

of vital importance to commerce and trade. The testimony of their far-sighted consular agents in various parts of the world is that British trade with all nations except our own is sadly handicapped by its units of measure, and our own consular reports are of the same tenor. Within a year we have entered upon a new era in our foreign relations. Our trade with foreign nations has increased enormously and must increase still further if we are to maintain our footing. We have already absorbed a considerable population by whom the metric system has long been used, and our merchants and manufacturers are already feeling the disadvantages of our antique and irrational measures of quantity. Fortunately for us, our principal competitors are the English, who are carrying nearly the same burden. But they have been quick to recognize the necessity for reform and in five years they have made more progress towards it than we have in thirty.

Schools of engineering and professors of engineering and applied science can do more, if they are so minded, to help their country in this emergency than any other agency that I know of. They can do it by a more liberal use of the metric system in their daily work. Electrical engineering, by a wonderful stroke of good fortune, emancipated itself from this curious slavery in the very beginning, and its astonishingly rapid growth from infancy to the vigorous manhood which it now enjoys is very largely due to that fact. In the engineering college of to-day the student in physics and chemistry is brought into close relations with the metric system, but when he advances to his professional studies in civil and mechanical engineering he is too often compelled to relapse into the exclusive use of the foot, the pound and the gallon. I am far from recommending the abandonment, at this time, of these useful units, but I strongly urge the importance of al-

lowing them to share their work with their metric analogues and very liberally. Even if there were no other advantage there would be an enormous gain to the student in compelling him to do his problems and his laboratory exercises in more than one system of units, than which nothing contributes more to clearness of understanding and soundness of knowledge. If we had begun this a quarter of a century ago and kept it up we should be in much less danger of being beaten in the race for the markets of the world than we are to-day; for this system is bound to become universal and in the near future. The prodigious advantages which it offers in its simplicity, its economy and its already extensive use will insure this. No body of men can more effectively influence public sentiment to an appreciation of this fact than those I now address.

One of the ablest and most scholarly arguments in favor of the metric system ever made was that of Charles Sumner in the Senate of the United States more than thirty years ago. He summarized the argument as follows: "A system of weights and measures born of philosophy rather than chance is what we now seek. To this end old systems must be abandoned. A chance system cannot be universal. Science is universal; therefore, what is produced by science may find a home everywhere."

T. C. MENDENHALL.

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*WORK OF THE U. S. GEOLOGICAL SURVEY.\**

APPROPRIATIONS for the work of the U. S. Geological Survey for the current fiscal year amount to \$806,000 as against \$816,000 for the preceding fiscal year. The apparent decrease is largely because of special items appropriated in the former year, one of which, for printing and binding monographs, amounted to \$40,000. The amounts for

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actual field work and office compilation thereof are, in fact, increased. In the two items of topographic surveys in general and topographic surveys of forest reserves there is an increase of \$40,000 over 1898-99, and \$10,000 was added to the amount for collecting and publishing statistics of mineral resources. A special appropriation for surveys in Alaska carries \$25,000, a sum the same as was available last year.

*Topographic Branch.*—The increase in the appropriations for topographic surveys resulted from the demands of Eastern States that cooperative surveys should proceed more rapidly. Cooperative surveys are now in progress with New York, Pennsylvania, Maryland, Maine and Alabama. The total sum of appropriations by these States for cooperation amounts to \$48,500. The Geological Survey is pledged to expend in each of these States an amount equal to that appropriated by it, and a State Commission or its representative determines the order of procedure of surveys; the work in New York, for example, is directed chiefly to surveys of the areas of water supply for the Erie Canal and the Hudson River, whereas in Pennsylvania stress is laid upon the importance of topographic maps to serve as bases for detailed geologic surveys of the coal, oil and gas regions. In Maryland the topographic work is distributed according to needs of the State Geological Survey, and the larger portion of the State has been surveyed. Cooperative surveys have not been entered into by any of the Western States. The federal appropriations are little more than sufficient to survey one quadrangle (approximately 1,000 square miles) in each State and to extend the necessary triangulation and spirit-level control. The purposes which determine the selection of areas of topographic surveys are to a large extent economic, and are related to the development of mining districts, water resources and forest reserves. The first of

these purposes includes also the surveys for general geology, which are usually extended over districts where economic interests are important. These topographic operations throughout the United States as planned for the present year are estimated to cover about sixty-five quadrangles on two different scales, or a total area of about 45,000 square miles.

The character of the topographic work is constantly improving, and the evolution of the topographer from the grade of a surveyor to that of a scientific observer is progressing. Whereas formerly the strongest man in any party was engaged in the more precise instrumental work, such as triangulation and leveling, and sketching topographic features was the work of subordinates, the reverse is now the case. The topographer in charge of the party is responsible for the expression of the map, which can only be satisfactory when controlled by experience and executed with artistic skill. Furthermore, the topographers are required to observe and note on the maps the classification of lands, as cleared or forested, and many of them take a scientific interest in the physiographic development of topographic forms. The tendency at the present time is to increase their responsibility and to make the place worthy of men ambitious to broaden knowledge of the conditions which fit the earth for man's habitation.

*Geologic Branch.*—In the northeastern district of the Appalachian province, comprising New England, eastern New York, and New Jersey, a number of competent geologists are engaged in the study of the difficult problems presented by the metamorphic sedimentary and igneous rocks. In the Adirondack area surveys of the southeastern portion of the mountains adjacent to Lake Champlain have been extended to cover nearly 1,000 square miles, lying between Lake Champlain and the

heart of the mountains. The greater part of the area is in the pre-Cambrian igneous rocks, and the problems relate to the sequence of eruptives and the character of metamorphism suffered by the anorthosites. The researches indicate an eruptive origin for the great magnetic ore bodies as parts of gabbro masses. A paper has been contributed to the 19th Annual on this subject (The Titaniferous Iron Ores of the Adirondacks, J. F. Kemp, 19th Annual Report). Preliminary surveys were begun last year in the region southwest of the Adirondacks in the Old Forge quadrangle, where the relations of igneous rocks to certain limestones are the more interesting questions.

The work begun by Pumpelly in the Green Mountains in Massachusetts, comprising the Housac and Greylock ranges, has been extended in several directions by those who were associated with him. In eastern New York, where Walcott had worked out the general outline of the problems, the complex stratigraphy and structure of the Paleozoic rocks have been unraveled practically from Manhattan Island to the vicinity of Rutland, and the relations of Cambrian and Silurian strata to Archean and Algonkian nuclei in northeastern Massachusetts and southern Vermont have been further investigated. Nearly all of Massachusetts as far east as the edge of the Boston basin has been surveyed according to the classification of the rocks published by Professor Emerson in the Holyoke folio and in the Monograph on old Hampshire county, and this work is progressing from the Massachusetts line southward in Connecticut. The difficulties of determining the origin and relationships of the unfossiliferous gneisses and schists which make up this area are so great that progress will probably be slow and differences of opinion may arise. It is accordingly advantageous that representatives of the several great universities are engaged upon the work.

In the eastern part of New England special studies have been made of the post-Cretaceous formations of the Elizabeth Islands and of Nantucket and Cape Cod; and an elaborate investigation of the Narragansett coal field has been completed, the results being published in Monograph XXXIII., entitled 'Geology of the Narragansett Basin,' by N. S. Shaler, J. B. Woodworth and August F. Foerste. In northern New Jersey surveys have been made of the Franklin Furnace quadrangle, including the celebrated zinc mines. A topographic map on a specially large scale was made, and through the courtesy of the companies the mine maps are available. These results will all be published in the Franklin Furnace folio of the Geologic Atlas.

For several years the geology of Manhattan Island and vicinity has been studied in its various aspects. The topographic surveys have been brought up to date, and it is proposed to issue a New York special folio, comprising about fourteen maps, to exhibit the surficial geology, under geology, structure and economic resources of the Patterson, Harlem, Staten Island and Brooklyn quadrangles. The field work for this folio is completed.

In the vicinity of Philadelphia the crystalline schists and gneisses present relations not unlike those of similar rocks in New England. Their distribution and relations have been worked up, and the results are to be elaborated in the Philadelphia folio of the Geologic Atlas, comprising the Germantown, Norristown, Chester and Philadelphia sheets. Through cooperation with the Maryland Geological Survey and through the work which has been in progress in Virginia, North Carolina and Georgia for ten years or more, a fairly complete reconnaissance of the crystalline schists has been accomplished throughout the Appalachian province, and their detailed relations have been unraveled in the

vicinity of Baltimore, Washington, and to some extent in the Smoky Mountains of North Carolina. The coordination of the observations in the pre-Cambrian rocks is entrusted to Professor Van Hise. The results will be published in part in cooperation with the Maryland Survey, in future folios of the Geologic Atlas, in the Washington folio, for which the manuscript is in hand, and in reports and folios relating to the Cranberry and Cherokee districts of North Carolina. This last-named work is performed partly in cooperation with the State Geological Survey of North Carolina.

In the Atlantic Coastal Plain the latest contributions to geology have resulted from the investigations supported by the State Surveys of New Jersey and Maryland. The study of the surficial deposits broadened the basis of stratigraphic discrimination, and the combination of minute observations in stratigraphy with elaborate studies of paleontology has led to recognition of important details in the Eocene and Miocene sections. Our views of unconformity and of the nature of oscillation of the Coastal Plain will probably be widened by the publication of these results. That, however, is not yet an immediate prospect, except in so far as they have appeared in the State reports of New Jersey and Maryland.

Surveys of the unaltered Paleozoic strata in the folded zone of the Appalachian province are not now being extended. The number of quadrangles surveyed and folios issued or about to be issued is large. With the exception of one folio, the Maynardville, shortly to appear, the valley and a part of the plateau region of eastern Tennessee are mapped in published folios, and the area of continuous surveys extends into Georgia and Alabama on the south and into Virginia on the north. Representative folios for the valley of northern Virginia cover over 6,000 square miles and fully exhibit the peculiarities of structure. Folios

relating to Paleozoic stratigraphy and Appalachian structure issued during and since 1896 are Nos. 27, 28, 32, 33 and 35, or the Morristown, Tenn.; Piedmont, Va., Md. and W. Va.; Franklin, Va. and W. Va.; Briceville, Tenn., and Gadsden, Ala., respectively.

The accuracy of the work performed by geologists who preceded the United States Survey in the Appalachian coal fields, and the importance of the economic interests involved, led to the use of the most careful stratigraphic and structural methods in that field. Unwilling to trust to correlation of lithologically similar strata which have not been mapped continuously, the geologists have measured and named local sections on the assumption that they may not be able to correlate the individual beds in each. The position of any stratum is determined throughout a network of intersecting sections which are checked against the bench marks established by precise level lines in course of the topographic survey. Lithologic variations are carefully noted from area to area, and each distinctive lithologic unit is identified so far as it is actually traceable, but correlation is not continued beyond that point. The stratigraphers have been greatly aided by the appreciative cooperation of the paleobotanist, and the result will be to establish our knowledge of the stratigraphy of the Coal Measure formations upon a sound basis of fact. The tendency of the observations is to replace the conception of uniform and widely extended strata by the recognition of numerous irregular and overlapping lenses, and to demonstrate that the later Carboniferous formations exhibit the character of coastal plain deposits rather than that of marine strata. The folios more recently published with reference to the Appalachian coal field are Nos. 34, 40, 44, 46 and 47, or the Buckhannon, W. Va.; Wartburg, Tenn.; Tazewell, Va. and W. Va.; Richmond, Ky.,

and London, Ky., respectively. The last two, the Richmond and London, include the western margin of the field. The eastern margin is described in several of the folios published, and others are in course of preparation.

Studies in Pleistocene geology have been pursued by Professor Chamberlin and his assistants during more than a decade. Through a conservatism which justifies confidence, even though the impatient may at times have thought it excessive, the publication of results has been postponed until the criteria for discriminating the several episodes of glacial occupation and the various genetic types of glacial formations have been fully elaborated. The final preparation of manuscript was, however, begun nearly two years ago, and the first of a series of monographs upon the Pleistocene history (Monograph XXXVIII., *The Illinois Glacial Lobe*, by Frank Leverett) is issued. In this connection also may be mentioned Monograph XXXIV., *The Glacial Gravels of Maine and their associated Deposits*, by Geo. H. Stone.

The extraordinarily difficult investigation of the relations of iron-ore deposits in the Lake Superior region, which was begun by Irving and has been continued under Van Hise, is approaching a successful completion. All of the great iron-producing districts except two have been carefully surveyed, and the field work on these, the Vermilion and Mesabe districts of northern Minnesota, is far advanced. The series of monographs which set forth the observations and conclusions are a monument to the scientific spirit and executive ability of their authors. It is probably not too much to claim for them a foremost place in the rank of great geologic works. Very rarely has a problem of equal magnitude and difficulty been so elaborately studied and adequately solved. The principles of investigation developed in the course of this work

are a contribution to geologic methods and will facilitate further researches of a similar character. To name only the latest of the resulting publications, reference may be made to Monographs XXVIII. and XXXVI., the former entitled '*The Marquette Iron-bearing District of Michigan*,' by C. R. Van Hise and W. S. Bayley, and the latter, '*The Crystal Falls Iron-bearing District of Michigan*,' by J. M. Clements and H. L. Smythe, published also in condensed form in the 19th Annual.

Studies of the stratigraphy of the Great Plains, more especially of the content of artesian waters, form an important item in the list of activities of the Survey. In the Pueblo folio the standard was set for precise discrimination of the formations and adequate illustration of their distribution and structure. The Geologic Branch, cooperating with the Hydrographic Branch, has extended more general investigations over parts of Nebraska and South Dakota. At present the surveys are being executed for the eastern and south margin of the Black Hills and the adjacent plains. The latest contribution to the subject is a preliminary report on the geology and water resources of Nebraska by N. H. Darton in the 19th Annual Report. The 18th Annual also contained an article on '*New Developments in Well Boring and Irrigation in Southeastern South Dakota*.' Observations of the temperatures of artesian waters have led to the discovery of interesting variations in underground temperatures which are being made the subject of careful investigation.

In the southern portion of the Great Plains province work is progressing in Indian Territory. The coal fields of Indian Territory are structurally related to a series of folded and faulted sandstones and limestones along their southern margin, as the Cumberland plateau is related to the formations of the Appalachian Valley. The coals

lie in basins of moderate depth, and the strata along their southern limb are sharply folded and overthrust. The progress of the work is such that the McAlester folio will probably appear during this fiscal year. Among the observations of scientific interest is the determination of strata of probable Silurian age in sandstones previously considered to be Carboniferous. In the 19th Annual there is an article entitled 'The Geology of the McAlester-Lehigh Coal Field,' by J. A. Taff.

The geology of Texas is associated with the name of Robert T. Hill. Under his direction a large map has been prepared of the State on the scale of 25 miles to the inch, including portions of Oklahoma, and an account of the physical geography has been written to accompany it. This will appear as a folio of the Topographic Atlas of the United States, coordinate with the folio on physiographic types. 'The Geology of Black and Grand Prairies, Texas,' a comprehensive discussion of the stratigraphy and structure of the Cretaceous and later formations, is completed and offered for publication, and an article on 'The Geology of Portions of the Edwards Plateau and Rio Grande Plain Adjacent to San Antonio, Texas,' by R. T. Hill and T. W. Vaughan, appeared in the 18th Annual.

The Rocky Mountains occupy the attention of several parties. There the problems of stratigraphy, structure, metamorphism and vulcanism make it scarcely possible for any one geologist to do justice to the phenomena of a single area, particularly in the present development of special branches of geologic research. In the San Juan Mountains of Colorado surveys have for several years been conducted with a degree of care and detail which must result in a mass of well established fact and afford the foundation for valuable generalizations. In age the formations range from supposed Archean to post-Tertiary; in character they include

an immense variety of sedimentary and igneous types, and in structural relations bearing upon the problems of vulcanism and orogeny they are of the deepest interest. The exposures in the rugged but rarely inaccessible heights are very clear, and the work is being done on a scale which affords opportunity for the elaboration of detail. The district offers a definite though complex problem, and it is being worked out according to a systematic plan. The 18th Annual contains a preliminary report on the mining industries of the Telluride quadrangle by C. W. Purington, and the Telluride folio by Whitman Cross will shortly be issued.

Among the publications which serve to add materially to the available information concerning the geology of Colorado are the Elmore, Walsenburg and Spanish Peaks folios, the manuscripts for which have recently been received by the Survey in accordance with a contract entered into a number of years ago. The area which they cover comprises a portion of the plains and the foothills of the Rockies and extends to the Spanish Peaks, where the phenomena of successive intrusions of various types of igneous rocks are exceedingly interesting. The relations of the eruptives have been elaborately worked out and appear to indicate a genetic sequence of petrographic types.

Although work in the precious metal districts is not confined to the Rocky Mountains, that which has been conducted under the general direction of Mr. Emmons may most connectedly be introduced here. This work is on a much larger scale than that of the geologic investigations as a rule, and is directed to the solution of problems of development of fissures and distribution and occurrence of ores. It involves usually the detailed study of an area specially surveyed on a large scale, and also the minute investigation of all accessible underground

workings. The examination of the Butte district was undertaken in 1896, and the Butte Special folio has been published. The Tintic district in Utah was surveyed in the following season, and the results appear in the 19th Annual Report under the title of 'The Geology and Mining Industry of the Tintic District, Utah,' by Geo. W. Tower, Jr., and Geo. Otis Smith.

The Deadwood district in the Black Hills of South Dakota next claimed attention, and areal and economic surveys are now in progress there. Apart from the economic interest, the region presents geologic features of comprehensive and significant character. The literature of the subject of laccoliths will receive an important addition when a report on the structural relations of the rocks in the Spearfish and Sturgis quadrangles is published. It is anticipated that this season will suffice to finish the necessary field work.

In Montana the work begun by Mr. Hague in the Yellowstone Park has, during a number of years, been extended northward nearly to the boundary of British Columbia, and surveys on the scale of 2 miles to the inch have replaced those on the formerly adopted scale of 4 miles to the inch. The Fort Benton and Little Belt Mountain quadrangles, covering together nearly 7,000 square miles, have been surveyed in connection with studies of the Neihart mining district. They will be published as folios of the Geologic Atlas. More detailed accounts of the geologic observations in Montana appear in the 19th Annual Report, *Geology and Mineral Resources of the Judith Mountains of Montana*, by W. H. Weed and L. V. Pirsson, and are contained in an elaborate article in the 20th Annual, 'The Geology and Mining Districts of the Little Belt Mountains,' by the same authors. This last is almost a monographic work, both in size and detail. Detailed areal surveys have been

carried out in the Boulder and Helena. Special quadrangles, and topographic surveys in preparation for geologic work have been conducted in the Bitter Root Valley. The discovery by Mr. Walcott of pre-Cambrian fossils in the Belt terrane of Montana lends additional interest to the northwestern extension of the Rocky Mountains, of which these rocks form a large part.

Mr. Hague's monographic work upon the Yellowstone National Park has been energetically pushed, and the volumes are well advanced. The surveys of the Absaroka Range to the east of the Yellowstone Park are represented in the Absaroka folio, which will shortly be issued from the press. The remarkable phenomena presented by volcanic breccias laid in horizontal attitudes over a wide area, and by post-Miocene intrusives, have been discussed by Mr. Hague in his Presidential Address to the Geological Society of Washington, but are more fully illustrated and described in the Absaroka folio.

The Boise mining district, Idaho, attracted attention to a region which has since been the subject of surveys during several successive field seasons. Among the results is the determination of the probably post-Paleozoic age of a large granite area formerly considered to be Archean, and the elucidation of interesting episodes in the history of Snake River. A portion of these results are published in the 18th Annual as a paper entitled *The Mining Districts of the Idaho Basin and the Boise Ridge, Idaho*, by Waldemar Lindgren, and in the Boise folio, No. 45, and the 20th Annual contains an article entitled *The Silver City, De Lamar and other Mining Districts in Idaho*, by the same author. The work of the present field season is designed through reconnaissance to obtain a general knowledge of the areal geology of central and northern Idaho up to and including the Cœur d'Alene district of eastern Washington.

The desert region of Nevada south of the 40th Parallel Surveys is geologically almost unknown, and the blank in the geologic map of the United States is correspondingly extensive. Surveys are begun with the present field season to accomplish a reconnaissance of this area, extending south into southern California. If appropriations permit, it is hoped that reconnaissance surveys may, in the course of a few years, be extended over all of the little known districts of the United States, so that a complete geologic map may be published on the scale of what is known as the nine-sheet base, namely 40 miles to the inch.

The geological survey of the Sierra Nevada has been completed over an area comprising about 21,000 square miles between the 37th and 40th parallels of latitude. Twenty geologic folios have been or are to be published illustrative of the results. The work at the present time is proceeding in the Yosemite quadrangle and further south on the eastern slope of the Sierra Nevada in the Silver Peak quadrangle, which includes the Silver Peak mining district. Following the general study of the mountain range and its geologic structure, special work has been done upon some of the principal mining districts—for instance, that of Nevada City, and more recently upon the Mother Lode. For the last-named work a large-scale topographic map was prepared with great care, and Mr. Becker entered upon the studies of physics of ore deposition along the lode. In July, 1898, he was, however, diverted therefrom by an assignment to ascertain the mineral resources of the Philippines. The performance of this duty required the acceptance of a military commission, and he was attached to the Bureau of Information at Manila. Geologic investigations being precluded by the activity of the insurgents, Mr. Becker accepted his military duties with *sang froid*, and with the troops under fire rendered service

which has been the subject of highly complimentary reports from his superior officers in the field. The information which he was able to obtain in the old Spanish bureau of mines in Manila and presumably from other reliable sources is contained in Part VI., of the 19th Annual Report.

In the Cascade Range of Washington studies conducted for the past two years with reference to the geology of the Mount Stuart quadrangle reveal a series of phenomena closely resembling those of the Sierra Nevada. The volcanic flows of which the range is composed throughout Oregon and into southern Washington give place about latitude  $46^{\circ} 30'$  to schists and granites of pre-Tertiary age, which are unconformably overlain by sandstones of the Eocene and Miocene periods. The structure of the range cannot be said to be understood at the present time, but work is energetically proceeding with the purpose of developing the facts in such detail and so accurately as to secure conclusive information. A reconnaissance of the northern portion of the range carried out during the past summer has resulted in an article in the 20th Annual—Geology of the Cascade Mountains of Northern Washington, by I. C. Russell.

In the Coast Ranges of California and Oregon, a geologist who has acquired ideas of mountain growth from the Paleozoic rocks of the Appalachian province must completely revise his conception of that process. Where the early Cretaceous or late Jurassic rocks appear as a schistose basement complex, and the Cretaceous and Tertiary formations are separated by as many unconformities as there are distinct episodes of history, the activity of the earth's crust seems an imminent phenomenon. The contributions to the stratigraphy and structure of these youngest ranges proceed from studies in Oregon (Coos Bay Coal Field, Oregon, J. S. Diller, 19th An-



nual Report, and the Roseburg folio, Oregon, J. S. Diller), and in California from investigations by the professors of Berkeley and Stanford in the vicinity of San Francisco, and of the San Luis Obispo district, comprising the vicinity of the town of that name. At present surveys are being prosecuted on the Klamath Mountains, where strata of early Paleozoic age are identified by fossils; on a series of quadrangles which include San Francisco and a section across the Coast Range eastward to the San Joaquin Valley; and about San Luis Obispo.

In the work of the Geological Survey outside of the Appalachian province, physiography has received scant attention. The development of the mountain ranges from the Great Plains to the Pacific is recorded in physiographic forms which are as significant as facts of stratigraphy and igneous eruptions, and which continue the record made in the rocks. The physiographic province bounded by these eastern and western limits and extending from the Isthmus far into British Columbia presents problems which are as yet unconsidered. In order that they may be studied in all their breadth and comprehensiveness within the United States, Mr. Gilbert has been assigned to the investigation. The results may confidently be expected to afford an interesting group of criteria for the elucidation of mountain history, and to advance the solution of continental problems.

Petrography and paleontology, two great aids to general geologic research, have each a special purpose of investigation intimately related to other sciences. The results achieved by the specialists who are members of the Geological Survey are proportionate to the opportunities, which are broad and numerous; but in this partial and general account of the work of the Survey it is not practicable to go into details concerning them. The 19th and 20th Annuals, however, contain important contributions of

general interest, namely: 'The Cretaceous Formations of the Black Hills as indicated by Fossil Plants,' by L. F. Ward; 'Status of the Mesozoic Floras of the United States,' L. F. Ward; and 'The Flora of the Pottsville Series,' David White. In the 20th Annual Professor Pirsson's contribution to the petrography of the Little Belt Mountains, Montana, is an important paper.

The Division of Mineral Resources prepares a statement of the quantity and value of the products from the mines of the United States, and also special reports on new features of mining technology in relation to mineral industries. Many inquiries which come to the Interior Department in regard to questions on mineral technology of every character find their way to this division for reply. There is opportunity for development of the scope of this work in response to the agitation among mining interests for representation in the executive branch of the National government. An amendment to the Sundry Civil Bill was introduced in the Senate at the last session of Congress authorizing the Director to establish a Division of Mining in the United States Geological Survey. While the establishment of a Division of Mining was not completed by the House of Representatives, the appropriation for the work was changed from \$20,000 to \$30,000 and the Survey is enabled to inaugurate some of the features contemplated. For example, through cooperation with the geologic branch, there will be made a study of the conditions of occurrence of asphaltum, a mineral of constantly increasing usefulness, to secure a complete account of the various deposits in the United States. Corundum, a demand for which has become imperative in this country, will be examined in the same way. A comparison of tests as to the physical strength and chemical composition of building stones of the country, published within the last month, illustrates

the possible scope of these operations. Similar comparisons of information concerning the composition of the various fuels of the United States are urgently required, and it is proposed to undertake them.

*Hydrographic Branch.*—The Hydrographic Branch of the Geological Survey devotes its energies mainly to the measurement of the volume of streams, chiefly in mountainous regions. About three-fourths of the stations maintained are west of the 97th meridian, a greater portion of the remainder being in the Appalachian Mountains. In addition to the work of stream measurements systematic information regarding the methods and results of the utilization of the water supply of the country is being obtained from all sources where it can be found in the hands of individuals and corporations and published in a series of 'Water Supply and Irrigation Papers.' Geological examinations of the artesian districts of the Dakotas and of Texas are also in progress, and various problems of a scientific nature are under investigation. In connection with stream measurements the attempt is being made to measure carefully the slope of streams and to describe their regimen, in order to obtain additional information regarding the proper coefficients of friction to be used in hydrographic formulæ. The movements of underground waters are being observed by means of wells and other available sources of information, this work being chiefly done in the Great Plains region and the valleys of California. Where possible, existing information regarding artesian and surface wells is being obtained and tabulated.

The branch being charged by law with the examination and segregation of reservoir sites, those which come within the studies pursued are surveyed and segregated from private entry under the homestead and desert land laws, in order to prevent the vestment and growth of private

interests which might in future be an obstacle to the best utilization of such sites.

*Forestry Investigations.*—The agitation for the preservation of the remaining forests of the United States resulted in the establishment of two distinct classes of work, both having reference to the forests. The one might be comprehensively described as a forest survey, its purpose being to obtain maps of the forested areas throughout the country and to set forth the present condition and future prospects of the forest reserves. The other relates to the administration of the established forest reserves, involving the appointment and supervision of numbers of rangers whose duty it is to prevent fires and depredations and to see that the laws governing the reserves are enforced.

The forest survey is in charge of the Director of the Geological Survey, and is under the immediate management of Mr. Gannett, except in so far as the topographic work, which supplies the base maps, is executed by the divisions of the Topographic Branch. It is carried out in cooperation with similar investigations conducted by the Forestry Division of the Agricultural Department under Mr. Gifford Pinchot. With the energy and capacity for broad generalizations which characterize his work, Mr. Gannett has caused the principal forest areas of the country to be investigated, and some part of the results is already published. They constitute Volume V. of the 19th Annual, and the fifth volume of the 20th Annual will also be composed entirely of papers relating to forests.

*Publications Branch.*—Standards of scientific and literary character were established for the textual publications of the Geological Survey early in its history. Their present style is in large measure due to the efficient work of the editor and his assistants. The magnitude of the labors of this branch can best be suggested by a state-

ment of the number of typewritten and printed pages handled during the past year. The manuscript pages, usually typewritten, amounted to 16,263, and proof sheets read and corrected during the year to 10,840; the latter, as a rule, were read twice. The editorial work increases with the growth and diversity of the Survey's work. Thus for five years, 1889 to 1894 inclusive, the number of manuscript pages edited was 46,891 and of proof pages read 22,795, whereas during the equal period from 1894 to 1899 inclusive, the corresponding numbers were 65,763 and 35,769.

The work of the Engraving Division also grows from year to year, as the output of original maps from the topographic and geologic branches is enlarged. The Chief Engraver has ingeniously simplified the technical processes, and he has organized his force on the best models of private business enterprise. The precise cost of each item of engraving, correcting, or printing is ascertainable, and the efficiency of each worker is demonstrated. To a certain extent this reacts upon the scientific branches of the Survey, since the character of original manuscripts may be such as to facilitate or to impede the work of reproduction. But in spite of efficient organization the division is not equal to the tasks imposed upon it. The publication of topographic maps (of which the number is being increased by cooperation) and the issues of geologic folios will be delayed if the appropriation for this work is not materially enlarged.

Following the precedents set under King and Powell, it has been the policy of the present Director of the Survey to secure the strongest men available for each branch of the work, and to encourage the development of individual members. Among the gratifying results of this policy was the cordial recognition of the service rendered by members of the Geological Survey,

Messrs. Hayes and Davis, attached to the Nicaragua Canal Commission under Admiral Walker. In the last four years the geologic personnel has been increased by the addition of a number of strong men, recently graduated from the leading centers of geologic instruction. Several of them entered through Civil Service examination, and others, whose university work succeeded practical field experience on the Survey, came back to it after their years of study. It has been said in the course of discussions concerning a National University that the Geological Survey at present constitutes the geologic branch of such a university, since it receives post-graduate students from the highest universities in the country and gives them opportunity to pursue independent researches in geology.\*

BAILEY WILLIS.

#### SCIENTIFIC BOOKS.

POINCARÉ'S COURS DE PHYSIQUE MATHÉMATIQUE.

*Théorie du potentiel Newtonien.* Par H. POINCARÉ. Rédigées par ÉDOUARD LEROY et GEORGES VINCENT. Paris, Georges Carré et C. Naud. 1899. 8vo. Pp. 366.

*Cinématique et mécanismes, potentiel et mécanique des fluides.* Par H. POINCARÉ. Rédigé par A. GUILLET. Paris, Georges Carré et C. Naud. 1898. 8vo. Pp. 385.

The fertility in mathematical resources of the eminent author of these volumes and the wide range of physical questions which he has illuminated by means of those resources excite at once our surprise and our admiration. He has proved, in fact, that it is still possible, as it was

\*The preceding article is not intended to present a complete catalogue of the activities of the Geological Survey or of its publications. The administration, distribution of work and funds, and the assignment of the personnel, are given in detail in the Director's Annual Report, issued in December of each year, and may be had on application to the Director of the Geological Survey. Complete lists of the publications are kept as nearly up to date as possible and may be had on request.