it is at least possible to select an Assistant Secretary in accordance with the theory outlined above, and a Director of the Museum possessed of special qualifications for that work, and who shall, of course, be subordinate to the Secretary of the Institution. This might lead the way to what is certainly still more to be desired.

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*THE GEOLOGY OF GOVERNMENT EXPLORATIONS.**

GEOLOGICAL EXPLORATION.

During the Civil War all scientific exploration in the West under the auspices of the government was suspended, and it was not until the summer of 1867 that it was resumed. By this time far-sighted men had come to appreciate the political importance of a more exact geological knowledge of the region between the Mississippi Valley and the Sierra Nevada. During the war there had been no little danger that the States of the Pacific slope might secede from the Union and form a republic of their own, isolated as they were from the other States by a barrier of 1,000 to 1,500 miles of comparatively uninhabited mountains and desert valleys. The lending of government aid to the building of a trans-continental railroad, which had already been decided on, was the first step toward removing this barrier and drawing the peoples of the East and the West into closer connection. The second step was to encourage the settlement of this intermediate region by making known to the public its rich and varied mineral resources. Hence, Congress showed itself ready to lend an ear to geologists who were desirous of getting government aid to carry on geological researches in the comparatively unknown region beyond the mountains.

Now, for the first time, explorations beyond the Missouri river, or surveys, as they soon came to be called, were fitted out avowedly for the purpose of geological investigation, instead of being primarily organized for geographic or military purposes and admitting researches into geologic and other branches of natural history as a sort of ornamental appendage of their work. For the first time also were they under civilian control instead of military discipline and command. During the twelve years previous to the organization of the present Geological Survey the principal geological work in the West was done under four district organizations, popularly known from the names of their leaders as as the King, Hayden, Powell and Wheeler Surveys. The official control of the first and last was under the Chief of Engineers of the United States army, but only the last was commanded in the field by military officers. The other two were under the Interior Department and their official titles changed somewhat with the development of their work.

During this period geologists were also attached from time to time to military reconnaissances, but with one exception—that of Newton and Jenny in the Black Hills, where the geological information had a political bearing—the march was so rapid that the opportunities of geological research were very limited, and the results of relatively little importance. Therefore, in view of the limited time at my disposal, I shall confine myself mainly to the principal surveys above mentioned.

Before commencing an account of their methods and work accomplished it will be well to pass in review the condition of geological knowledge of the country west of the Mississippi Valley at the commencement of this period in 1867.

No areal work, in the sense in which it is understood to-day, had been commenced or hardly thought of. The only maps that

* Concluded from the issue of January 1st.

existed were those giving the general features of the larger drainage systems on which was no connected or systematic representation of the surface features; in certain limited areas the relief was sketched in by hachures, or, as in Egglofstein's maps, by delicate shading.

On the Great Plains it was known that Mesozoic and Tertiary formations formed the greater part of the surface, and the Cretaceous rocks had been divided by Meek and Hayden into five subdivisions. Around the Black Hills, Lower Silurian and Carboniferous rocks had been identified. Carboniferous limestones were known to have a considerable extension in the interior region in middle and southern latitudes, and to have been seen in the northern part of the Sierra Nevada. The age of the upheaval of the latter range had been determined to be post-Jurassic, by the discovery by Clarence King, of the State Geological Survey of California, of Jurassic fossils in the auriferous slates. It was conjectured, reasoning from their association in the Black Hills, that Silurian beds would ultimately be found associated with the Carboniferous, but the discovery of Devonian fossils in central Nevada by Engelmann in 1859 had not yet been made public. It was known in a general way that igneous rocks, granites and metamorphic rocks were widely distributed throughout the interior, but of their mutual relations, or the actual structure of the mountain ranges, there was little but surmise, and not very much of that.

As regards the physical conditions of the interior, although the region east of Salt Lake was known to be well watered, in the desert region of the Great Basin to the westward, it was not supposed that campaigning was possible, except along certain lines of emigrant travel, and on these it was known that there were inconveniently long stretches without water.

King Survey. The Geological Exploration of the 40th Parallel, as it was officially known, was entirely the creation of its chief, Clarence King. The first conception of the feasibility of making a geological cross section of this, the longest mountain system in the world, at its widest part, had come to him during his long three months' journey with an emigrant train from Missouri to the Sierra Nevada, which he undertook in the summer of 1861. His personal influence had, during the winter of 1866–7, secured the passage of a bill through Congress creating the 40th Parallel Survey, whose duty it was to examine into and report upon the geology and mineral resources of the country to be opened up by the Pacific railroads. At his suggestion it was placed under the official direction of Gen. A. A. Humphreys, Chief of Engineers, in whose scientific ability he had the greatest confidence.

His plan of work contained much that was novel and startling, especially in consideration of the desert character of the region in which it was to be carried out. This plan contemplated making a topographical map of the region surveyed, not simply a map of meander lines, with sketches in hachures of the hillsides, which was the only form of relief map known at that time, but a contour map on the same general plan with the Survey maps of the present day, controlled by systems of primary and secondary triangulations, the relative elevations to be determined by frequent observations of cistern barometers. The scale adopted was four miles to the inch. Besides the usual botanical and zoological assistants, an excellent photographer was attached to the party. The area to be surveyed, which was always to include the line of the projected railroad, was divided into rectangular blocks or atlas sheets, about 165 miles in length by over 100 miles in width. The original plan contemplated

three, but ultimately five of such blocks were surveyed.

The party rendezvoused in California in the early part of the summer of 1867, and commenced work at the east base of the Sierra Nevada in August of that year, with J. D. Hague, Arnold Hague and S. F. Emmons as geological assistants to Mr. King. The following winter was spent in Virginia City in a study of the Comstock lode, where the mines, then about 1,000 feet deep, had already produced 100 millions of dollars. In the following year the work had become more systematized, and, by parcelling it out in several parties each consisting of a geologist and topographer, by the close of an unusually long season it had been carried entirely across the Great Basin to the western shore of Great Salt Lake. In 1869 the remaining desert ranges of Utah, the great Wasatch Range and the western end of the Uinta Mountains were surveyed. This completed the work of the Survey as originally planned, and the party was then located at New Haven for the purposes of working up their large collections of rocks and fossils and platting their notes both geologic and topographic.

Mr. James D. Hague had detached himself from the field parties in 1868 to make a special study of the mining districts, and the result of his work, with some contributions from other members of the party, was published in 1870 as Vol. III. of the Survey reports, entitled 'Mining Industry.' The most important part of this volume is the elaborate study of the great Comstock lode, which has served as a model for all subsequent monographic studies of mining districts in this country, the only country in which such work has been done. In Chapter VII. of this volume, on the Green River coal basin, Mr. King defined the stratigraphical position of the coal-bearing rocks as undoubtedly Cretaceous, and gave a brief preliminary sketch of the general geological column as developed in the Wasatch Mountains, which he estimated as 56,000 feet in thickness below the Cretaceous.

Stratigraphical work in Nevada and Utah among the isolated mountain ranges, subsequently designated by Gilbert as the Basin Range system, was exceptionally difficult because these ranges were separated from each other by valleys 10 to 15 miles in width covered with an unknown depth of Quaternary detritus. Thus no stratigraphical sequence of rocks could be carried from one range to the other, and until the Wasatch Range was reached there was practically no starting point for the geological column, for most of the fossils collected were of new species, and their horizons could only be finally determined after a long comparative study.

Work at New Haven was abruptly interrupted in midsummer of 1870 by telegraphic orders from Gen. Humphreys to take the field at once, as Congress, without solicitation from any one, had passed the usual appropriation to continue the field work. As it was then too late to get together the necessary outfit for a campaign in the high mountain regions to the east of the Wasatch, the work of that season was devoted to a study of the extinct volcanoes of the Pacific Coast, which were apportioned, Mt. Shasta to Mr. King, Mt. Hood to Mr. Arnold Hague, and Mt. Rainier to myself. This work was interrupted by the winter snows, and, as Gen. Humphreys decided that the connection of these mountains with the 40th parallel was too remote to admit of its being taken up again, the only immediate fruit of the summer's geological campaign was a paper in the *American Journal of Science* (June, 1871), announcing the discovery of active glaciers on their slopes, the first then known within the boundaries of the United States.

In the summers of 1871 and 1872 the

work of the survey was carried eastward to the Great Plains, taking in the great Eocene beds of the Green River basin; the Uinta Range, unique on account of its east and west trend and its anticlinal structure; the Elkhead Mountains with their remarkable development of rare varieties of igneous rocks; the inclosed Mesozoic and Tertiary valleys of the North Park and the Laramie Plains; the Medicine Bow Range, with its series of Algonkian rocks, then classed as Huronian; and finally the northern extension of the Front or Colorado Range, with its granite core flanked by upturned Paleozoic rocks, which had thinned from 30,000 feet in the Wasatch section to less than 2,000 feet, and were only visible at a few points, being overlapped by Mesozoic or Tertiary beds, as the case might be.

The thorough study and discussion of the material gathered during these years of field exploration necessarily occupied much time, but the then-existing conditions protracted the work much more than would be the case at the present day. The topographical base of the five large atlas sheets was not completed until 1874. In the summer of that year a member of the Survey visited Europe and conferred with the directors of the leading Geological Surveys there on methods of treatment and of publication.

Microscopical petrography was then an unknown science in this country, and one result of this visit was that Prof. Ferd. Zirkel, of Leipzig, then the highest authority in this branch of geology, was induced to visit this country to examine the collections of igneous and crystalline rocks and take notes on their field habits. Chips for making thin sections were taken back by him on his return to Germany for systematic microscopical study, and his report (Vol. VI.) published in 1876 was the first work of this kind on American rocks.

The final determination of the fossils collected was confided to F. B. Meek, James Hall and R. P. Whitfield, at that time the only paleontologists competent to undertake so important a work, but they could only devote to this task moments of leisure from other and to them more pressing work, consequently it was nearly four years after the completion of field work before the geological material was finally ready for publication. The volume on Descriptive Geology by A. Hague and S. F. Emmons with the final sheets of the geological atlas went to press in 1876, and in the following year was written Mr. King's masterly summary of the whole work, designated 'Systematic Geology,' which discussed not only the general history and structure of the Cordilleran system, but also such subjects of general theoretical interest as the 'Genesis of granite and crystalline schists,' the 'fusion, genesis and classification of volcanic rocks,' etc.

The distinguishing character of this Survey, as compared with the other organizations, was that its work was founded on a complete and comprehensive plan adopted before taking the field, which in all its essential features was systematically followed out during the ten years of its existence.

Hayden Survey. The names of Hayden and Meek had long been identified with the geology of the Missouri Valley and the Great Plains, and when it was found in 1867 that of the appropriation for legislative expenses of the Territory of Nebraska there remained an unexpected balance of $5,000 it was very wisely given to Dr. Hayden to expend in geological researches in that territory. From this modest beginning grew, by a process of gradual evolution, what became finally known as the United States Geological and Geographical Survey of the Territories, the catalogue of whose reports constitutes a pamphlet of fifty pages. F. B. Meek and Dr. C. A. White assisted Dr. Hayden during the first

two years. In 1869 James Stevenson was appointed executive officer, a position which he continued to fill with credit until the end. In this year Persifor Frazer, jr., was attached to the party as mining geologist, and the line of geological travel, for such was the character of their work during the early years, led along the foothills of the Rocky Mountains from Cheyenne to Santa Fé. In 1870 it ran westward from Cheyenne through the South Pass to Fort Bridger, and back along the north slope of the Uinta Mountains.

In 1871, for the first time, two topographical assistants were attached to the party, and Dr. A. C. Peale made his first field season as mineralogist. The line of travel this year led from Ogden, Utah, via. Fort Hall, Idaho, to Fort Ellis (Bozeman), Montana. From there an excursion was made into the geyser region of the Upper Yellowstone, and the enthusiasm aroused by the view of these wonders of nature, and the representations of Dr. Hayden on his return, induced Congress to set the region apart as a National Park.

In 1872 the force was greatly augmented, the names of Holmes as artist and Gannett as astronomer first appeared upon the rolls of the Survey, and F. H. Bradley did a season's work as geologist and paleontologist. Work was conducted in two parties in the same general region that was visited in the previous year.

In the spring of 1873 James T. Gardner, who had been chief topographer of the 40th Parallel Exploration, was engaged as chief geographer, and the areal survey of Colorado was commenced. Work was carried on in three or more parties, each in charge of a geologist or of a topographer, as the case might be; but, as on the 40th Parallel Survey, geologist and topographer worked side by side, and the one had to suit his work to the exigencies of that of the other. This system had certain disadvantages, and on the 40th parallel it was sometimes found necessary to go back to study key points. Such a trip was made by Mr. King and the speaker to the Wasatch Mountains in 1873.

A. D. Wilson, who had also been topographer on the King Survey, joined the Hayden Survey in 1874. The areal survey of Colorado under the Hayden Survey was continued for four years, and finally completed in 1876.

Among the geologists, Marvine, who early showed great ability, had charge of the northern division for two seasons, but died before he had written up his second season's work. Dr. F. M. Endlich, who had studied in Germany, where he served on the Geological Survey of Baden, joined the Hayden Survey in 1874, and continued to the end in 1878. In Colorado he worked mostly in the southern part of the area mapped, as he was supposed to have a better knowledge of igneous rocks than the others, but in later years the practical test of his work by other geologists in the field has proved it to be less reliable than that of any of the other geologists.

Dr. A. C. Peale worked mostly in the central part of the State, and as he gained in experience proved himself a careful and intelligent worker. The genius of the party was W. H. Holmes, who, starting as an artist without previous geological training, gradually developed, as a result of his study of nature, a remarkable aptitude for structural geology. His drawings of mountains have never been equalled by any other artist in their combination of fidelity to nature, with artistic effect and keen insight into geological structure. The paleontologists, C. A. White, F. B. Meek, E. D. Cope and Leo Lesquereux, contributed in their special lines to the work in Colorado, the first also doing considerable field work. Other specialists were attached to the parties at different times, and the sons of many promi-

nent men in the East were temporarily attached to the various parties. W. H. Jackson, the eminent photographer, was also a member of the Survey.

Dr. Hayden's plan was to make the Survey as widely popular as possible, and one method of accomplishing this result was to publish a volume every year, abounding in excellent illustrations from the pen of Holmes, which were gratuitiously distributed in very large numbers. One consequence of this method was that the geologists did not have time to thoroughly digest their material, or correlate and compare it one with another. It is much to be regretted that in consequence no summary like the 'Systematic Geology' of King has ever been written of the Hayden work. The beautifully colored maps in the atlas of Colorado, which were compiled and drawn by Holmes, answer in one sense as such a summary, for they indicate graphically many general conclusions that are not to be found in the annual reports. The latter, on the other hand, often have a different system of geographical nomenclature from that given on the map, which renders them sometimes almost unintelligible.

The Colorado areal work joined that of the 40th parallel on the south. In the years 1877 and 1878 the areal work was transferred to Wyoming and carried northward from the northern limit of the 40th parellel maps northward to the Yellowstone Park. On this work St. John served one season in the Wind River country and in 1878 Holmes and Peale made an extensive study of the phenomena of the Yellowstone Park. Even photography has not accomplished, in all the time that has elapsed since, any improvement on the admirable illustrations drawn by Holmes of the geological wonders of this region.

Powell Survey. In the summer of 1869 Maj. J. W. Powell made, under the auspices of the Smithsonian, his famous boat exploration of the mysterious depths of the canyons of the Colorado River, starting from Green River City, on the Union Pacific Railroad, in May, and emerging from the mouth of the dark canyon nearly 900 miles below, three months later, a journey that is unequalled for its courage and daring in the annals of geographical exploration.

Already in the two preceding summers he had visited the valleys of many of the streams tributary to the Green River, and during 1870 and 1871 his explorations of the canyons were continued, still under the same auspices. With the narrative report of these explorations, published in 1875, appeared an admirable discussion of erosion and land sculpture in its relation to geological structure, defining for the first time *base-levels of erosion.* This, with the similar discussions of Gilbert, based on his studies of the Colorado Plateau region in 1871–2, have formed the starting point of modern physical geography.

In no part of the world can there be found so admirable a region to study the elementary processes of stratigraphical geology as in that traversed by Powell's exploration. It is, so to speak, nature's text book of geology, whose pages lie open to the inspection of any one who possesses the physical courage and endurance to reach the depths of its canyons. Hence, Powell's geographical exploration was at the same time a valuable contribution to geology, in that it opened the road to so important a field that had hitherto been supposed to be inaccessible except to the birds of the air.

The Powell organization soon became a geological exploration, receiving its appropriations directly from Congress, and assuming the title of Second Division of the United States Geological and Geographical Survey of the Territories. It did not attempt to make an areal survey of this interesting region, but devoted itself to monographic studies of some of the most novel

and striking features of its geology. In 1873 and '74 Powell himself, assisted by Dr. C. A. White, extended the geological observations made along the banks of the upper Green River into the surrounding country, and in 1876 published his report upon the geology of the eastern Uinta Mountains.

Under this organization also Mr. Gilbert made, in the summer of 1775, his classic study of the Henry Mountains, the most prominent among the laccolitic groups that project above the Colorado Plateau, and introduced for the first time the term *laccolite* into geological literature. This effectually refuted Scrope's dictum, which at one time was almost an axiom among Europe geologists, that igneous eruptions do not exert any elevatory force upon the surrounding sedimentary beds through which they have been extruded.

The final work of the Powell Survey was the study, in 1875-6 and 7, of the High plateaus of Utah by Captain C. E. Dutton, an officer of the Ordinance Corps of the United States, on detached duty; he also made the petrographical examination of the igneous rocks brought in by Gilbert from the Henry Mountains. To this report, which was published in 1880, there was appended a prefatory note by Major Powell, giving a general sketch of the orographic movements recorded by him during his investigations in the Plateau region.

Wheeler Survey. I have reserved my mention of the work of the Wheeler Survey to the last, although chronologically its geological work antedates much that has already been mentioned, for the reason that as an organization, as indicated by its title (United States Geographical Surveys West of the 100th Meridian), it did not recognize geology as an essential part of its work.

The Wheeler Survey was indirectly an outcome of the 40th Parellel. When two seasons' campaigning of the latter organization had proved the practical feasibility of conducting such work in the Western mountains, Lieutenant G. M. Wheeler, of the United States Engineers, secured the consent of his chief to undertake, in the summer of 1869, a military reconnaissance for topographical purposes in southwest Nevada and western Utah. Although no geologist was attached to this first expedition, visits were made to various mining districts, but the reports thereon, like the ordinary mining reports of the time, were of little or no geological value. From this gradually grew up an important organization supported by direct appropriations from Congress, which contemplated the making of a topographical map of the whole area of the United States west of the 100th meridian, and which in point of numbers finally far exceeded any of the other organizations.

Its work was carried on continuously from 1871 to 1879, and produced a large number of topographical maps of the western country, a few of which were afterwards colored geologically.

Wheeler did not approve of the system of topographical survey adopted by the 40th Parallel and subsequent surveys, but conducted his work after the manner of earlier military expeditions, by making meander lines along the valleys, instead of triangulations from the summits of the ridges, the principal basis of his details of topographical structure. His maps, morever, were drawn in hachures instead of in contour lines.

In spite of the somewhat discouraging peculiarities of organization, the geological work done under this survey reached a high standard of excellence, owing to the ability of the men to whom it was entrusted. First among these was Gilbert, who as chief geologist, worked in the Great Basin of Nevada, in eastern California and southwestern Utah in the summers of 1871 and '72, visiting the plateau region around the mouth of

the Canyon of the Colorado in the former year; he had A. R. Marvine as his assistant in 1871, and E. E. Howell in 1872. In 1873–'74 he extended his investigations further south into New Mexico and Arizona, and in the following year left to join the Powell Survey.

Gilbert in his reports on the work of these years (published 1875) did not pursue the descriptive method in presenting the results of his geological observations, but discussed them at once as a whole under general heads.

In this way he first characterized what he designated the 'Basin Range' system of mountain uplift, as brought about mainly by faulting, in contrast to the structure of the Appalachian Mountains, which is produced mainly by plication. The geologists of the 40th Parallel regarded the uplift of the narrow ranges of Nevada, from which the term was derived, to be produced primarily by folding, and that the faulting was a later phase in Tertiary or post-Tertiary time, in contradistinction to the more modern interpretation of Basin Range structure as a system of tilted beds without plication.

His volume also contains able discussions on land sculpture and erosion, on the Glacial period, and the conditions attending the drying up of the ancient lake which once filled the Utah basin, and to which he gave the name of Lake Bonneville, from the explorer who first determined that the basin has no exterior drainage. He also had a chapter on recent volcanic manifestations and a section of the rocks shown in the Canyon of the Colorado.

In 1873 Prof. J. J. Stevenson was also employed on the Survey and made a rapid reconnaissance through the greater part of Colorado. Hurried as this work necessarily was, his report shows the grasp of mind of the trained geologist, but his results were soon superseded by the more detailed areal work of the Hayden Survey.

In 1874 E. D. Cope did some field work as vertebrate paleontologist, and in 1875 Jules Marcou was attached to one of the Californian parties and determined the Tertiary age of the Tejon beds. In 1876 A. R. Conkling was attached to the Survey as geological observer, and 1877 J. A. Church made a second study of the Comstock lode, the results of which appeared in a private publication.

J. J. Stevenson was again attached to the Survey in 1878 and 1879, with I. C. Russell as assistant, during which time he had an independent party under his own charge, and he was making valuable contributions to the geology of southeastern Colorado and northern New Mexico, when by legislative enactments the Survey came to an end.

From a geological point of view the system pursued on the Wheeler Survey was less advantageous and, in proportion to the expense, less productive of permanent additions to geological knowledge of the country involved than either of the other organizations. The parties as a rule were under the charge of a military officer, who might have ideas of military discipline not always consonant with the best interests of geological work.

Black Hills Surveys. Among military reconnaissances the more important from the geological point of view were those undertaken as a result of the mining excitement in the Black Hills, of the attacks upon miners by the Sioux Indians, within whose reservation they lay, and their consequent appeals for government aid and for the opening of the reservation for white settlement.

The reconnaissance across the southern end of the hills, returning around their northern flanks, which was under the command of Capt. Wm. Ludlow, in the summer of 1874, was accompanied by N. H. Winchell and Geo. B. Grinnell as geolo-

gists. It was their first experience among Western geological formations, and considering the rapidity of the march it is not surprising that no considerable additions were made to the geological knowledge of the region.

In the summer of 1875 and 1876, however, Wm. P. Jenney and Henry Newton were sent out under military escort to investigate the mineral resources and geology of the Hills, in order to determine whether the reports of the great mineral wealth were well founded. The untimely death of Mr. Newton, who was a most promising young geologist, delayed the publication of the scientific results of this investigation, which was finally accomplished in 1880, under the editorial supervision of Mr. G. K. Gilbert, who kindly undertook the very delicate task of putting in form the field notes of Mr. Newton.

Among other reconnaissances to which geologists were attached may be mentioned those in 1873, of Capt. W. A. Jones, in northwestern Wyoming, with T. B. Comstock as geologist, and that of Lieut. E. H. Ruffner, into the Ute county around the San Juan Mountains, on which Prof. H. Hawn and L. Hawn served in geological capacities.

In the year 1875 E. S. Dana and G. B. Grinnell accompanied the party of Capt. Wm. Ludlow on a reconnaissance from Carroll, Montana, to the Yellowstone Park. On this trip they got glimpses of the isolated groups of mountains rising out of the plains, such as Little Rockies, Crazy Mountain, etc., that have yielded such interesting petrographical data of later years. They collected Saurian remains in beds overlying the Fox Hills Cretaceous at the mouth of the Judith River and made many interesting observations on probable unconformities in the Bridger Mountains and elsewhere.

The eagerness with which geologists have pursued their investigations into the new fields of geological observation, opened up by these various explorations, may be compared in a certain sense with that which takes possession of prospectors and miners upon the discovery of some new and extraordinarily rich mining district.

In their emulations to obtain possession of some of the stores of scientific wealth which nature has exposed to view, and to gain the reward of scientific reputation which is accorded to the first discoverer, they are sometimes inclined to neglect the rights of priority which scientific courtesy accords to the first occupant of a new field.

Thus the publication of Powell's geological report was, in so far as it related to the Uinta Mountains, in contravention of a more or less definite agreement among the heads of the various surveys not to encroach upon the areas covered by the maps of the 40th Parallel Survey, since the work of this Survey was strictly confined within previously prescribed limits, while the whole West lay open to the others. Powell's report was published in 1876, and the topographic base of the 40th Parallel map of the Uinta Mountain region had been used, by permission but without acknowledgment, in the preparation of the map which accompanied that report. Furthermore, during the summer of 1875 the geologically colored map of the same region, prepared by the geologists of the 40th Parallel, was in press in the cartographic publishing house of Julius Bien, and upon its final completion on November 12, 1875, Mr. King sent out to the leading geologists of the country 12 copies of these maps signed and dated by the authors, in the hope of securing to them the priority of record which was their due.

Already in 1873 friction had sprung up between the Hayden and Wheeler Surveys. Neither was willing to accord to the other the exclusive right to survey any particular part of the geologically unexplored regions,

and each claimed the privilege of stretching its work over the whole unsurveyed area of the West. Thus in this year each party had geological and topographical parties covering the same ground in Colorado, which was a deplorable dissipation of energy when so much ground was untouched by either party. As time went on, this friction increased to such an extent that the influence of one party with Congress was used to curtail the appropriations allotted to the other.

At first glance it would seem that such disagreement among men, whose sole object was avowedly the advancement of science, was most unfortunate, but here again the truth of the old saying about an 'ill wind' was again proved, for Congress, unable to decide of itself on the merits of the contending parties, referred the matter to a committee of the National Academy of Sciences, and, acting on their report, passed a bill terminating all the previously exististing explorations and creating the United States Geological Survey. Thus, instead of a number of rival organizations with no necessity of concordant action between them, and each liable to pass out of existance at any time by the failure of Congress to pass its annual appropriation, there has resulted the present organization, which forms a constituent part of the Department of the Interior, and has thereby acquired a permanence which invites the best scientific talent of the country to take part in its work.

S. F. EMMONS.
U. S. GEOLOGICAL SURVEY.

PROFESSOR EUGEN BAUMANN.

ON the 2d of November, 1896, occurred the death of Dr. Eugen Baumann, professor of chemistry in the medical faculty of the University of Freiburg, in Baden. The deceased was born in Würtemberg, in 1846, and obtained his early education at Stuttgart. After studying chemistry, physics and natural sciences, at the Stuttgart Polytechnicum, where he worked under Fehling, he served an apprenticeship as apothecary in his father's employment, and in 1870 passed the pharmacists' examination at Tübingen. This was the occasion of his first meeting with Hoppe-Seyler, to whose encouragement and inspiration his career as an investigator owed its beginning. A life-long friendship was formed between the two men, and only a few months before his death Baumann paid fitting tribute to his great teacher in an obituary published with Kossel.*

Already an assistant to Hoppe-Seyler, Baumann obtained his doctor's degree at Tübingen, in 1872, with a dissertation on vinyl compounds.† When Hoppe-Seyler was called to take charge of the instruction in physiological chemistry in the newly opened German university at Strassburg, Baumann accompanied him thither as his first assistant, and in 1876 became 'Privatdocent' in chemistry. At the opening of DuBois Reymond's new physiological institute at Berlin, in 1877, Baumann was appointed to have charge of the chemical laboratory; upon his departure from Strassburg the medical faculty honored him by conferring the degree of doctor medic. *honoris causa*. In 1882 Baumann was appointed professor extraordinarius in the Berlin medical faculty, and in October, 1883, he accepted a call as successor to v. Babo at Freiburg, where he labored without interruption until his death. He declined the call to succeed Hoppe-Seyler at Strassburg and only recently the title of 'Hofrat' was bestowed upon him.

Baumann's earliest researches were intended to throw light upon the behavior of sarcosin in the organism. To this period belong the beginnings of the researches on the aromatic substances of the body—a

* Zeitschrift für Physiologische Chemie, Band 21.
† Ann. Chem. Pharm. Band 163. S. 308.