5-2-1874

Message from the President of the United States, in answer to a resolution of the House of April 15, 1874, transmitting a report from the Secretary of War, relative to geographical and geological surveys west of the Mississippi

43D CONGRESS, 1st Session. } HOUSE OF REPRESENTATIVES. { Ex. DOC. No. 240.

GEOGRAPHICAL AND GEOLOGICAL SURVEYS WEST OF THE MISSISSIPPI.

MESSAGE

FROM THE

PRESIDENT OF THE UNITED STATES,

IN ANSWER TO

A resolution of the House of April 15, 1874, transmitting a report from the Secretary of War, relative to geographical and geological surveys west of the Mississippi.

MAY 2, 1874.—Referred to the Committee on the Public Lands and ordered to be printed.

To the House of Representatives:

In pursuance of the resolution of the House of Representatives of the 15th instant, requesting to be informed "what geographical and geological surveys under different Departments and branches of the Government are operating in the same and contiguous areas of territory west of the Mississippi River, and whether it be not practicable to consolidate them under one Department, or to define the geographical limits to be embraced by each," I have the honor to transmit herewith the views of the officers of the War and Interior Departments on the subjects named in the said resolution, and invite attention thereto.

Where surveys are made with the view of sectionizing the public lands, preparatory to opening them for settlement or entry, there is no question but such surveys, and all work connected therewith, should be under the direct control of the Interior Department, or the Commissioner of the General Land-Office, subject to the supervision of the Secretary of the Interior. But where the object is to complete the map of the country; to determine the geographical, astronomical, geodetic, topographic, hydrographic, meteorological, geological, and mineralogical features of the country; in other words, to collect full information of the unexplored, or but partially known, portions of the country, it seems to me a matter of no importance as to which Department of the Government should have control of the work. The conditions which should control this subject are, in my judgment, first, which Department is prepared to do the work best; second, which can do it the most expeditiously and economically.

As the country to be explored is occupied in great part by uncivilized Indians, all parties engaged in the work at hand must be supplied with escorts from the Army, thus placing a large portion of the expense upon

the War Department, and, as the Engineer Corps of the Army is composed of scientific gentlemen, educated and practiced for just the kind of work to be done, and as they are under pay whether employed in this work or not, it would seem that the second condition named would be more fully complied with by employing them to do the work. There is but little doubt but that they will accomplish it as promptly and as well, and much more economically.

U. S. GRANT.

EXECUTIVE MANSION,
Washington, April 30, 1874.

WAR DEPARTMENT,
Washington City, April 27, 1874.

SIR: In response to your request of the 16th instant for report upon House resolution of April 15, I have the honor to transmit herewith the report of the Chief of Engineers, and accompanying papers, respecting the geographical and geological surveys made by his Department. He reports that the surveys of Lieutenant Wheeler of the Engineer Department, and those under Professor Hayden of the Department of the Interior, and that of Professor Powell under the Smithsonian Institution, are operating in contiguous areas of territory west of the Mississippi River, and that in the years 1872 and 1873 the survey of Lieutenant Wheeler embraced a small portion of the survey of Professor Powell, and that, contrary to an agreement made between Lieutenant Marshall and Professor Hayden during last season while both were operating in Colorado, (which agreement was that they should operate on opposite sides of the Upper Arkansas River,) the parties of the latter surveyed portions of the region allotted to Lieutenant Wheeler's parties, causing a duplication of survey of such portions.

I respectfully invite attention to the report and recommendations of the Chief of Engineers, and, in response to your invitation, I must express my conviction that economy and efficiency would be the result of consolidating all such surveys under the War Department, and placing the work under the supervision of the Corps of Engineers of the Army: this of course not to include the surveys under the General Land-Office.

This Department has been repeatedly called upon to supply the surveys under various Departments with arms, ammunition, transportation, subsistence, and escort, and it would be very economical to stop this practice.

Very respectfully, your obedient servant,

WM. W. BELKNAP,
Secretary of War.

The PRESIDENT OF THE UNITED STATES.

OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., April 23, 1874.

SIR: In compliance with your direction to report with full expression of views upon the subject of the resolution of the House of Representatives of the 15th instant, I have the honor to report as follows, viz:

The geographical and geological surveys of the territory west of the Mississippi River now in progress are conducted under the direction of the

War Department, Department of the Interior, and Smithsonian Institution. In addition may be named the determination of the northern boundary between this country and the territory of Great Britain, carried on under the Department of State, the scientific part of the duties being performed by engineer officers detailed for the purpose.

The surveys under the War Department are:

1. The geological survey of the fortieth parallel, in charge of Mr. Clarence King.
2. Explorations and surveys west of the Mississippi River, in charge of Lieut. G. M. Wheeler, Corps of Engineers.

To these must be added the surveys and reconnaissances for the use of troops made by engineer or acting engineer officers on duty at the headquarters of the following military divisions and departments:

3. Military Division of the Missouri.
4. Military Division of the Pacific.
5. Military Department of the Platte.
6. Military Department of the Missouri.
7. Military Department of Dakota.
8. Military Department of Texas.
9. Militarp Department of Arizona.
10. Military District of New Mexico.

The geographical survey of the fortieth parallel is conducted in a thoroughly scientific manner, and consists in an elaborate geological survey in connection with a careful topographical survey based upon the determination of the positions of prominent geographical points and their connection with other points by triangulation and measurements, and in examinations in mineralogy, zoology, and botany.

The field-work of this survey is completed, and covers an area of 81,600 square miles.

Two volumes of report with maps have been published, and the remaining volumes and atlases are being prepared for publication.

The work is one of a high order, and will increase the reputation of the country for scientific ability.

The survey in charge of Lieutenant Wheeler is conducted upon the same general plan and embraces the same subjects of inquiry as the survey on the fortieth parallel.

The basis of this work is the collection and preparation of the data for a series of topographical atlas maps, upon a scale of one inch to eight miles, of the territory of the United States west of the one hundredth meridian; each sheet representing an area of from 17,000 to 18,000 square miles, and so projected that the several sheets may be joined to comprise entire political or other divisions.

For the preparation of each of these sheets that delineate more especially the mountain forms, astronomic, geodetic, topographic, and meteorological observations are necessarily made.

The examinations in geology, mineralogy, and natural history have been intrusted to gentlemen trained in these specialties.

The operations in the several branches of the survey are conducted in pursuance of a systematic plan, under which an annual project, in detail, is submitted by the officer in charge to the Chief of Engineers.

So far as possible, without detriment to the principal objects of the survey, examinations are made concerning the resources of the country in wood, water, and agricultural productions; the influence of climate; the character of vegetation; the location and extent of precious and economic minerals; the routes of communication for rail and common roads; the character, habits, and disposition toward settlers of the

several Indian tribes; the water-supply available for irrigation; the season of rain and snow fall; the condition of mining and other industries, &c.

During the years 1867,-'71,-'72,-'73 an area of 228,150 square miles has been surveyed in California, Nevada, Arizona, Utah, Colorado, and New Mexico.

Maps representing 72,000 square miles of this area, with other explanatory and physical sheets, making a partial atlas, are ready for distribution, and the remainder are well advanced.

The data for thirteen sheets of the proposed geological atlas have been gathered,

One hundred and fifty mining districts have been examined.

Photographs are obtained, which, beside being illustrative of the country traversed, are useful aids in the topographical and geological branches.

The progress and condition of the work is reported annually to Congress by the Secretary of War, (see annual reports of the Chief of Engineers, 1869,-'71,-'72,-'73.)

In addition, preliminary reports and maps for the years 1869 and 1871 have been published.

An astronomical report is now ready for distribution.

It is proposed to publish the data, gathered in six quarto volumes, one topographical and one geological atlas, 19 inches by 24 inches.

Vol. 1. General report of the expeditions of 1871,-'72,-'73, and mining information, 250 pages, with plates.

Vol. 2. Astronomical report, 250 pages, with plates.

Vol. 3. Meteorological report, 30 pages, with plates.

Vol. 4. Geological report, to include mineralogy, 400 pages, with plates.

Vol. 5. Paleontology, 100 pages, with plates.

Vol. 6. Natural history, 400 pages, with plates, embracing reports from several eminent scientists upon the collections in the several branches.

These volumes will be published when authorized by Congress. (See Appendix E E, annual report of the Chief of Engineers, 1873.)

The cost of this survey, so far, has been less than $1 per square mile, or one-eighth of a cent per acre.

The greater part of the time and money has been expended in field operations; the preparation of the results for publication is now being pressed forward.

The surveys and reconnaissances by engineer officers made for the use of the troops in the several military divisions and departments have been of noted value.

During the past season, in addition to the ordinary duties, the following surveys and reconnaisances have been made, viz:

By Captain Ludlow, in the Department of Dakota, a survey in connection with the Yellowstone River expedition.

By Captain Jones, in the Department of the Platte, a reconnaissance of the approaches to the Yellowstone Park from the south and east, resulting in finding a practicable route for a wagon or rail road from Point of Rocks, on the Pacific Railroad, to the Yellowstone Park and Fort Rice.

By Lieutenant Ruffner, in the Department of the Missouri, a reconnaissance about the head-waters of the Rio Grande and Southwestern Colorado, and observations made for the determination of the latitude and longitude of Denver, Colo., and longitude of Fort Hays and Fort Wallace, in Kansas, and Pueblo, in Colorado; and in addition a recon-

naissance for the route for a military road from Santa Fé to Taos, N. Mex., to be followed by the construction of the road under appropriation of Congress.

The survey under the Smithsonian Institution is entitled, "Survey of the Colorado of the West and its Tributaries, by Professor J. W. Powell."

Although the lines of reconnaissance of Professor Powell were contiguous to the areas being surveyed by Lieutenant Wheeler's parties, there was no actual duplication of work until the years 1872 and 1873, in which the latter survey embraced a portion of the borders of the Colorado, and, to a small extent, the survey of Professor Powell.

The surveys carried on under the Department of the Interior are—

First. The Land-Office surveys.

Second. The survey styled in the appropriation bill "The geological and geographical survey of the Territories of the United States, by Professor F. V. Hayden."

The field of this survey in 1871 and 1872 comprised, I understand, portions of the Territories of Wyoming and Montana, including the Yellowstone Basin. It is reported to me that during the last season its parties were transferred to Middle Colorado, and to the scene of the labors of one of Lieutenant Wheeler's parties, as well as that of the reconnaissance party of Lieutenant Ruffner, the projects for both of which parties were prepared and approved when it was understood Professor Hayden was engaged upon the region of the Yellowstone Basin and other portions of Montana; consequently, when Lieutenant Marshall, in charge of one of Lieutenant Wheeler's parties, took the field in Middle Colorado, in accordance with the project for the season's work, prepared under the general plan of survey, he found Professor Hayden's parties about to commence work in the same region.

To avoid duplication of survey, it was agreed between the two parties that they should operate on opposite sides of the Upper Arkansas, which agreement Lieutenant Marshall reports was not adhered to by Professor Hayden, and the result was a duplication of survey in a certain part of that region.

I have already expressed my views respecting the consolidation of these surveys under one department of the Government, in a letter to the Hon. James A. Garfield, chairman of the Committee on Appropriations of the House of Representatives, dated February 5, 1873, a communication made at his request, and beg leave to repeat here some of those views:

> The surveys and explorations conducted by the War Department have had for their object the determination of the physical structure and condition of that region for the use of the Government of the United States in its military operations in the settlement and development of its Territories, and for safe and speedy transit through them. The first and chief object of the expeditions is the collection of data for the preparation of complete maps of the region by astronomical, goedetic, topographic, and hydrographic methods of survey, with different degrees of refinement, according to the facility of movement through it. Joined to these observations are those on the meteorology, mineralogy, and geology of the country, as well as its botany and zoology. The number, positions, and character of the Indian tribes also form subjects of inquiry. The report of the chief of the exploration shows in what manner the results of these various labors can be applied in the establishment of military posts and routes of supply for them, in the military operations constantly going on there, in the establishing or perfecting general routes of communication by wagon-roads, rivers, and railroads, and in the settlement of the country by agriculturists and by miners.
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> In the very early part of this century, soon after the acquisition of the Territory west of the Mississippi River, Mr. Jefferson, then President, set on foot its exploration, assigning the charge of the first expedition to Captains Lewis and Clarke, of the Army.
>
> This was followed in two years by an expedition under a young officer of the Army, Lieutenant, afterward General, Pike, killed in the war of 1812–'14.
>
> A few years later these labors were assumed by Major Long, Topographical Engineers,

and following him they were continued by officers of the Army, whose names would furnish a long list of men distinguished in their profession.

The parties are essentially military in their organization, and are nearly always accompanied by troops. I know of but few instances in which they were not. Their organization also comprises men from civil life, accomplished in the different subjects which require especial training. The chief labors of these parties are devoted to the geographical, astronomical, goedetic, topographic, hydrographic, and meteorological determinations, without which the geological and mineralogical would be comparatively useless, especially in their practical application to military, mining, and agricultural purposes. In these chief labors of the party the officers of the Army are especially instructed and skilled.

The regularly organized explorations that have been made in that vast interior region have been almost always conducted under the War Department, and their results have received the highest commendation in this country and in Europe, where the plans of operation and methods of survey are considered as models of their kind.

Most of the geologists whose names are connected with the development of the geology of that interior region have served in these War Department explorations.

If it is intended that these interior surveys shall be conducted solely under one Department, then it seems to me that the War Department has superior claims to any other Department of the Government, since it has been usually intrusted with them, and possesses officers skilled in the operations which form the chief labors of the party; skilled, too, in the application of the results of all the labors of the party to the great practical ends had in view in making the explorations, and trained to the command of men and of the troops that always form a part of such expeditions.

The War Department and its parties have always maintained cordial relations with the many scientific societies and men of science of the country, who are interested and skilled in the inquiries that form part of the labors of the expeditions, and they have been consulted in the organization of the expeditions and in the methods of observation to be followed in their own special branches, geology, botany, and natural history.

By placing all these surveys under one department, there would be unity of plan, greater economy, and greater efficiency, and, as a consequence, more useful results for the same expenditure of money. I can see no advantages to the public service in placing them under several departments.

I transmit herewith a preliminary atlas of the sheets, as far as published, of the survey of the territory of the United States west of the one hundredth meridian, upon the progress map of which will be found delineated the routes of the various expeditions conducted under the War Department, a list of which is also transmitted.

The resolution of the House of Representatives is returned herewith.

Very respectfully, your obedient servant,

A. A. HUMPHREYS,
Brigadier-General and Chief of Engineers.

Hon. W. W. BELKNAP,
Secretary of War.

List of explorations and surveys west of the Mississippi River, conducted under the War Department.

Captains Meriwether Lewis and William Clarke, 1804–'5–'6.
Maj. Z. M. Pike, 1804–'6–'7.
Maj. S. H. Long, first expedition, 1819–'20.
Maj. S. H. Long, second expedition, 1823.
J. C. Brown, 1825–'26–'27.
R. Richardson, 1826.
Lieut. J. Allen, 1832.
Henry R. Schoolcraft, 1820 to 1832.
Capt. B. L. E. Bonneville, 1832 to 1836.
Col's J. B. Many and Henry Dodge, 1833 to 1835.
C. Dimmock, 1838.

Prof. I. N. Nicollet, 1836 to 1840.
Lieut. J. C. Frémont, 1842.
Capt. N. Boone, 1843.
Capt. J. Allen, 1843.
Capt. J. C. Frémont, 1843–'44.
Capt. J. C. Frémont, 1845–'46.
Lieuts. James W. Abert and W. G. Peck, 1845.
Lieut. W. B. Franklin, 1845.
Bvt. Maj. William H. Emory, 1846–'47.
Lieuts. James W. Abert and W. G. Peck, 1846–'47
Lieut. Col. P. St. George Cooke, 1846–'47.
Bvt. Capt. W. H. Warner, 1847–'48–'49.
Lieut. G. H. Derby, 1849.
Lieut. J. H. Simpson, (road,) 1849.
Lieut. J. H. Simpson, (reconnaissance,) 1849.
Capt. R. B. Marcy, 1849.
Capt. H. Stansbury, 1849–'50.
Bvt. Maj. S. Woods and Bvt. Capt. John Pope, 1849.
Bvt. Lieut. Col. J. E. Johnston, 1849–'50–'51.
Lieut. W. F. Smith, 1849.
Lieut. F. T. Bryan, 1849.
Lieut. W. H. C. Whiting, 1849.
Lieut. N. Michler, 1849–'50.
Lieut. M. L. Smith, 1850.
Lieuts. M. L. Smith and N. Michler, 1850.
Lieuts. W. F. Smith and F. T. Bryan, 1850.
R. H. Kern, 1850.
Capt. Lorenzo Sitgreaves and Lieut. I. C. Woodruff, 1850–'51.
Capt. Lorenzo Sitgreaves, 1851.
Bvt. Capt. John Pope, 1851.
Lieut. G. H. Derby, 1851.
Lieut. I. C. Woodruff, 1852.
Capt. R. B. Marcy, 1852.
Gov. I. I. Stevens and Capt. G. B. McClellan, 1843–'54–'55.
Lieut. R. Arnold, 1854.
F. W. Lander, 1854.
Capts. J. W. Gunnison and E. G. Beckwith, 1853.
Capt. E. G. Beckwith, 1854.
Capt. A. W. Whipple, 1853–'54.
Lieut. R. S. Williamson, 1853–'54.
Lieut. J. G. Parke, 1854.
Bvt. Capt. John Pope, 1854.
Lieut. J. G. Parke, 1854–'55.
Lieuts. R. S. Williamson and H. L. Abbot, 1855.
Capt. J. L. Reno, 1853.
Capt. R. B. Marcy, 1854.
Col. J. C. Frémont, 1853–'54.
Col. E. J. Steptoe, 1854–'55.
Lieut. John W. Withers, 1854.
Lieut. G. H. Derby, 1853–'55.
Leut. G. H. Mendell, 1855.
Capt. J. H. Simpson, 1855.
Lieut. G. K. Warren, 1855.
Lieut. F. T. Bryan, 1855.
Lieut. T. J. C. Amory, 1855.
Bvt. Major H. W. Merrill, 1855.

Lieut. I. N. Moore, 1855.
Lieut. E. L. Hartz, 1856.
Lieut. F. T. Bryan, 1856.
Capt. John H. Dickerson, 1856.
Lieut. W. D. Smith, 1856.
Capt. A. Sully, 1856.
Lieut. G. K. Warren, 1855–'56–'57.
Col. E. V. Sumner, 1857.
Col. J. E. Johnston, 1857.
E. F. Beale, 1857.
Lieut. J. C. Ives, 1858.
Capt. W. F. Raynolds, 1859–'60.
Capt. J. N. Macomb, 1859–'60.
Capt. J. H. Simpson, 1859.
Lieut. J. Dixon, 1860.
Lieut. John Mullan, 1859–'60.
Lieut. R. W. Petrikin, 1869.
Capt. C. W. Raymond, 1869.
Capts. J. W. Barlow and D. P. Heap, 1871.
Capt. J. W. Barlow, 1872.
Capt. W. A. Jones, 1871–'72–'73.
Capt. G. J. Lydecker, 1873.
Capt. William Ludlow, 1873.
Lieut. E. H. Ruffner, 1872–'73.
Clarence King, 1867–'73.
Lieut. G. M. Wheeler, 1869–'73.

International boundary surveys, under the direction of the Department of State, made by officers of the Army detailed from the War Department.

Texas boundary, 1840–'41: Maj. James D. Graham and Lieut. Col. J. Kearney.

Northeastern boundary, 1840–'46: Maj. James D. Graham.

Mexican boundary, 1849–'56, transferred to and completed under the direction of the Department of the Interior: Lieut. Col. J. D. Graham and Major W. H. Emory.

Northwest boundary, 1857–'61: Lieut. John G. Parke.

Northern boundary, in progress: Majors F. U. Farquhar and W. J. Twining.

DEPARTMENT OF THE INTERIOR,
Washington, D. C., April 28, 1874.

SIR: I have the honor to acknowledge the receipt, by your reference, on the 16th instant, of a resolution adopted in the House of Representatives on the 15th instant, in the following language, viz:

Resolved, That the President of the United States be requested to inform the House what geographical and geological surveys, under different departments and branches of the Government, are operating in the same and contiguous areas of territory west of the Mississippi River, and whether it be not practicable to consolidate them under one department, or to define the geographical limits to be embraced by each.

I have the honor to submit the following report upon the subject-matter of the resolution, so far as it relates to this Department:

The only geographical and geological survey of the public domain,

under the charge of the Department, at the present time, is that which has been conducted during the past five years by Prof. F. V. Hayden, who was appointed United States geologist by Mr. Secretary Cox, on the 1st of April, 1869, in accordance with the provisions of an act entitled "An act making appropriations for sundry civil expenses of the Government for the year ending June thirtieth, eighteen hundred and seventy, and for other purposes," approved March 3, 1869. (U. S. Statutes, vol. 15, page 306.) During the period above named Prof. Hayden's expedition has explored various portions of the Territories of Montana, Wyoming, (including the Yellowstone National Park,) and Colorado. The field of his survey, during the past year, was the more mountainous portions of Colorado Territory, and the results thereof are now being prepared for publication. The reports, already published, of the previous surveys conducted by Prof. Hayden constitute a valuable addition to that portion of the public documents which relate to matters of scientific investigation, and are sought after by scientific institutions in this country and in Europe. Believing the results of these surveys to be of intrinsic value to the country at large, a continuation of the same was recommended in the last annual report of this Department.

A survey of the Colorado of the West, under the direction of Professor Powell, was authorized by Congress on July 12, 1870, (U. S. Statutes, vol. 16, page 243,) the expenditure of the appropriation therefor being placed under the direction of the Secretary of the Interior; but on the 3d of March, 1871, (*idem*, page 503,) Congress placed the completion of said survey under the direction of the Smithsonian Institution, to which, I am informed, Professor Powell has made his final report.

It is not officially known to this Department whether any other surveys "are operating in the same or contiguous areas of territory west of the Mississippi River."

With respect to the second inquiry of the resolution I have the honor to submit the following views:

In view of the powers conferred and duties enjoined upon the Secretary of the Interior touching the development of agricultural, mineral, and kindred interests in our vast territorial domain, I respectfully submit that all matter having any relation thereto should be wholly under the jurisdiction of the Department of the Interior. In my judgment, therefore, all surveys which are made for the purpose of ascertaining the geological character, natural history, climatology, and mineral, agricultural, and other resources of the public domain, come entirely within the province and should be conducted under the direction of the Department of the Interior, as contradistinguished from those surveys which may be found necessary for purely military purposes, and which, from their very nature, should properly be conducted under the supervision of the War Department.

The business of the General Land-Office, an important bureau of this Department, has an intimate connection with surveys of a geological character, and the geological surveys heretofore directed by this Department are made to conform, as far as practicable, to surveys made by officers of that bureau.

I am fully of the opinion, therefore, that all surveys of unoccupied public territory, except those for military purposes, should be consolidated under the direction of one Department, and that the Department of the Interior should be charged with their supervision so far as they relate to the following branches of scientific research, viz: geological formations, climatology, mineralogical, agricultural, and other resources, and topography, so far as the latter may be necessary for the construc-

tion of accurate maps, whereon the several features above enumerated could be properly illustrated for the information of the people. In these different branches of investigation past experience has demonstrated the necessity for combining geological and topographical examinations, in order to reach more harmonious and valuable results.

Should the foregoing views meet with your approval, and with that of Congress, the last inquiry of the resolution would be practically answered. If all such surveys were placed under the supervision of this Department the possibility of different surveys going over the same ground would be avoided, whereas were they not thus consolidated such a contingency might arise.

In this connection I deem it proper to inclose, for your information, copies of communications from Professors Hayden and Powell, dated the 25th and 24th instant, respectively, wherein the views of those two gentlemen upon the subject of the House resolution are fully set forth.

I have the honor to be, very respectfully, your obedient servant,

C. DELANO, *Secretary*.

The PRESIDENT.

OFFICE UNITED STATES GEOLOGICAL
SURVEY OF THE TERRITORIES,
Washington, D. C., April 25, 1874.

SIR: In accordance with the request contained in your letter of April 16, 1874, I have the honor to present the following statement:

In regard to surveys operating in the same or contiguous areas, I can only speak of such as I came in contact with while conducting the survey under my charge. I believe it is true that an exploring party connected with one of the other Departments did extend examinations last season upon the territory which you had assigned to me, as per letter of instructions of January 27, 1873, which is hereto appended.

I have not been officially apprised of the object of that exploration, but, as the expedition was conducted under the auspices of the War Department, I presume the chief object of the survey was for military purposes, and, if so, could have no relation to or in any way necessarily conflict with the geological survey under my charge. This is the only apparent duplication of which I have any knowledge, and as the objects of the two expeditions are presumed to have been distinct and different, it was, if this supposition is correct, only apparent, and not real.

My report of last year's expedition, which is now nearly ready to be submitted to you, will show that I confined my explorations and investigations strictly to the territory assigned me, and to the objects and purposes embraced in the instructions heretofore received—that is, the geology, natural history, mineral and agricultural resources of the country explored, and such geographical and topographical work as is necessary for the construction of proper geological maps.

The resolution submitted inquires as to the propriety of placing the various surveys of the western section under one department or head, or of giving to each a definite geographical boundary.

With respect to the first inquiry, I beg leave to submit the following suggestions for your consideration:

It is presumed that the language of the resolution is intended to include all surveys which are made for the purpose of ascertaining the geological character, mineral and agricultural resources, and natural history of the Territories. The experience of geological surveys of the

States, and of the civilian surveys under the United States, have thoroughly demonstrated their value and shown that it is unnecessary to have a leader accompanying the parties mainly to direct the movements of those who have the entire work to perform, as the geologist in charge finds no difficulty, when he has the arranging of his own party, in doing his full share of personal scientific labor, and at the same time guiding the general movements. And, in addition to this important consideration, I may add that such a leader not only occasions unnecessary expense to the Government, but often proves a source of discord and conflict.

Much greater efficiency has always been gained where the leader of the survey is himself an ardent worker in geology and science generally, as he is better able to judge of the work to be performed, and as he urges forward all his scientific assistants by the force of his example and enthusiasm. As an evidence of this, it is only necessary to refer to the geological reports of Owen, Foster, Whitney, Hall, Worthen, and others in this country, and those of Sir W. E. Logan in Canada, and Sir Roderick Murchison in Europe, &c.

On the other hand, it is found by experience that when a scientific party is placed under charge of one who is not himself a devotee and enthusiastic laborer in some especial field of science, the work done is inferior in quality and quantity.

The higher the scientific character of the party, the more certainly do they demand a leader in full sympathy with them. Reports on such objects of natural history as can be collected and brought to the room of the naturalist may be, and often are, very valuable, no matter by whom collected, as the works of Professors Baird, Torrey, and others in these reports show. But such is not the case with the geologist; he must of necessity go upon the ground, and, to be successful, must organize his own corps, distribute the work, form his own plan, and have full control of the entire operations. But not only must the geologist go upon the ground in person, the same necessity exists in regard to the paleontologist and mineralogist.

If the language of the resolution is designed to include only scientific and geographical surveys, which are intended to ascertain the value of the public lands, and to determine their character by ascertaining their geological features, mineral and agricultural resources, productions and climate; in that case, as the land department is under the Department of the Interior, and is one of the chief objects for which this Department was originally created, it certainly is proper that such surveys should be placed under its control and supervision. Placing them under the control of any other would be as unwise and injudicious as it would be to place the military surveys under the Interior or State Departments.

In regard to combining these surveys under one control, or head, there can be but one real question; that they should all be under the Department of the Interior, there can be no reasonable doubt; this being conceded, the question arises, would it be judicious to place them under one Bureau of that Department?

The first impression of many, in fact of most, persons, might favor such a plan, but I think more mature reflection will show that this is an erroneous idea. It necessitates the expense of a number of salaried officers, clerks, and employés, which are not needed so long as these surveys are special. If a geologist is placed in charge of this bureau, which must necessarily be done if it is to be of any value, it at once gives him a feeling of security and ease, and he no longer looks upon his continuance in office as depending upon the results of his surveys.

Such a system tends very strongly to crush out and destroy that scientific individuality from which the greatest results have always been derived. It also destroys that healthy emulation which produces extra exertion, gives stimulus to energy, and a proper regard for expenses. There is no necessity for such a system in order to prevent conflict or duplication, if all the surveys of this character are placed under the supervision and control of the Secretary of the Interior, as he can easily determine the plan of operation of each after consultation, and can prevent conflict or duplication of work. There is no complicated and extensive machinery necessary; each has its work to perform, and having done this, reports annually, and the results determine the propriety of its continuance or discontinuance.

Thus the continuance of each is made to depend upon the value of the work performed, and Congress is left the sole and immediate judge as to the value. By combining these surveys under a bureau, these important features are, to a great extent, lost.

It is supposed by many who have no practical experience in geological surveys, that the ordinary geographical and topographical surveys for other purposes will supersede the necessity for any geographical or topographical work in connection with these geological explorations. But experience has shown this to be erroneous.

Where the country is quite level and uniform in character, any map on a scale of sufficient size which is accurately done and has sufficient details, will generally answer all the purposes of the geologist. But in a very broken and mountainous region, like that of the greater portion of the Western Territories, especially the entire Rocky Mountain region, no maps which have heretofore been made can possibly answer the purposes of the geologist.

In these geological surveys of the Rocky Mountain regions, the vertical topography and accurate and minute surveys of certain localities become of most vital importance. In presenting on maps and sections the geological character of these regions, often long and continuous, transverse and longitudinal sections are also necessary, yet none of these are brought out in any case by the surveys which are made especially for military and geographical purposes. If the topography necessary for geological purposes is separated from the geological survey, and the two are done by separate parties, we find by experience that the cost is increased about forty per cent., which is an important matter to be considered.

Therefore, both for economic and scientific reasons, geologists should control the geological surveys, and make such complete maps as are required to show the physical conditions and resources of the Territories. The maps, if complete enough for the above purposes, will be permanently suitable for all other uses.

Thus it is evident that there need be no unnecessary expenditure of the public money, if each department is restricted to its own proper sphere of labor. Geology and geological maps certainly are the province of the geologist.

The resolution asks if it be not practicable to limit these surveys by geographical boundary-lines. To a certain extent, this can and ought to be done, and if all the surveys which appertain to the business of the Department of the Interior are placed under the supervision of the Secretary of the Interior, there will be no necessity for, or danger of, conflict or duplication of work. While different surveys of the same character can and should to a certain extent be confined during the same period to different geographical districts, yet there are certain investigations

in regard to geological explorations of the great Rocky Mountain range and bordering plains which cannot be thoroughly carried out if too rigidly limited by arbitrary lines.

For example: the great problem of the age, and dynamic geology of this range, can never be properly worked out if the examination is limited rigidly to a given transverse section; the action of the great upheaving forces must be traced along their various lines of progress. Again, Professor Lesquereaux, the leading fossil botanist of our country, who has, in connection with the survey under my charge, been studying the lignite coal-beds of this region, in order to make his work of most value, and to determine the age, extent, and value of these beds, must follow them up and examine them throughout, without being confined too rigidly to a given section. Likewise the special paleontologists must, to make their work efficient, be allowed a like privilege. Yet this does not conflict with the idea of confining the main party of each survey to a given district.

In concluding, allow me to say that I think, as these surveys are made at public expense, their utilitarian or general economic object should never be lost sight of; although I believe the Government would be justified in carrying them on if confined to a purely scientific purpose, yet it is the duty of Government to make them of a more general and public benefit. This, therefore, should be, and always has been with me, a very prominent object; while I have endeavored, as far as possible, to add to our scientific knowledge, I have always felt it to be my duty to keep constantly in view, as the primary object, the gathering of such facts and knowledge as will be of use to the public, and tend to develop the material resources of the Territories. To this end, I have made it a special object to investigate the value and extent of the coal-fields of this region, its mineral, timber, and agricultural resources, its climate and productions, and, in order to bring this information before the public in as rapid, concise, and useful manner as possible, I have adopted the method of preparing annual reports, using, in all but the purely scientific portion, plain and popular language.

To make these surveys the more directly beneficial, I have, with your consent and advice, gone to those sections which appeared at the time to be the chief objective points of emigration and improvement, striving to keep in advance of the wave of pioneer population, and especially in the direction in which you were moving the land-surveys. In this way you have, by controlling the movements of the land and geological surveys, been prepared to give useful and important information to the many who were seeking homes in the Far West. Therefore, if these surveys are not kept under the control of the Secretary of the Interior, all these important and beneficial results will be wholly lost.

Very respectfully, your obedient servant,

F. V. HAYDEN,
United States Geologist.

Hon. C. DELANO,
Secretary of the Interior.

WASHINGTON, D. C., *April* 24, 1874.

SIR: In reply to your letter of the 20th instant, I have the honor to make the following statement:

In the year 1870 the survey of the Colorado River of the West and its tributaries was authorized by act of Congress, and the work placed

under the direction of the Secretary of the Interior. The following year provision was made for the continuance of the survey, and the work was placed under the direction of the Smithsonian Institution, and has been under the same supervision up to the present time.

Green River is the true upper continuation of the Colorado, and the course of these rivers between the point where the Union Pacific Railroad crosses Green River to the mouth of the Rio Virgin, a tributary of the Colorado, was to be a meandering base or central line of the work. We began by establishing astronomic stations along the course of these streams, averaging in distance apart about forty-five miles by the winding course of the rivers, but about twenty-five miles in direct lines. These astronomic stations were used as the extremities of lines from which extensive series of observations were taken for the purpose of constructing a net-work of triangles as the base of the topographic work. Then the topographic features were sketched, the most salient points being determined as above indicated. This method was the same as that which had been adopted in previous explorations and reconnaissance of railroad-routes and boundary-lines of Territories, and adopted by various officers of the Government, except that we attempted to make it more thorough and elaborate than anything which had been done previously.

With this geographic work a geological survey was connected, and it was found that the maps produced from the results of this method were not sufficiently accurate for the proper presentation of the geological facts collected. This inadequacy of the topographic work resulted in the adoption of another method, viz, the expansion of a system of triangles from measured base-lines.

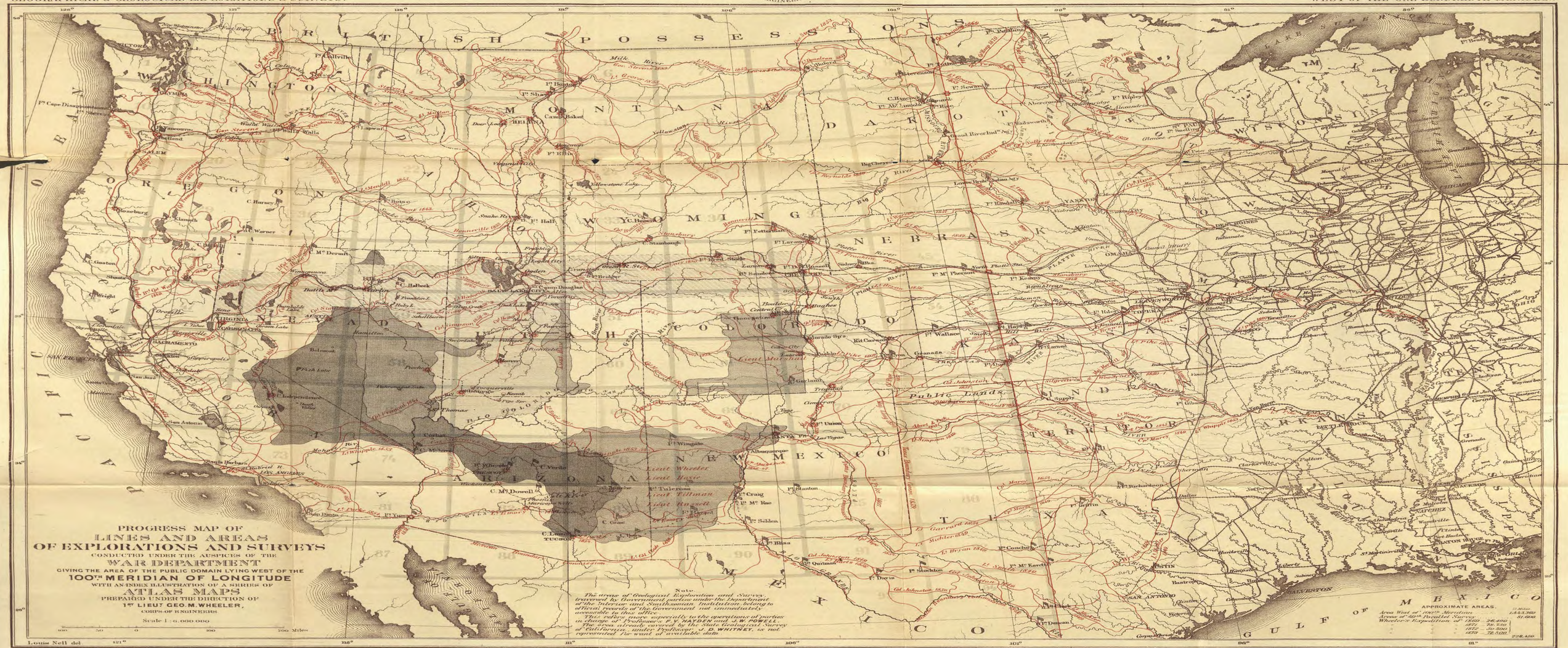
By the first method a district of country embracing 20,000 square miles was explored and mapped, and by the more accurate method last mentioned an area of 25,000 square miles has been surveyed and mapped, including in this survey the descent of the river in boats for more than a thousand miles—a river more difficult to navigate than any other on this continent, or perhaps in the world; running as it does in a gorge varying from a few hundred to six thousand feet in depth, obstructed in many places along its course by dangerous rocks, and beset with rapids and cataracts.

For more detailed information concerning the work which has been performed, I would most respectfully refer you to a report which I have just prepared to be submitted to the secretary of the Smithsonian Institution, a copy of which I transmit herewith.

There is now left within the territory of the United States no great unexplored region, and exploring expeditions are no longer needed for general purposes; their methods do not produce results sufficiently accurate to warrant their continuance for economic purposes, as the industrial interests of the country are not greatly subserved by them; nor are the results for scientific purposes of an importance commensurate with their expense.

A more thorough method, or a survey proper, is now demanded. I need not mention the importance of such a survey to the General Government, and also to the State governments, for purposes of intelligent legislation on the railroad interests of the country, nor the value it would be to those persons or companies engaged in the construction of railroads; nor need I mention the importance of such a survey in determining the mineral resources of the country—deposits of coal, salt, ores, precious metals, &c.

WAR DEPARTMENT
CORPS OF ENGINEERS U.S.ARMY



About two-fifths of the entire area of the United States has a climate so arid that agriculture cannot be pursued without irrigation.

When all the waters running in the streams found in this region are conducted on the lands there will be but a very small portion of the country redeemed, varying in different Territories perhaps from 1 to 3 per cent. Already the greater number of smaller streams, such as can be controlled by individuals who wish to obtain a livelihood by agriculture, are used for this purpose; the largest streams, which will irrigate somewhat greater areas, can only be managed by coöperative organizations, great capitalists, or by the General or State governments.

It is of the most immediate and pressing importance that a general survey should be made for the purpose of determining the several areas which can thus be redeemed by irrigation. But I will not further discuss the importance of a thorough survey for economic and scientific purposes, but will simply say that a survey which meets all these demands must be thorough and accurate, and if it fails in any of the particulars indicated, such a failure will necessitate a resurvey of the country, involving the General Government in greatly increased expense.

I have no hesitancy in expressing the opinion that all surveys made for these general purposes should be under the management of one Department, that the work may be properly co-ordinated and kept up to that standard of excellence necessary to the required result.

While I am decidedly of the opinion that it is not wise to continue a system of explorations or meandering surveys for the general purpose indicated, it is not perhaps within my province to say that they are not necessary for military purposes.

If military explorations are needed for such special reasons, it might be well to carry them on without regard to the general survey; but if these military explorations are intended to subserve the purposes of the general survey also, the territorial limits of the various surveys should be defined by act of Congress or regulated by departmental instructions. It would seem to be unnecessary to conduct both over the same areas with the same end in view, and experience has demonstrated that such will be the case under the present management, for quite a large part of the territory embraced in the survey of which I have had immediate direction has been subsequently re-explored by military parties, and this can only be justified on the ground that such exploration was necessary for military purposes, of which I am not a judge.

I am, sir, with great respect, your obedient servant,

J. W. POWELL,
In charge of the Colorado River Exploring Expedition.

The Hon. SECRETARY OF THE INTERIOR,
Washington, D. C.