mineral and those remaining withdrawn at the end of the fiscal year for certain minerals under the act of June 25, 1910, are shown in the following table:

Summary of outstanding mineral withdrawals and classifications June 30, 1926, in acres

State	Coal		Oil		Oil shale		Phosphate		Potash
	Withdrawn	Classified as coal land	Withdrawn	Classified as oil land	Withdrawn	Classified as oil shale land	Withdrawn	Classified as phosphate land	Withdrawn
Alaska		56,993							
Arizona	139,415		92,496						
Arkansas		61,160							
California	17,603	8,720	1,178,392						90,518
Colorado	4,241,477	3,174,422	218,997		64,560	952,239			
Florida							84,522	120	
Idaho	4,761	4,603					396,612	268,299	
Louisiana			466,990	4,191					
Montana	8,160,273	8,418,643	1,350,426	67,651			279,944	3,833	
Nevada	83,673				123				39,422
New Mexico	5,157,782	568,084							7,418,437
North Dakota	5,954,364	11,178,286	84,894						
Oregon	4,361	18,887							
South Dakota		250,093							
Utah	3,742,766	1,252,589	1,870,627		91,464	2,703,755	301,945	160	
Washington	691,801	141,444							
Wyoming	2,347,039	6,740,907	545,737			460,103	992,969	25,293	
	30,545,315	31,874,831	5,808,559	71,842	156,147	4,116,097	2,055,992	297,705	7,548,377

Since February, 1920, the principal activity of the mineral-classification division has been connected with the administration of the mineral-leasing laws—that is, the Alaskan coal-leasing law, the potash-leasing law, and the general mineral-leasing law. Every application for a prospecting permit or lease under any of these laws is carefully scrutinized, and a report is made to the Commissioner of the General Land Office or the Secretary of the Interior on the geologic conditions involved. Applications for coal permits require a determination of the necessity for prospecting any or all of the land sought. Applications for coal leases entail a division of the area sought into logical operating or leasing units consistent in area and content of coal with the scale of mining operations proposed and the recommendation of appropriate requirements as to royalty, minimum investment, and minimum annual production. Applications for oil and gas prospecting permits require a determination of the structural relations of the land sought with respect to those of other permit and lease holdings of the applicant elsewhere in the same State and with respect to the known geologic structure of any producing oil or gas field and, if in conflict with an unperfected entry under the nonmineral-land laws, classification as to the prospective oil and gas value of the entered land. Applications for oil and gas leases involve a determination of the validity and sufficiency of the oil or gas discovery alleged and a recommendation of appropriate royalty requirements. Applications for sodium permits or leases, potassium permits, leases, or patents, and oil-shale leases entail generally similar determinations and recommendations.

The following table summarizes the results of the year's work to the extent that they involve specific applications for permit, lease, or patent rights under the leasing laws:

Applications received, acted on, and pending under the mineral-leasing acts, fiscal year 1925–26

Mineral	Permits			Leases			Patents		
	Received	Acted on	Pending	Received	Acted on	Pending	Received	Acted on	Pending
Oil and gas	5,321	5,136	397	29	23	7			
Coal	167	166	16	93	90	15			
Phosphate				2	2				
Sodium	19	18	2	1		1			
Potassium	224	292	7	16	17		55	55	
Oil shale				2	2				

In addition to the work summarized, the division determines and defines the limits of the "known geologic structure" of producing oil and gas fields and reports on the structural relations of lands involved in proposed assignments of leases or permits, on the status and structural significance of drilling on or adjacent to lands involved in permit relinquishments or cancellations, on the feasibility of permit and lease consolidations, on the propriety of time extensions based on alleged contributions to drilling on lands other than those described in the permit of the contributor, and on the beneficial

or adverse effects on present or future mineral development of all applications for rights of way across withdrawn, classified, or defined public lands.

During the fiscal year 1925–26 definitions of the "known geologic structure" of the Artesia field, N. Mex., and the Hatfield, Mahoney, Rex, East Ferris, and West Ferris fields, Wyo., were promulgated, together with revisions of the outstanding definition of the Woodside field, Utah; and the Kevin-Sunburst, Gas Ridge, and Shelby fields, Mont.; and cancellation of the definition of the White River field, Colo., promulgated in 1922. The net area included in outstanding definitions of "known geologic structure" of producing oil and gas fields on June 30, 1926, was 531,720 acres, in California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming.

Other phases of division activity include the scrutiny of all enlarged and stock-raising homestead designations for the elimination of any lands within the limits of defined or producing oil or gas structures and the preparation of reports at the request of the General Land Office and the Office of Indian Affairs on the mineral possibilities of lands sought under certain of the nonmineral-land laws.

In order to facilitate the solution of mineral-leasing problems, Geologist W. W. Boyer was assigned to permanent headquarters in Denver, Colo., from which field investigations of specified lands are made to satisfy urgent requirements of the division.

The larger items of geologic field work undertaken by the geologic branch but financed largely by the conservation branch during 1926 include (1) areal examinations in Routt and Moffat Counties, Colo.; in Carbon and Sweetwater Counties, Wyo.; and in Carbon, Emery, Grand, and San Juan Counties, Utah; (2) coal investigations in Grand, Sevier, and Sanpete Counties, Utah; and in Garfield, Mesa, Montrose, and San Miguel Counties, Colo.; (3) potash investigations in Tooele and Box Elder Counties, Utah, and in Esmeralda County, Nev.; (4) phosphate investigations in southwestern Montana and southeastern Idaho; and (5) oil and gas investigations in the Kevin-Sunburst and Bowdoin districts, Mont.; in the Black Hills region, S. Dak.; in Kern, Monterey, and Humboldt Counties, Calif.; and in the Artesia district, N. Mex.

POWER DIVISION

The work of the power division consists primarily in obtaining and making available for use in the administration of the public-land laws information as to the water-power resources of the public lands. The specific problems on which reports are made ordinarily involve the ascertainment of the potential power resources of areas that are or may be subject to disposal under public-land laws. An endeavor is made to determine the proper administrative action by which the possibility of power development may be preserved with minimum interference with agricultural, transportation, or other interests. In the course of this work a review of all power reserves is carried on, in order that all land having primary value for the development of power, and only such land, shall be reserved for that purpose. The extent of this task is indicated by the fact that areas aggregating more than 5,000,000 acres are now included in

power reserves whose use will be required for the development of about 15,000,000 continuous horsepower.

In order that this information may be made substantially complete, areas not thoroughly surveyed are designated for examination by the topographic and water-resources branches of the Geological Survey. The larger field projects undertaken during the year at the request and expense of the conservation branch to obtain information for power classification include plan and profile surveys and power-site and reservoir-site investigations on (1) South Fork of Payette River and in Bear Valley and the Stanley Basin, Salmon River drainage basin, Idaho; (2) North and South Forks of Stilaguamish River, Skokomish, Lilliwaup, Hamma Hamma, and Dosewallips Rivers, Wash.; (3) McKenzie, Siletz, North Fork of Coquille, and Crooked Rivers, Oreg.; (4) Eel River, Calif.; (5) San Rafael River, Utah; (6) San Juan River and tributaries, Colo. and N. Mex. Studies were continued leading to the preparation of reports for publication on water utilization on Green and upper Colorado Rivers in Colorado, Utah, and Wyoming.

The information obtained is indexed and incorporated in an inventory of water resources, which, when complete, will enable the Geological Survey to give competent advice on short notice as to the manner in which each tract of public land having value for power can best be used in connection with the development of water power and as to the relation of such use to other possible uses of the tract. Copies of many of the reports on the power possibilities of the streams examined have been placed in the district offices of the Geological Survey for public inspection, and notices of the availability of the reports have been sent to the press.

The work of the division is briefly summarized in the accompanying tables, showing power-site reserves and outstanding water resources, withdrawals, and classifications, and in the general summary of cases involving land classification (p. 74).

Pursuant to instructions of the Secretary of the Interior, dated August 24, 1916 (45 L. D. 326), permittees under the act of February 15, 1901 (31 Stat. 790), and grantees under the act of March 4, 1911 (36 Stat. 1253), to whom rights have been granted by the Secretary since January 1, 1913, were called upon for detailed reports of the operation or development of their power systems during the calendar year 1925. The total installation of the reporting companies is 1,950,000 kilowatts, of which 1,510,000 kilowatts is installed at hydraulic plants. The total energy generated amounted to 6,930,000,000 kilowatt-hours, of which more than 6,000,000,000 kilowatt-hours was generated by water power.

Power output of permittees and grantees, 1916–1925

Year	Kilowatt-hours	Increase or decrease		Year	Kilowatt-hours	Increase or decrease	
		Kilowatt-hours	Per cent			Kilowatt-hours	Per cent
1916	1,200,000,000			1921	3,725,000,000	−475,000,000	−11
1917	2,000,000,000	+800,000,000	+67	1922	4,947,000,000	+1,222,000,000	+33
1918	3,200,000,000	+1,200,000,000	+60	1923	5,910,000,000	+963,000,000	+19
1919	3,100,000,000	−100,000,000	−3	1924	6,100,000,000	+164,000,000	+3
1920	4,300,000,000	+1,100,000,000	+35	1925	6,930,000,000	+830,000,000	+14

Power-site reserves, in acres

[Includes all areas reserved or classified as valuable for power purposes and withheld subject to disposal only under the Federal water-power act of June 10, 1920 (41 Stat., 1063). Designations, classifications, and other types of reserves are included in the total areas without distinction]

State	Reserved prior to July 1, 1925	Eliminated prior to July 1, 1925	Reserves outstanding prior to July 1, 1925	Reserved during fiscal year	Eliminated during fiscal year	Reserves outstanding June 30, 1926
Alabama	785		785	1,592		2,377
Alaska	211,220	520	210,700	2,426		213,126
Arizona	1,263,795	113,194	1,150,601	6,600	1,150	1,156,051
Arkansas	28,551		28,551			28,551
California	1,033,500	25,582	1,007,918	137,117	2,907	1,142,128
Colorado	479,634	70,509	409,125	27,464	5,274	431,315
Florida	486		486			486
Idaho	451,394	186,220	265,174	16,413	80	281,507
Michigan	1,240		1,240			1,240
Minnesota	13,289	532	12,757	5,773		18,530
Mississippi				3		3
Montana	302,667	93,779	208,888	922	600	209,210
Nebraska	761		761			761
Nevada	300,750	480	300,270	48		300,318
New Mexico	270,878	7,633	263,245		81	263,164
Oregon	577,693	85,648	492,045	76,744	24,669	544,120
South Dakota	12		12			12
Utah	671,395	123,114	548,281	74,859	320	622,820
Washington	249,032	52,810	196,222	43,585		239,807
Wisconsin	1,210	226	984			984
Wyoming	222,543	73,408	149,135	17		149,152
	6,080,835	833,655	5,247,180	393,563	35,081	5,605,662

Summary of outstanding water resources withdrawals and classifications June 30, 1926, in acres

State	Power reserves					Reservoir withdrawals	Public water withdrawals	Groundwater reclamation designations
	Withdrawals	Classifications	Designations [a]	Miscellaneous	Total			
Alabama	120	1,735		522	2,377			
Alaska	93,415	43,005		76,706	213,126			
Arizona	394,139	37,182	528,239	196,491	1,156,051	23,040	15,280	
Arkansas	22,354	1,590		4,607	28,551			
California	289,073	173,484		679,571	1,142,128	1,160	167,551	
Colorado	231,910	164,317		35,088	431,315	1,728	2,220	
Florida				486	486			
Idaho	210,856	63,556		7,095	281,507		13,185	
Michigan	1,240				1,240			
Minnesota	12,309			6,221	18,530			
Mississippi				3	3			
Montana	131,944	53,409		23,857	209,210	9,080	8,097	
Nebraska	761				761			
Nevada	27,492	27,786		245,040	300,318		6,946	1,559,255
New Mexico	120,003		143,161		263,164		8,956	
North Dakota						1,569		
Oregon	374,188	95,835	15,731	58,366	544,120	10,619	20,181	
South Dakota				12	12		240	
Utah	444,688	153,766		24,366	622,820	80	33,475	
Washington	97,751	81,395		60,661	239,807	35,943	920	
Wisconsin				984	984			
Wyoming	82,829	25,621		40,702	149,152	1,714	79,905	
	2,535,072	922,681	687,131	1,460,778	5,605,662	84,933	356,956	1,559,255

[a] Designated and not otherwise withdrawn.

HOMESTEAD DIVISION

The homestead division of the conservation branch incorporates the personnel and functions of the division of homestead classification and the irrigation section of the division of hydrographic

classification of the former land-classification branch with those of the division of land-classification investigations of the water-resources branch.

The functions of the reorganized division consist of the classification of lands under the enlarged-homestead law as nonirrigable; the classification of lands under the Nevada ground-water reclamation act as nontimbered and not known to be susceptible of successful irrigation; the preparation of reports on the sufficiency of the water supply and the general feasibility of irrigation projects that require some form of Federal approval in connection with the administration of public-land laws; the initiation of withdrawals of land for reservoir sites and for public watering places; and the classification as stock-raising lands under the stock-raising homestead law of tracts whose surface is chiefly valuable for grazing and raising forage crops, does not contain merchantable timber, is not susceptible of successful irrigation from any known source of water supply, and is of such character that 640 acres is reasonably required for the support of a family.

Applications for classification are disposed of in accordance with the results of field examinations by members of the division and with information obtained from other sources. Applications in some regions lead to the planning and execution of broad field studies that result in the classification of large areas and provide in advance the basis for appropriate action on new applications.

The number of cases received and acted on during the fiscal year is shown in the general summary of cases (p. 74). In the field broad areal studies were made in the northern Great Plains region and also in Colorado, Idaho, Nevada, Utah, and Washington. The work in Nevada included a reconnaissance investigation to determine the agricultural utility of the unreserved public land throughout the State. Detailed examination of lands embraced in specific applications for designation under the enlarged and stock-raising homestead laws was continued in all the public-land States west of the 100th meridian.

Substantial progress was made on the report, begun in 1925 in cooperation with the Department of Agriculture, on agriculture and land utilization in the northern Great Plains region, the remaining four of eight atlas sheets showing land classification in that region being completed during the year. Authorization was given by the Secretary of the Interior for the extension of this cooperation to include the preparation of similar classification maps for the central Great Plains region, and some preliminary field work on this project was done incidental to other work in the region.

During the year the area designated under the Nevada ground-water reclamation act, as a result of the work of the division, was increased from 1,550,420 to 1,559,255 acres. Outstanding withdrawals, aggregating 11,530 acres, under the act of October 2, 1888 (25 Stat. 527), on the basis of a selection by the Director of the Geological Survey, remained unchanged. Other results of the division's work are tabulated in the summaries of enlarged and stock-raising homestead designations and the general summary of cases.

Summary of enlarged-homestead designations, in acres

[Areas classified as arid and nonirrigable, residence by entrymen required (acts of Feb. 19, 1909 (35 Stat. 639), applicable to Arizona, Colorado, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming; June 17, 1910 (36 Stat. 531), applicable to Idaho; June 13, 1912 (37 Stat. 132), applicable to California, North Dakota; Mar. 3, 1915 (38 Stat. 953), applicable to Kansas; Mar. 4, 1915 (38 Stat. 1163), applicable to South Dakota). Areas classified as arid, nonirrigable, and lacking domestic water supply, residence by entrymen not required (acts of Feb. 19, 1909 (35 Stat. 639), applicable to Utah; June 17, 1910 (36 Stat. 531), applicable to Idaho)]

State	Designations prior to July 1, 1925	Cancellations prior to July 1, 1925	Designations outstanding prior to July 1, 1925	Designations during fiscal year	Cancellations during fiscal year	Designations outstanding June 30, 1926
Arizona	31,400,664	5,429,754	25,970,910	20,835	441,120	25,550,625
California	13,187,333	238,453	12,948,880	68,447		13,017,327
Colorado	33,580,721	195,508	33,385,213	102,031		33,487,244
Idaho:						
Total	13,603,838	460,885	13,142,953	66,886	40	13,209,799
Nonresidence	572,747	4,233	568,514			568,514
Kansas	647,914		647,914	2,170		650,084
Montana	53,345,205	245,728	53,099,477	70,401		53,169,878
Nevada	50,120,150	3,564,797	46,555,353	46,170	15,920	46,585,603
New Mexico	43,726,225	227,732	43,498,493	45,955		43,544,448
North Dakota	12,274,012	3,848	12,270,164	2,737		12,272,901
Oregon	21,256,324	989,902	20,266,422	17,130		20,283,552
South Dakota	16,333,811	348,170	15,985,641	2,285		15,987,926
Utah:						
Total	11,415,634	408,609	11,007,025	119,760	52,315	[a] 11,074,470
Nonresidence	1,640,094	28,280	1,611,814	5,875	50,320	1,567,369
Washington	6,646,592	251,842	6,394,750	3,350		6,398,100
Wyoming	29,411,041	161,764	29,249,277	136,860	279	29,385,858
	336,949,464	12,526,992	324,422,472	705,017	509,674	324,617,815

[a] Includes 8,395 acres previously designated under secs. 1–5, now designated under sec. 6.

Summary of stock-raising homestead designations, in acres

[Areas classified as nonirrigable, nontimbered, chiefly valuable for grazing and raising forage crops, and of such character that 640 acres is reasonably required for the support of a family. Act of December 29, 1916 (39 Stat. 862)]

State	Designations prior to July 1, 1925	Cancellations prior to July 1, 1925	Designations outstanding prior to July 1, 1925	Designations during fiscal year	Cancellations during fiscal year	Designations outstanding June 30, 1926
Arizona	13,896,383	851,720	13,044,663	50,714	35,860	13,059,517
Arkansas	1,120		1,120			1,120
California	7,720,392	760	7,719,632	91,917	640	7,810,909
Colorado	8,152,040	18,720	8,133,320	203,896	120	8,337,096
Florida	480	480				
Idaho	5,262,682	1,774	5,260,908	104,982	80	5,365,810
Kansas	113,499		113,499	640		114,139
Michigan	3,451		3,451			3,451
Montana	15,023,286	17,081	15,006,205	183,004		15,189,209
Nebraska	183,494		183,494	6,080		189,574
Nevada	498,548	2,800	495,748	21,585	320	517,013
New Mexico	31,139,754	636	31,139,118	39,498		31,178,616
North Dakota	364,855		364,855	11,037		375,892
Oklahoma	76,260		76,260	3,765		80,025
Oregon	6,216,412	2,488	6,213,924	35,995	640	6,249,279
South Dakota	6,468,914	550	6,468,364	16,519		6,484,883
Utah	1,350,587	880	1,349,707	137,080		1,486,787
Washington	673,745	1,134	672,611	8,876		681,487
Wyoming	19,813,988	5,054	19,808,934	125,764	1,159	19,933,539
	116,959,890	904,077	116,055,813	1,041,352	38,819	117,058,346

Additions during the year to public water reserves included 495 acres in Arizona, 40 acres in California, 56 acres in Colorado, 990 acres in Idaho, 720 acres in Nevada, 640 acres in New Mexico, 2,400 acres in Oregon, and 125 acres in Utah. Eliminations from such reserves aggregated 11 acres in Arizona, 80 acres in Idaho, 2,740 acres in Nevada, and 760 acres in Wyoming. Outstanding withdrawals of public land for stock watering are tabulated in the summary of water-resources withdrawals and classifications (p. 79).

By blanket order of withdrawal creating Public Water Reserve No. 107, which received Executive approval April 17, 1926, every smallest legal subdivision of the public-land surveys which is vacant unappropriated public land and contains a spring or water hole and all land within a quarter of a mile of every spring or water hole located on unsurveyed public land was reserved for public use and in aid of pending legislation. This order obviates the necessity for future withdrawals of specific tracts valuable for stock watering but requires a determination by the division with respect to all entries of public land whether or not any of the subdivisions involved are in fact affected by it.

MINERAL-LEASING DIVISION

The mineral-leasing division of the conservation branch incorporates the records, personnel, and functions relating to mineral leasing of the petroleum division and mineral-leasing division of the Bureau of Mines, which were transferred to the Geological Survey July 1, 1925.

The work of this division is supervisory (both inspectional and regulatory) with respect to operations for the discovery and development of petroleum, natural gas, oil shale, coal, phosphate, sodium, and potassium on public lands, of petroleum and natural gas on naval petroleum reserves, and of a variety of minerals on Indian lands. This work is carried on with a minimum of administrative supervision from Washington through district offices and suboffices at or near the primary centers of mining or drilling activity, under the direction of responsible district engineers who have full authority to represent the Government within their jurisdiction and to enforce compliance with the law and regulations under which operations are conducted.

The district offices and suboffices and the engineers in charge June 30, 1926, are as follows:

Oil and gas operations:
- Rocky Mountain district, Casper, Wyo., J. W. Steele, supervisor; D. P. Wardwell, deputy supervisor. Suboffices as follows:
  - Midwest, Wyo., R. O. Armstrong, engineer in charge.
  - Fort Washakie, Wyo., L. S. Miller, engineer in charge.
  - Billings, Mont., J. R. Reeve, engineer in charge.
  - Shelby, Mont., E. A. Hanson, engineer in charge.
  - Denver, Colo., B. H. Carnahan, engineer in charge.
  - Shiprock, N. Mex., J. H. Hassheider, engineer in charge.
  - Roswell, N. Mex., J. C. Miller, engineer in charge.
- Pacific district, Taft, Calif., R. C. Patterson, supervisor; J. M. Alden, deputy supervisor.
- Mid-Continent district, Muskogee, Okla., H. J. Lowe, supervisor. Suboffices as follows:
  - Guthrie, Okla., H. B. Soyster, engineer in charge.
  - Ardmore, Okla., H. W. Shaner, engineer in charge.

Mining operations:
- Denver, Colo., C. L. Duer, mining supervisor.
- Billings, Mont., R. H. Allport, mining supervisor.
- Salt Lake City, Utah, B. W. Dyer, mining supervisor.
- McAlester, Okla., W. W. Fleming, mining supervisor.
- Miami, Okla., C. F. Williams, mining supervisor.

At the beginning of the fiscal year the personnel of the mineral-leasing division numbered 138; at its end 89. Most of the decrease is due to separations resulting from termination of the period of Government operation of the Red River oil field, Oklahoma, on

December 1, 1925, and the return of the producing properties to their owners in accordance with awards by the Secretary of the Interior under the Red River relief act of March 4, 1923 (42 Stat. 1448). The remainder is due to the discontinuance of certain lines of research; to the discontinuance of suboffices at Shreveport, La.; Wichita Falls, Tex.; and Laramie, Wyo.; to the consolidation of the suboffice at Winnett, Mont., with that at Billings, Mont.; and to distribution among other employees, in such manner as to obviate for the time being the making of new appointments, of the duties of certain employees who resigned. The activities of the suboffice formerly at Shreveport, La., were transferred to the district office at Muskogee, Okla.; the supervisory activities of the office at Wichita Falls, Tex., were transferred to Ardmore, Okla.; those of the suboffice at Laramie, Wyo., to the district office at Casper, Wyo. A new suboffice was established during the year at Roswell, N. Mex., and the suboffice formerly at White Eagle, Okla., was transferred to Guthrie, Okla.

ACTIVITIES ON THE PUBLIC DOMAIN

The supervisory work of the mineral-leasing division on lands involving publicly owned mineral deposits was increased during the year by the receipt of notification of the issuance of prospecting permits, leases, and licenses as follows: Oil and gas permits, 3,891; oil and gas leases, 45; coal permits, 108; coal leases, 32; coal licenses, 79; potassium permits, 29; potassium lease, 1; sodium permits, 12; sodium lease, 1; phosphate lease, 1; oil-shale lease, 1; a total of 4,200.

The following tables show, by States and by minerals, the total number of prospecting permits, leases, and licenses involving public land issued and the number under supervision at the end of the fiscal year, together with important data relative thereto:

Mineral leases, licenses, and permits issued by the Secretary of the Interior and notification received by the Geological Survey up to June 30, 1926

State	Coal [a]			Potash [b]		Sodium [a]		Oil shale, leases [a]	Phosphate, leases [a]	Oil and gas [a]	
	Permits	Leases	Licenses	Permits	Leases	Permits	Leases			Permits	Leases
Alabama		1									
Arizona	2			7						763	
Arkansas	1									2	
California	12			68	17	5				2,856	143
Colorado	171	66	16	4						2,817	7
Idaho	19			1					2	192	
Kansas										5	
Louisiana										37	3
Michigan										1	
Mississippi										11	
Montana	91	49	4	2						3,128	34
Nebraska				4						12	
Nevada	41			75		37	1			940	
New Mexico	108	10		17		4				2,986	
North Dakota	11	30	2			5				29	
Oklahoma										[c] 54	[c] 16
Oregon	35	2		1		1		1		53	
South Dakota	5	1	1							147	
Utah	104	48	2	325						3,192	
Washington	46	2				2				63	
Wyoming	169	36	15		1	1		1		4,714	262
	815	245	40	504	18	55	1	2	2	22,002	465
Alaska	[c] 33	[d] 11	[d] 72							1,046	

[a] Act of Feb. 25, 1920. [b] Act of Oct. 2, 1917. [c] Act of Mar. 4, 1921. [d] Act of Oct. 20, 1914.

Required investment and total acreage: Act of Feb. 25, 1920, $9,928,670, 2,181,665.48 acres; act of Oct. 2, 1917, $2,715,470, 1,154,736.54 acres; acts of Mar. 4, 1921, and Oct. 20, 1914 (Alaska), $1,204,000, 69,458.15 acres.

Mineral leases, licenses, and permits under supervision on public lands and naval petroleum reserves June 30, 1926

State	Coal						Oil and gas	
	Leases		Permits		Licenses		Permits (number)	Leases (number)
	Number	Acr	Number	Acres	Number	Acres		
Alaska	9	9,877.28	23	38,875.01	1	10.00	980	
Alabama	1	1,840.00						
Arizona							621	
Arkansas							2	
California			4	2,363.98			2,492	134
Colorado	63	11,682.83	20	11,858.60	8	320.08	2,600	5
Idaho			6	7,597.96			172	
Kansas							5	
Louisiana							32	2
Michigan							1	
Mississippi							3	
Montana	44	6,011.34	13	5,264.59	1	40.00	2,962	34
Nebraska							10	
Nevada			3	6,001.21			845	
New Mexico	8	1,121.10	46	69,543.72			2,760	
North Dakota	28	4,104.75	3	800.00	1	40.00	28	
Oklahoma							52	16
Oregon	2	2,095.24	4	2,960.00			52	
South Dakota	1	79.04					105	
Utah	40	35,898.71	38	32,717.25	1	40.00	3,090	
Washington	1	600.00	4	2,117.00			54	
Wyoming	34	15,199.92	22	14,440.79	2	80.00	4,477	253
	231	88,510.21	186	194,540.11	14	530.08	21,343	444

State	Sodium				Potash			
	Permits		Leases		Permits		Leases	
	Number	Acres	Number	Acres	Number	Acres	Number	Acres
Arizona					3	7,680.00		
California					1	1,639.21	5	9,423.76
Colorado					1	2,560.00		
Nevada	11	25,320.00	1	1,440.00	5	5,561.32		
New Mexico	1	2,560.00			7	16,000.00		
North Dakota	3	520.00						
Oregon	1	920.00						
Utah					23	46,080.00		
Washington	2	766.30						
Wyoming	1	80.00						
	19	30,166.30	1	1,440.00	40	79,520.53	5	9,423.76

Also Idaho 2 phosphate leases, 1,700 acres; Oregon 1 oil-shale lease, 2,680 acres.

With respect to oil and gas operations the duties of this division include the periodic inspection of properties under development with a view to preventing waste of oil and gas, damage to productive oil, gas, and water "sands," coal beds, and other valuable mineral deposits, and injury to life or property; the approval of well locations and of plans for drilling, setting casing, testing water shut-off, testing for production, shooting, perforating or altering casing, redrilling or repairing and abandonment of wells; the witnessing of as many of these operations as feasible; the testing or witnessing of tests of

natural gas for gasoline content; the issuance of receipts for royalty oil delivered to the Government account and the approval of orders authorizing pipe-line companies to receive oil or gas from Government leaseholds; the determination of royalties due and payable to the Government; and the custody of records and reports pertaining to oil, gas, or gasoline operations and production on public land. With respect to mining operations involving publicly owned deposits of coal, phosphate, sodium, potassium, and oil shale comparable functions are performed. All inspectional and regulatory work of the division is supplemented by informal advice and assistance to lessees in the solution of technical and engineering problems connected with their activities.

An abnormal activity of the division was ended on November 30, 1925, when Federal operation of the Red River oil fields, begun on April 1, 1920, under Federal receivership and continued after June 30, 1924, under the Secretary of the Interior, was brought to a successful conclusion, and the operating properties and profits were turned over to lessees in pursuance of an award made by the Secretary on September 1, 1925. Under the receiver 2,274,634.23 barrels of oil with associated gas was produced and disposed of at a profit, after payment of Government royalties as well as all other expenses, of $1,983,016.13, or $0.87 a barrel. Under the Secretary of the Interior 310,975.23 barrels of oil with associated gas was produced and disposed of at a net profit of $388,826.48, or $1.25 a barrel. The receivership period was one of drilling wells and flush production. The operations under the Secretary of the Interior began after drilling was substantially complete and involved no flush production. It is felt that unit operation of this field by the mineral-leasing division was a distinct success, the potentialities of the field having been well maintained while a material profit was being made. The field is now under diversified control, but the principles of unit operation are still largely being practiced.

PRODUCTION

Statistics relating to the production of petroleum, natural gas, natural-gas gasoline, and coal under Government lease, permit, and license involving public land are summarized in the following tables:

Petroleum produced from public lands

Fiscal year	Production (barrels)	Royalty oil (barrels)	Royalty value	Royalty gas	Royalty gasoline
1920–21	5,789,803.48	1,025,985.19	$1,939,963.68	$23,678.33	$5,993.91
1921–22	14,352,826.24	2,568,964.02	3,320,891.86	86,909.24	12,864.46
1922–23	28,443,357.80	5,466,171.00	8,071,051.30	121,885.01	59,834.26
1923–24	39,437,658.44	7,872,073.04	12,033,294.00	88,555.13	70,355.38
1924–25	30,310,308.05	4,951,024.27	7,573,293.63	77,515.59	102,149.69
1925–26	29,712,876.16	4,431,563.63	7,951,665.52	93,508.29	154,265.43
	148,046,830.17	26,315,781.15	40,890,159.99	492,051.59	405,463.13

Petroleum produced from public lands, by States

	Fiscal year	Production (barrels)	Royalty oil (barrels)	Royalty value
California	1920–21	2, 201, 116. 28	311, 570. 19	$573, 266. 63
	1921–22	3, 739, 448. 30	616, 491. 09	792, 444. 87
	1922–23	4, 666, 523. 03	674, 899. 86	619, 391. 36
	1923–24	4, 702, 623. 55	620, 170. 36	561, 064. 90
	1924–25	6, 978, 882. 39	874, 515. 54	1, 033, 142. 91
	1925–26	6, 467, 196. 06	916, 301. 77	983, 952. 57
		28, 755, 789. 61	4, 013, 948. 81	4, 563, 263. 24
Colorado	1921–22	36. 00	7. 20	10. 08
	1922–23	272. 67	54. 52	57. 47
	1923–24	17, 730. 08	3, 391. 14	2, 973. 47
	1924–25	409, 057. 34	32, 758. 60	36, 750. 75
	1925–26	825, 180. 92	44, 601. 98	64, 287. 99
		1, 252, 277. 01	80, 803. 44	104, 079. 76
Louisiana	1920–21	2, 716. 00	221. 02	583. 62
	1921–22	1, 970. 36	92. 34	131. 69
	1922–23	[a]	[a]	[a]
	1923–24	[a]	[a]	[a]
	1924–25	2, 270. 60	283. 82	472. 87
	1925–26	2, 089. 52	261. 20	553. 35
		9, 046. 48	858. 38	1, 741. 53
Montana	1920–21	169, 634. 63	9, 385. 64	15, 406. 07
	1921–22	1, 535, 775. 75	70, 443. 66	185, 157. 86
	1922–23	2, 067, 446. 93	153, 011. 71	293, 978. 83
	1923–24	1, 496, 303. 77	91, 885. 19	202, 765. 36
	1924–25	1, 510, 356. 21	83, 393. 60	160, 294. 86
	1925–26	2, 332, 851. 97	148, 370. 25	332, 421. 63
		9, 112, 369. 26	556, 490. 05	1, 190, 024. 61
New Mexico	1925–26	15, 902. 58	2, 211. 70	3, 609. 13
Oklahoma	1925–26	112, 160. 75	17, 351. 41	44, 353. 24
Utah	1925–26	2, 496. 41	499. 29	499. 29
Wyoming	1920–21	3, 416, 336. 57	704, 808. 34	1, 350, 707. 36
	1921–22	9, 075, 595. 83	1, 881, 929. 73	2, 343, 147. 36
	1922–23	21, 709, 115. 17	4, 638, 204. 91	7, 157, 623. 64
	1923–24	33, 221, 001. 04	7, 156, 626. 35	11, 266, 490. 27
	1924–25	21, 409, 741. 51	3, 960, 082. 71	6, 342, 632. 24
	1925–26	19, 954, 997. 95	3, 301, 966. 03	6, 521, 988. 32
		108, 786, 788. 07	21, 643, 618. 07	34, 982, 589. 19
Grand total		148, 046, 830. 17	26, 315, 781. 15	40, 890, 159. 99

[a] No production.

Coal produced from public lands, in tons

State	1920–21	1921–22	1922–23	1923–24	1924–25	1925–26
Alaska	[a] 65, 000. 00	86, 551. 79	116, 105. 99	88, 645. 82	99, 193. 83	98, 144. 74
Alabama						10, 056. 00
Colorado	540. 90	52, 613. 27	219, 627. 24	257, 294. 46	297, 795. 51	353, 433. 61
Montana	100. 00	2, 046. 44	9, 575. 05	22, 317. 19	218, 934. 90	198, 602. 15
New Mexico		8, 255. 18	19, 654. 38	28, 150. 14	18, 367. 56	37, 461. 86
North Dakota	378. 00	33, 507. 50	123, 711. 79	168, 642. 90	127, 455. 19	163, 533. 79
Oregon				51. 20	637. 77	628. 88
South Dakota			586. 75	427. 50	828. 38	1, 074. 00
Utah		26, 158. 08	103, 676. 44	218, 439. 96	139, 029. 14	172, 433. 36
Washington		25, 565. 05	60, 284. 64	52, 757. 66	25, 673. 08	16, 910. 29
Wyoming	226, 091. 70	314, 016. 10	445, 775. 49	645, 379. 44	857, 836. 30	962, 490. 51
	292, 110. 60	548, 713. 41	1, 098, 997. 77	1, 482, 106. 27	1, 785, 751. 66	2, 014, 769. 19

[a] Estimated.

ACTIVITIES ON NAVAL PETROLEUM RESERVES

On behalf of the Bureau of Engineering, Department of the Navy, the duties and activities of the mineral-leasing division include supervision, similar to that exercised over oil and gas operations on public lands, over Naval Petroleum Reserves Nos. 1 and 2, in California, and No. 3, in Wyoming. Statistics of the production of petroleum, natural gas, and natural-gas gasoline from naval petroleum reserves are summarized below:

Petroleum produced from naval petroleum reserves

Fiscal year	Production (barrels)	Royalty oil (barrels)	Royalty value	Royalty gas	Royalty gasoline
1920–21	1,614,448.12	266,339.59	$574,166.09	$4,336.80	$11,582.71
1921–22	3,863,994.87	1,014,481.32	1,474,669.88	8,440.79	10,511.26
1922–23	9,451,445.67	2,180,874.92	2,173,724.67	64,899.22	57,226.73
1923–24	12,605,519.22	2,863,999.70	2,692,223.03	101,994.76	58,346.08
1924–25	12,870,750.26	3,056,065.95	3,770,876.53	119,199.32	87,322.44
1925–26	12,755,382.16	2,779,100.13	3,310,658.54	114,247.75	152,480.36
	53,161,540.30	12,160,861.61	13,996,318.74	413,118.64	377,469.58

Petroleum produced from naval petroleum reserves, by States

State	Fiscal year	Production (barrels)	Royalty oil (barrels)	Royalty value
California	1920–21	1,614,448.12	266,339.59	$574,166.09
	1921–22	3,863,994.87	1,014,481.32	1,474,669.88
	1922–23	9,034,795.29	2,106,645.04	2,046,619.04
	1923–24	11,246,134.92	2,675,674.75	2,403,799.27
	1924–25	12,123,571.89	2,962,668.64	3,628,039.50
	1925–26	12,234,702.16	2,714,015.11	3,187,461.22
		50,117,647.25	11,739,824.45	13,314,755.00
Wyoming	1920–21			
	1921–22			
	1922–23	416,650.38	74,229.88	127,105.63
	1923–24	1,359,384.30	188,324.95	288,423.76
	1924–25	747,178.37	93,397.31	142,837.03
	1925–26	520,680.00	65,085.02	123,197.32
		3,043,893.05	421,037.16	681,563.74

ACTIVITIES ON INDIAN LANDS

On behalf of the Office of Indian Affairs the functions of the division include a variety of services—inspectional, regulatory, and advisory—in connection with mineral development on Indian lands, both tribal and allotted.

In Oklahoma the supervision of oil and gas activities includes 1,260 developed leases involving lands of Cherokee, Choctaw, Chickasaw, Creek, and Seminole Indians, containing about 7,342 productive wells, which yield a royalty income in excess of $3,700,000; and 66 developed leases of Otoe, Pawnee, Kaw, Kiowa, Ponca, and Sac and Fox Indians, containing 195 productive wells, which yield a royalty income in excess of $280,000. The supervision of coal-mining operations included at the end of the year 150 leaseholds involving segregated and allotted lands of the Five Civilized Tribes, aggregating 84,702 acres, a coal production in excess of 802,000 tons during the

fiscal year, and an income of approximately $80,000. The supervision of asphalt-mining operations involves one leasehold of 960 acres. The supervision of lead and zinc mining operations includes 50 leaseholds, aggregating 6,976 acres of restricted allotted lands of Quapaw Indians, which yielded an income of $1,785,923.40 during the fiscal year. The production from these lands amounted to about 25 per cent of the zinc and 7 per cent of the lead output of the United States.

In Wyoming the supervision of oil and gas activities includes 73 productive wells, 25 of which are shut in awaiting a market for black oil, on the Shoshone Indian Reservation. In New Mexico similar supervision involved 23 productive wells on the Navajo Indian Reservation, which produced about 320,000 barrels of oil during the year.

An important feature of the division's work in connection with Indian lands which includes restricted allotted lands, as well as tribal lands, consists in field investigations of mineral land prior to the granting of leases therefor to determine the feasibility of leasing the land sought, the adequacy of the bonus bid and royalty offered, and the existence on the proposed leasehold of conditions warranting special stipulations in the lease. Field examinations and engineering reports are also made of restricted allotments in connection with applications for removal of restrictions and subsequent sale of the land. During the fiscal year special reports or field investigations made at the instance of the Office of Indian Affairs included asbestos deposits on the Fort Apache Reservation, Ariz.; coal on the Hopi Reservation, Ariz.; gold, silver, and copper deposits on the Gila River Indian Reservation, Ariz.; granite on a Kiowa allotment, Okla.; volcanic ash on a Creek allotment, Okla.; and lead and zinc in Osage Nation, Okla.

COOPERATIVE WORK

In addition to the work for the Navy Department and the Office of Indian Affairs briefly discussed above, cooperative contributions were made to investigations carried on by the Bureau of Mines and Bureau of Standards in connection with the design of mine stoppings to withstand explosions of coal dust, with the explosibility of coal dust, with the amount and character of oils obtainable from coal by distillation and the economic value of the resulting char, and with the country-wide search of the helium division, Bureau of Mines, for sources of helium; and aid was rendered to the Bureau of Reclamation on coal-mining problems.

COST OF SUPERVISION

Preliminary estimates indicate that the cost of the supervisory work of the mineral-leasing division averages about 2 per cent of the aggregate rents and royalties involved, or only one-fifth of the estimated cost of administration when the leasing law was enacted. This cost for essential engineering supervision is materially less than that of similar supervision of operations under private ownership and is more than covered by the economies effected and reflected in immediate royalty returns. The future values preserved by conservation measures established by the supervisory forces and the eventual royalties to be derived therefrom far exceed the current monetary returns from the work of the division.

PUBLICATION BRANCH

DIVISION OF BOOK PUBLICATION

SECTION OF TEXTS

During the year 22,342 pages of manuscript were edited and prepared for printing by the section of texts, and proof sheets comprising 1,831 galley proofs and 11,588 page proofs were read and corrected. Indexes were prepared for 40 publications covering 5,686 pages. Copy and proof or stencils for 654 pages of multigraph and mimeograph matter were read. The book publications of the year are listed and abstracted on pages 7–13. At the end of the fiscal year five persons were employed in this section.

SECTION OF ILLUSTRATIONS

The number of drawings prepared by the section of illustrations was 1,629, including 132 maps, 448 sections and diagrams, 335 photographs, and 714 paleontologic drawings; 131 miscellaneous jobs were also done by the section. The illustrations transmitted to accompany reports numbered 1,685, to be reproduced by chromolithography, photolithography, halftone, zinc etching, combination zinc and halftone, and cuts already engraved. The number of proofs received and examined was 872. At the end of the year material for illustrating 49 reports is in hand. The section now consists of nine employees.

DIVISION OF MAP EDITING

SECTION OF GEOLOGIC EDITING AND DRAFTING OF MAPS AND ILLUSTRATIONS

During the year all the original drafting for the geologic branch was assigned to the section of geologic editing and drafting of maps and illustrations, and the draftsman for the geologic branch was transferred to the section.

The Gillespie-Mount Olive (Ill.) folio (No. 220) was completed and published. The geologic map of Alabama, which was issued by the State Geological Survey, was prepared, its color scheme planned and its engraving and printing directed and supervised in this section. The drawing of the geologic map of Oklahoma was completed, its color scheme planned, and color stones prepared during the year. The maps for the Bessemer-Vandiver (Ala.) folio were engraved and sent for transfer to stone. The Gaffney-Kings Mountain (S. C.–N. C.) folio was prepared, and engraving of the maps was begun. The Somerset-Windber (Pa.) and Coatesville-West Chester (Pa.) folios were received for publication, and their preparation was well advanced. The geologic map of New Mexico reached the stage of color-stone preparation. Some progress was made on the Columbiana-Montevallo (Ala.) and Hollidaysburg-Huntingdon (Pa.) folios.

Maps, sections, and other geologic illustrations for 19 reports were drawn in the section, and numerous diagrams and other sketches for lectures, exhibits, and the Sesquicentennial Exposition were pre-

pared. Illustrations for 22 reports besides the folios and State geologic maps were critically examined and edited in the section.

SECTION OF INSPECTION AND EDITING OF TOPOGRAPHIC MAPS

During the year 97 topographic maps were edited and transmitted for engraving, 226 published topographic maps, 10 State maps, and 14 State index circulars were edited for reprint, 45 plan and profile river-survey sheets were edited for photolithography, 25 miscellaneous maps were edited for engraving or photolithography, and 305 maps were edited as illustrations for survey reports, a total of 722 maps edited. First, second, combined, and woodland proofs of engravings for new topographic maps and reprints numbering 440 and proofs of maps reproduced by photolithography numbering 261 were read. At the end of the year 91 new topographic maps were in process of engraving and printing. (See also "Topographic branch," p. 56.)

DIVISION OF ENGRAVING AND PRINTING

TOPOGRAPHIC MAPS AND GEOLOGIC FOLIOS

During the fiscal year 75 new or revised topographic maps were engraved, 51 other new maps were photolithographed, and 2 maps of proposed national parks were compiled by transfers, making a total of 128 new maps printed and placed in the sale stock. In addition, 201 advance sheets of topographic maps were photolithographed and printed. Corrections were engraved on the plates of 226 maps. Reprint editions of 172 engraved topographic maps and 16 photolithographed State and other maps were printed and delivered. In addition, 46 new topographic maps had been engraved and were in press June 30, and the engraving of 16 other new topographic maps was nearly completed. Of new and reprinted maps 316 different editions, amounting to 786,025 copies, were delivered. One new geologic folio was printed, in an edition amounting to 656 copies. Extra geologic maps of folios, numbering 1,637 copies, were also delivered.

OTHER GOVERNMENT MAP PRINTING

A large amount of work was done for the Government Printing Office, the office of the Secretary of the Interior, the Bureau of Mines, Bureau of Reclamation, Bureau of Education, General Land Office, National Park Service, Office of Indian Affairs, Bureau of Public Roads, Bureau of Agricultural Economics, Forest Service, Weather Bureau, Bureau of Standards, Bureau of Lighthouses, Department of Labor, Department of State, War Department, Post Office Department, Treasury Department, Department of Commerce, Interstate Commerce Commission, Federal Power Commission, International Boundary Commission, Commission of Fine Arts, Civil Service Commission, United States Tariff Commission, National Capital Park Commission, Hydrographic Office, Coast and Geodetic Survey, Alaska Railroad, National Research Council, Federal Farm Loan Bureau, United States Shipping Board, United States Coast Guard, United States Veterans' Bureau, Federal Board for Vocational Edu-

cation, Engineer Map Reproduction Plant, National Sesquicentennial Exposition, American Red Cross, and the States of North Carolina, Tennessee, Wisconsin, and Illinois. This work done for other branches of the Government and State governments included many reprints, and the charges for it amounted to about $118,000, for which the appropriation for engraving and printing geologic maps was reimbursed by transfer of credit on the books of the Treasury Department. Other work amounting to $7,769.90 was done for various State surveys, and payment was effected by transferring employees from Federal to State pay rolls. Transfer impressions numbering 344 were made during the year, including 153 furnished to contracting lithographic printers on requisition of the Government Printing Office, 186 furnished to private firms, 4 furnished to the War Department, and 1 furnished to the Weather Bureau. The amount turned over to miscellaneous receipts from this and other miscellaneous work was $410.50.

Of contract and miscellaneous work of all kinds, 2,670,797 copies were printed. Including topographic maps and geologic folios, a grand total of 3,458,459 copies were printed and delivered.

PHOTOGRAPHIC LABORATORY

The output of the photographic laboratory consisted of 9,475 negatives (2,163 wet, of which 928 were for photolithographs, 288 paper, 2,162 dry, 3,956 field negatives developed, and 906 lantern slides), 58,061 prints (33,945 maps and diagrams, 23,184 photographs for illustrations, and 932 rectigraphs), 2,893 zinc plates, 232 zinc etchings, 98 celluloid prints, 126 lantern slides colored, 20 transparencies colored, 10 prints colored, 15 enlargements colored, and 3,760 prints mounted.

DIVISION OF DISTRIBUTION

A total of 390 publications, comprising 72 new books and pamphlets, 1 reprinted book, 1 new geologic folio, 128 new or revised topographic and other maps, and 188 reprinted topographic and other maps, were received by the division of distribution during the year. A number of special pamphlets and forms for administrative use were also delivered and distributed. The total units of all publications received numbered 215,126 books and pamphlets, 4,078 geologic folios, 1,637 geologic maps, and 781,947 topographic and other maps, a grand total of 1,002,788.

The division distributed 227,036 books, 8,949 folios, and 760,346 maps, a total of 996,331, of which 7,288 folios and 630,491 maps were sold.

The sum received and deposited in the Treasury as the result of sales of publications was $47,089.06, including $44,545.78 for topographic and geologic maps and $2,543.28 for geologic folios. In addition to this, $751.80 was repaid by other establishments of the Federal Government at whose request maps or folios were furnished. The total receipts, therefore, were $47,840.86. The division received and answered 80,822 letters.

ADMINISTRATIVE BRANCH

SECTION OF CORRESPONDENCE AND RECORDS

The work of the section of correspondence and records was of the same general character as during the fiscal year 1925.

During the year 118,077 pieces of mail, of which 2,058 were registered, were opened and referred. In addition 143,752 letters were received direct by the other divisions, making a total of 261,829, a decrease of 18 per cent compared with 1925, due to the transfer of the mineral-statistics work to the Bureau of Mines. Of the letters opened in this division 20,686 contained $47,478.57 remitted for Geological Survey publications. The number of ordinary letters mailed through the division was 49,302; of registered letters and packages, 6,305. In addition, 142,077 pieces of mail were sent out direct from other divisions. The total number of outgoing pieces of mail for the Geological Survey was 197,684.

During the year 2,346 pieces of freight and express were handled, 1,150 outgoing and 1,196 incoming.

The roll of Secretary's appointees numbered 845 at the end of the fiscal year, 11 more than at the end of 1925. This is not a significant figure, however, because of the interchange of units with the Bureau of Mines on July 1, 1925. The net change during the year was a reduction of 72. The total number of changes in personnel was 1,151, which included 284 appointments, 273 separations, and 594 miscellaneous changes.

During the calendar year 1925, 17,184 days of annual leave and 3,725 days of sick leave were granted—68 per cent of the amount of annual leave which could have been taken and about 14 per cent of the amount of sick leave it would have been possible to grant. Leave without pay and furloughs amounted to 4,773 days.

LIBRARY

Accessions to the library numbered 14,682 books, pamphlets, and periodicals and 433 maps. The recorded loans were 7,035 books and 284 maps, not including those used by 12,097 readers who consulted the library in person. The catalog was increased by the addition of 8,063 cards. In accordance with the cooperative cataloging arrangements, 810 title entries were furnished to the Library of Congress for printing, the proof reading of which involved 160 galleys.

The correspondence, consisting of 2,118 letters written and 1,752 received, largely concerned the exchange of publications. This correspondence involved the translation of many letters in foreign languages. Foreign articles and letters translated for other divisions of the Geological Survey numbered 219. There were 958 books collated and prepared for binding and 893 newly bound books accessioned and labeled.

Many books were loaned to other libraries and institutions in Washington and in other parts of the country.

Cooperation in the compilation of the "Union list of serials in the libraries of the United States and Canada," to be published under the auspices of the American Library Association, was continued.

The manuscript of the bibliography of North American geology for 1923 and 1924 was submitted for publication in April and is now in the hands of the printer. The preparation of the bibliography for 1925 and 1926 is in progress.

DIVISION OF FIELD EQUIPMENT

On October 1, 1925, the division of scientific and technical equipment and the section of field property were merged and the enlarged unit designated the division of field equipment. This division has continued to repair instruments and other equipment—both field and laboratory—to develop new and improved apparatus for the scientific and technical work, and to care for and issue the equipment required for field work.

SECTION OF ACCOUNTS

Condensed statements covering the expenditures from Federal funds during the year are given on the following pages. The amounts expended by States for cooperative work are set forth in the reports of the field branches.

GEORGE OTIS SMITH,
Director, Geological Survey.

Amounts appropriated for and expended by the United States Geological Survey pertaining to the fiscal year ended June 30, 1926[a]

Appropriation	Funds available					Expenditures			Balance
	Amount of appropriation	Repayments on account of work performed			Total	Disbursements	Outstanding liabilities	Total	
		For cooperating agencies		For other Geological Survey units					
		Made	To be made						
Salaries	$54,760.00			$212.49	$54,972.49	$54,263.46		$54,263.46	$709.03
Topographic surveys	[b] 558,300.00	$121,519.26	$18,296.92	16,235.41	714,351.59	707,653.00	$5,687.02	713,340.02	1,011.57
Geologic surveys	325,000.00	2,331.71	2,276.28	387.70	329,995.69	319,791.07	5,732.85	325,523.92	4,471.77
Chemical and physical researches	40,000.00	7.00			40,007.00	39,205.51	483.70	39,689.21	317.79
Mineral resources of Alaska	72,000.00	391.66			72,391.66	56,684.05	[d] 14,336.54	71,020.59	1,371.07
Gaging streams	165,000.00	59,034.87	8,280.10	324.34	232,639.31	230,122.57	2,199.09	232,321.66	317.65
Classification of lands	265,000.00			846.66	265,846.66	258,271.07	5,014.72	263,285.79	2,560.87
Geologic maps of the United States	105,000.00	74,933.80	20,297.94	22,768.26	223,000.00	205,296.78	14,159.34	219,456.12	3,543.88
Preparation of illustrations	18,000.00				18,000.00	17,995.57		17,995.57	4.43
Mining investigations in Alaska	22,000.00				22,000.00	19,909.07	1,165.03	21,074.10	925.90
Oil, gas, and oil-shale investigations and leasing	240,630.00			5.89	240,635.89	202,729.74	14,758.69	217,488.43	23,147.46
Enforcement of mineral leases	86,920.00			450.00	87,370.00	75,620.14	2,075.55	77,695.69	9,674.31
	[b] 1,952,610.00	258,218.30	49,151.24	41,230.75	2,301,210.29	[c] 2,187,542.03	65,612.53	[cd] 2,253,154.56	• 48,055.73

[a] In addition to these appropriations, items of $85,930 for printing and binding Geological Survey publications and $11,700 for miscellaneous printing and binding were contained in the appropriation act, but the accounts for these items were not kept in the Geological Survey. There was also an allotment of $6,165 for miscellaneous supplies from the appropriation for contingent expenses of the Interior Department.

[b] Appropriation was increased by Congress in amount of $73,300 by act of Mar. 3, 1926.

[c] Included in this amount is $41,230.75 covering work performed by Geological Survey units for other Geological Survey units, necessarily reported in combining totals, but otherwise a duplication.

[d] Of this total, $8,860 is in the hands of special disbursing agents and therefore has not been included in the classification of expenditures, as no vouchers covering disbursements have been received.

• A budget reserve of $11,435 is included in this balance.

Classification of expenditures by the United States Geological Survey pertaining to the fiscal year ended June 30, 1926

Object of expenditure	Geological Survey salaries	Topographic surveys	Geologic surveys	Chemical and physical researches	Mineral resources of Alaska	Gaging streams	Classification of lands	Geologic maps of the United States	Preparation of illustrations	Mining investigations in Alaska	Oil, gas, and oil shale investigations and leasing	Enforcement of mineral leases	Total
Personal services	$54,263.46	$522,573.83	$277,290.04	$33,901.03	$45,756.45	$185,617.12	$202,106.88	$170,463.75	$17,673.44	$15,617.17	$146,067.15	$52,843.00	$1,724,173.32
Stationery and office supplies		5,227.14	366.92	33.58	175.72	658.75	326.37	34,545.54	26.18	8.40	2,504.22	921.39	44,794.21
Scientific and educational supplies		536.63	1,996.70	1,080.27	56.93	300.36	191.84				16.08	32.82	4,211.63
Sundry supplies		3,483.07	527.78	228.09	959.60	1,018.83	537.73	6,778.04	16.57		646.49	67.59	14,263.79
Subsistence and care of animals and storage and care of vehicles		1,926.51	1,009.21			10.00	12.00					5.00	2,962.72
Telegraph service		646.65	284.52		69.85	203.09	67.91	6.34		119.29	521.07	58.61	1,977.33
Telephone service		156.77	2.90	1.30	7.70	484.86	145.64			101.95	1,115.60	344.47	2,361.19
Other communication service		12.75				19.00	6.45			1.50	29.15		68.85
Travel expenses		86,479.05	20,461.40	1,479.96	10,322.81	19,580.60	27,078.43	131.04		4,565.09	12,225.19	9,451.45	191,775.02
Attendance at meetings		168.44	1,517.47			334.46	356.89				37.71	39.42	2,454.39
Hire, maintenance, operation, and repair of horse-drawn and motor-propelled passenger-carrying vehicles		5,192.72	2,587.57	995.29	50.00	4,844.17	6,357.10			15.00	18,716.85	5,256.04	44,014.74
Transportation of things		32,628.55	5,161.98	41.52	705.55	1,994.05	6,485.34	63.37		102.02	1,320.43	568.24	49,071.05
Lithographing, engraving, and engrossing		9,581.12	1,229.58	24.82	79.85	426.55	3,293.13	80.00	103.19				14,818.24
Stenographic work, typewriting, and duplicating work, etc. (job work)		15.56	17.63		47.50		8.75				13.29		102.73
Photographing and making photographs and prints		9,113.75	3,716.25	185.82	262.20	935.48	1,584.33		173.21	12.65	305.85	107.94	16,397.48
Heat, light, power, water, and electricity			62.50							220.80	777.36	5.02	1,065.68
Rents		20.75				1,032.00				25.08	2,308.00	735.00	4,120.83
Repairs and alterations		125.72	88.66	166.11	24.50	425.16	22.25	1,014.85			10,033.56	28.30	11,929.11
Special and miscellaneous current expenses		9,243.09	4,819.54	553.46	1,016.80	746.66	5,794.61	2,189.89	2.98	30.00	1,118.10	212.15	25,727.28
Purchase of passenger-carrying vehicles			990.50			5,027.56	3,785.00				14,779.85	5,148.25	29,731.16
Furniture, furnishings, and fixtures		1,548.77	410.18		100.97	810.79	918.54	50.00		20.00	3,344.05	1,464.90	8,668.50
Educational and scientific equipment		6,238.80	2,741.83	997.96	425.46	4,411.74	1,526.61	161.39		136.40	729.23	324.94	17,694.36
Livestock		839.50			1,000.00		1,320.00						3,159.50
Other equipment		17,580.85	240.46		1,098.70	3,440.43	1,359.99	3,971.91		98.75	879.20	81.16	28,751.45
	54,263.46	713,340.02	325,523.92	39,689.21	62,160.59	232,321.66	263,285.79	219,456.12	17,995.57	21,074.10	217,488.43	77,695.69	2,244,294.56

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