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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

*WORK OF THE U. S. GEOLOGICAL SURVEY, 1899–1900.**

Appropriations.—The appropriations for the U. S. Geological Survey for the fiscal year 1899–1900 amounted initially to the sum of $817,190. During the winter of 1900 additional appropriations were made for special purposes, making the total amount available for the year $889,740.89. For the fiscal year 1900–1901 the appropriations passed by the last Congress amount to $969,690, there having been important increases in response to public demand for work. The Division of Mineral Resources receives an advance of $20,000, raising its appropriation to $50,000; the Division of Hydrography receives $100,000 in lieu of $50,000 last year, and the demand for geologic work is recognized by an increase of that appropriation from $110,000 to $150,000.

Topographic Work.—The federal appropriation for topographic work remained the same as during the past year, namely $240,000, except that there was a considerable increase for the Alaskan surveys, the amount available for geologic and topographic investigations being $60,000. The list of states co-operating was increased by the addition of Ohio, the legislature having provided $25,000 for topographic mapping.

From the appropriation for surveying the forest reserves an allotment of $90,000 was

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made by the director for the continuation of topographic mapping within and adjacent to the reserves, including triangulation and spirit leveling and the marking of certain reserve boundaries, and under this allotment operations will be conducted in the following reserves: Bighorn, Black Hills, Lewis and Clarke, Flathead, Uinta, Gila River, Prescott, Sierra, Pine Mountain and Zaca Lake, San Jacinto, San Bernardino, Washington, and Mount Rainier.

The general topographic operations contemplated for the present year include the mapping of about 40,000 square miles. This area is distributed through about eighty-five quadrangles on two scales, and twenty-seven States.

The topographic mapping is progressing steadily if slowly, as is indicated by the fact that for the past five years the percentage of surveyed area has been increased each year approximately one per cent. the total percentage at the end of the fiscal year 1900 being twenty-eight. If this rate is not increased it will require over seventy years to complete the survey of the United States, to say nothing of the colonial acquisitions, but it is hoped that this period may be reduced. That the present rate of appropriation is inadequate is evident from the fact that in making up the plans for the current fiscal year it was necessary to deny applications for work covering about as much territory as that for which surveys were provided. These applications came, not only from the officers of the surveys engaged in geologic, hydrographic, and forestry investigations, but from the business interests of the country generally.

Geologic Work.—During the spring of 1900 the Director has planned, with the approval of the Secretary of the Interior, an important reorganization of the Geologic Branch. In order that the significance of this step should be appreciated in all its bearings, it is desirable briefly to review the history of the administrative and scientific control within the Survey. In the First Annual Report, Mr. King set forth a plan of organization based on grand geographic and geologic provinces. The work being then restricted to the national domain west of the 101st meridian, four divisions were established, that of the Rocky Mountains under Emmons, that of the Colorado under Dutton, that of the Great Basin under Gilbert, and of the Pacific under Hague. Each of these divisions corresponded to a province within which the geological phenomena had a certain unity of history and character, and it was wisely argued that the work in each should be directed by a geologist familiar with the special problems of the area entrusted to him. At the same time, the limited appropriations of the Survey and the adopted policy of surveying the most important mining districts led to a concentration of effort upon Leadville, Eureka, and the Comstock Lode, so that initially comparatively little progress was made in solving the broad geologic problems presented to each division. The principal contributions which the West yielded to the philosophy of the science were made by the surveys through whose consolidation the Geological Survey was created. With the growth of the Survey and the addition to its corps of many of the leading minds in American geology, more numerous geographic divisions were established and their limits became more artificial. Thus in the Sixth Annual Report we find enumerated, in addition to the ones first established, the Division of Glacial Geology (Chamberlin), the Division of Volcanic Geology (Dutton), the Division of the Crystalline Schists of the Appalachian and Lake Superior Regions (Pumpelly and Irving respectively), the Appalachian Region (Gilbert), and the Yellowstone Park (Hague). As divisions

became more numerous and restricted, the administrative machinery became more complex, and the opportunities afforded the geologists in charge to study broad problems became more and more limited. Finally, it was found that the administrative relations were not only difficult but expensive, since they involved the maintenance of independent offices and clerks, and in the interests of economy and efficiency the system of geographic divisions was abolished in 1893. In its place was substituted an organization by parties, of which there were at first twenty and subsequently nearly double that number, each acting independently of the other except in so far as they were all brought into co-operation through the Director and the Assistant in Geology. Broad co-ordination of scientific work was for the time being subordinated to the accumulation of facts, especially in the form of geologic maps, rather than to the consideration of philosophic problems. After six years of this activity in the working out of special problems, the time has come for broader supervision and co-ordination of work, and to this end the following appointments have been made: Geo. F. Becker, Geologist in charge of Physical and Chemical Research; T. C. Chamberlin, Geologist in charge of all Pleistocene Geology; S. F. Emmons, Geologist in charge of Investigation of Metaliferous Ores; C. Willard Hayes, Geologist in charge of Investigation of Non-Metaliferous Economic Deposits; T. W. Stanton, Paleontologist in charge of Paleontology; C. R. Van Hise, Geologist in Charge of Pre-Cambrian and Metamorphic Geology; Bailey Willis (Assistant in Geology to the Director), Geologist in charge of Areal Geology.

The field of supervision of each geologist in charge is coextensive with the work of the Geological Survey and relates to all parties engaged in work connected with his special subject. His assistance in field or office work may appropriately be offered or invited. His opinion is to be considered authoritative in subjects under his supervision, and his approval to any report may be required. This authority, however, is restricted to the scientific aspects of the work. Administrative direction remains as heretofore wholly in the hands of the director, and the work of the survey will proceed after the manner which has been found successful—of authorization of plans of operations after full consideration and conference upon estimates submitted by geologists in charge of parties.

Under the organization now adopted, each geologist is at liberty to make full use of the facts which he observes within his field of operations, the degree of supervision exerted by the geologist in charge of any particular subject to be duly credited in an appropriate manner. For the geologists in charge the plan affords an opportunity to study a special subject in all its aspects throughout the field of operations of the survey, either directly by personal observation or by conference with associates. This opportunity is unequaled in both multiplicity and magnitude of the phenomena presented to each specialist.

In SCIENCE, Volume X., No. 242, August 18, 1899, was given a somewhat detailed account of the geologic work of the survey. The following notes refer to extension of the work there described:

In the Atlantic Coastal Plain work in the Mesozoic and later formations has been carried out in the Cape Cod district (Shaler), and in Maryland and Virginia (W. B. Clark).

The investigations of Bascom, Dale, Emerson, Hobbs, Keith, Kemp, Mathews, Williams, and Wolff in the pre-Cambrian and metamorphic rocks of the Appalachian Range have been continued at various points from New England to Georgia.

In the belt of folded Paleozoic strata of

the Appalachian Valley and Allegheny ranges no field work is now in progress except incidentally to the investigation of the Coal Measures. Folios of the Geologic Atlas, for which the data have been on hand, have recently been advanced to publication. The detailed surveys of the Appalachian coal field (Campbell and David White) have, however, been pushed energetically in West Virginia, Kentucky, and Ohio.

In the Lake Superior region the studies of the iron-bearing ranges begun under Irving are approaching completion. The work on the Vermillion Range, Minnesota (Van Hise and others) is nearly accomplished, and the Mesabi district alone remains to be surveyed. The results of the survey of the Menominee district are published as a folio of the Geologic Atlas.

The long continued investigation of the glaciated region is now bearing fruit in a series of monographs by Mr. Leverett, one of them having been published, another being ready for the printer, and the work on others being planned.

The geology of Indian Territory is being studied in prosecution of surveys having for their initial purpose the determination of the stratigraphy and structure of the coal field. Three folios of the Geological Atlas have been prepared (Taff), and data for others are accumulating.

The Black Hills has long been a center of much geologic interest. Detailed stratigraphic surveys of the Paleozoic and Mesozoic formations around all but the northern portion of the Hills have been very successfully and carefully carried out (Darton), and there has resulted a report to be published in the twenty-first Annual, in which the facts of stratigraphy and structure are set forth with much detail and clearness.

The detailed investigation of the Spearfish and Sturgis quadrangles in the vicinity of Deadwood has resulted in an important contribution to our knowledge of laccolithic intrusions (Jaggar), and the mining districts have been carefully examined (Emmons and Iriving).

The investigating of the Butte, Montana, mining district has been facilitated by the workings opened up during litigation, and advantage has been taken of this fact to study that interesting region exhaustively. A survey was also made of the Elkhorn district (Emmons and Weed). In connection with the examination of the copper deposits in general, those of the Appalachian Range have also been visited.

In the San Juan Mountains of Colorado the work begun several years ago continues with accuracy and energy, and in connection with it special investigations have been made of the Silverton and Rico mining districts (Cross, Spencer, and Ransome). The publication of the Telluride folio marks a departure in the character of the Geologic Atlas, in as much as it contains a detailed record of the geologic facts (Cross, Purington).

In the Great Basin province, southern Nevada was traversed during a prolonged reconnaissance, the purpose of which was to secure data for the geologic map of the United States (Spurr).

Where the Rio Grande traverses the mountain region of Texas it flows through a grand canyon, from which several parties, including those of the Boundary Surveys, turned back after vain efforts to traverse it. In the autumn of the past year this canyon was successfully studied and an important contribution to the geology of western Texas was thus made (Hill).

In Washington the surveys of the Cascade Range were extended by the survey of the Mount Stuart quadrangle and the partial survey of the Snoqualmie quadrangle and the Tacoma folio was completed and published (Willis, Smith, and Mendenhall).

In Oregon work in the Roseburg and

Coos Bay quadrangles having been completed and the reports advanced to publication, surveys were continued in the Port Orford quadrangle, covering the southwestern portion of the Klamath Mountains (Diller).

In the Sierra Nevada and adjacent ranges, a survey was made of the Silver Peak quadrangle, Nevada, and additional work was done on the Yosemite and Mount Lyell quadrangles, California, in preparation for final survey (Turner).

In the vicinity of San Francisco the study of the Coast Ranges was continued, and material prepared for publication as folios (Lawson). A reconnaissance was made of the Santa Lucia Range from Monterey to San Luis Obispo (Willis, Fairbanks).

Alaska.—In the autumn of 1899 all the Alaskan parties returned after having successfully accomplished the tasks laid out for them without serious accident. Messrs. Peters and Brooks had traversed the northern foothills of the St. Elias Range, finding one of the most interesting features of the region to be a recently abandoned broad valley, trending northwest and southeast, across which the present streams now flow. The geology of the region, including formations from the ancient metamorphic schists to Tertiary deposits and associated igneous rocks, was studied along the route of progress, and occurrences of copper on the northern side of the Wrangel Alps were located. North of the Yukon a traverse was carried from Eagle City to the Koyukuk, and the headwaters of that stream, far beyond the Arctic Circle, were explored by Mr. Schrader. The general surface of the Yukon plateau was traced into the summits of high mountain ranges, and the distribution of the various geologic formations along the route made out. The reports of these expeditions are included in the Twenty-first Annual. Late in the autumn both Schrader and Brooks, hearing of the Cape Nome excitement, proceeded to Nome, and there, in spite of the wintry season, gathered data for a report, which was published as a special document during the winter. Plans for Alaskan work during the current fiscal year were matured as early as Congressional action permitted, and at the present time Schrader, Spencer and Gerdine are entering the Copper River region to undertake a detailed topographic and geologic survey of the Chettyna district, while Messrs. Barnard, Peters, Brooks and Mendenhall, with a strong corps of assistants, are *en route* in the Coast Survey steamer *Pathfinder* to Golofnin Bay, to undertake a topographic and geologic survey of the Seward Peninsula, of which Nome is now the center of interest. In the preparation and execution of these plans the Coast and Geodetic Survey and the Geological Survey have cordially co-operated to the great advantage and economy of the work.

Hydrographic Work.—This branch of the Geological Survey is making systematic examination of the water resources of the United States, considering water as a mineral of fundamental economic importance. Not only are the fluctuations of surface streams being investigated, but the occurrence of water underground, especially where reached by deep or artesian wells. During the past year this work has attracted widespread public attention, and the demand for data, both published and in process of completion, has been notable. This has come from all parts of the United States, but especially from the Appalachian region where water powers are being utilized, and from the arid region of the far West, where agricultural development depends upon irrigation. Engineers and investigators appreciate the importance of accurate data concerning the flow of streams and their fluctuations from season to season and from year to year. The recent disaster to the dam at Austin, Texas, which cost, with its acces-

sories, one and one-half millions of dollars, has lent tragic emphasis to this point.

In 1888 the Director of the Geological Survey was authorized by Congress to examine the arid region with reference to reclamation of agricultural lands by irrigation. The initial appropriation of $100,000, which was raised to $250,000 in 1889, was discontinued for several years thereafter; but having been restored in part, it has been from time to time increased, and of the $100,000 appropriated for hydrographic work a large part is expended in ascertaining the service of streams, in surveying reservoir sites, and determining the possibilities and cost of flood water storage in the West.

During the present year a notable increase in hydrographic work is being made in the State of New York in co-operation with the office of the State Engineer and Surveyor. Streams tributary to the Mohawk and upper Hudson are being measured, the data having importance not only in water power development, but also in consideration of the quantity available for the deep waterway across the State. In the Southern Appalachian region the amount of water coming from the area which it is proposed to include within a National Park is being ascertained, this work being in addition to systematic measurement of streams entering the Atlantic Ocean, such for example as the Delaware, Susquehanna, Potomac, James and Savannah. Various important streams are also being measured along the head waters of the Ohio and Mississippi.

Through co-operation of the Hydrographic and Geologic branches, the investigation of artesian water conditions about Black Hills is being continued, and plans are under consideration for similar studies of southern California and of the southern coastal plain of the Atlantic and Gulf States.

Bailey Willis.

SECOND REPORT OF THE COMMITTEE OF THE GERMAN CHEMICAL SOCIETY ON ATOMIC WEIGHTS.

In 1897 a committee was appointed by the German Chemical Society to consider the subject of atomic weights with especial reference to securing uniformity for practical analytical work. As a matter of fact two distinct standards were in use, $H = 1$ and $O = 16$, and as the latest determinations of Morley had reduced the atomic weight of oxygen to 15.87 ($H = 1$) it made a decided difference in the atomic weights of the heavier elements which standard was used. This committee consisted of Landolt, Ostwald and Seubert, and to the surprise of many, their first report in November, 1898, was unanimous in favor of the standard $O = 16$. Up to this time Seubert himself had used and advocated $H = 1$ and the same was true of most German chemists. The two chief arguments for $O = 16$ are: (1) many of the atomic weights are determined with reference to oxygen or readily reduced to oxygen standard with little error, while reduction to hydrogen brings in a new and unnecessary error, and necessitates a recalculation and new table every time the hydrogen-oxygen ratio is corrected, as it has been several times in the past few years; (2) if $O = 16$ is taken, a large number of most frequently used atomic weights approximate very closely to whole numbers, simplifying calculations.

A second point advocated by the committee in the first report was that only so many figures should be given in the atomic weight of an element, as that the last figure should be correct within half a unit. In this report the suggestion was made of the desirability of international agreement, and a little later the society directed its committee to invite the co-operation of the chief scientific bodies of the world who might be specially interested in