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Geological and geographical surveys. Letter from the Secretary of the Interior, in response to a resolution of the House of Representatives, transmitting report of Professor Hayden upon geological and geographical surveys.

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GEOLOGICAL AND GEOGRAPHICAL SURVEYS.

LETTER

FROM THE

SECRETARY OF THE INTERIOR,

IN RESPONSE TO

A resolution of the House of Representatives, transmitting report of Professor Hayden upon geological and geographical surveys.

APRIL 19, 1878.—Referred to the Committee on Appropriations and ordered to be printed.

DEPARTMENT OF THE INTERIOR,
Washington, D. C., April 18, 1878.

SIR: In reply to the resolution of the House of Representatives of the 8th ultimo, requesting the Secretary of the Interior to furnish to Congress information relative to all geographical and geological surveys conducted under the supervision of the Department of the Interior during the last ten years, I have the honor to transmit herewith a report from Prof. F. V. Hayden upon the subject-matter of said resolution, so far as it relates to the survey under his charge. A copy of the letter of Professor Hayden transmitting his report to this department is also herewith transmitted. Maj. J. W. Powell is engaged in the preparation of a report in answer to the inquiries contained in said resolution, so far as they relate to the work under his supervision. His report will be transmitted to Congress at the earliest date practicable.

Very respectfully,

C. SCHURZ,
Secretary.

Hon. SAMUEL J. RANDALL,
Speaker of the House of Representatives.

OFFICE OF THE UNITED STATES GEOLOGICAL AND
GEOGRAPHICAL SURVEY OF THE TERRITORIES,
Washington, D. C., April, 1878.

SIR: Referring to your letter of March 11, 1878, transmitting a copy of a resolution which passed the House of Representatives March 8, 1878, calling for certain information in regard to the survey under my charge, I have the honor to forward herewith a report in compliance with said resolution.

I beg to say that I have endeavored to comply, to the fullest extent with the intent of the resolution, and would further say that should Congress, or any committee thereof to which the papers may be referred, desire any further information relating to this inquiry, it will afford me pleasure to grant it without delay.

Very respectfully, your obedient servant,

F. V. HAYDEN,
United States Geologist.

Hon. CARL SCHURZ,
Secretary of the Interior.

OFFICE OF THE UNITED STATES GEOLOGICAL AND
GEOGRAPHICAL SURVEY OF THE TERRITORIES,
Washington, D. C., April, 1878.

SIR: In answer to your communication of March 11, transmitting a copy of the following resolution of Congress: "*Resolved*, That the Secretary of the Interior be, and he is hereby, requested, at as early a day as possible, to report to this House a list of all geological and geographical surveys conducted under or by authority of his department during the past ten years, together with a statement of the areas of territory so surveyed, the year in which each district or area was surveyed, the cost incurred by direct appropriations by Congress, what aid and supplies, and the value thereof, have been furnished by the Ordnance, Commissary, and Quartermaster's Departments outside of said appropriations, and from what funds transportation and office rents have been paid, together with a list of publications made and in progress, as the result of such surveys; also, whether said surveys have duplicated other public geological and geographical surveys made by authority of Congress, the cost of such duplications, if any have occurred, and the reasons why they have been made;" and asking for all information in our possession relative to the subjects embraced in said resolution, so far as it relates to the work under my charge, I have the honor to reply as follows:

The survey under my charge, known as the United States Geological and Geographical Survey of the Territories, was organized in 1867, under the Commissioner of the General Land Office. In the year 1869 the survey was transferred from the General Land Office and placed directly under the Secretary of the Interior, where it has since remained. It has, therefore, been in existence nearly twelve years.

During the years from 1867 to 1870, inclusive, no geographical work was done, and therefore no maps were made. The energies of the survey were devoted to the study of the geology, natural history, and agricultural resources of the country examined. The geology was expressed on pre-existing maps.

In 1871, finding that the existing maps were too inaccurate, and on a scale too small for the proper representation of the geology, it was decided to carry on geographical work in connection with the other work of the survey. In that, and the following year (1871 and 1872,) the topographical work was of a reconnaissance character. Several topographical and geological maps were published. (See list of maps, in subsequent portion of letter.)

In 1873, recognizing the fact that the day for rough reconnaissances in the west was over, and that the necessity for accurate geological and

geographical work had arisen, the geologist in charge decided to take a new departure by making an accurate geological and geographical survey of the State (then the Territory) of Colorado, with small adjacent portions of Utah, Arizona, and New Mexico. The survey of this area has been the chief work of this organization during the years 1873, 1874, 1875, and 1876. The results will be found in the annual reports, atlas, and other publications for those years, herewith submitted. (*Vide* Appendix D, Nos. 1-7.)

The plan of the geographical work has been, substantially, that followed by Mr. Clarence King in the survey of the fortieth parallel, and with a view to making a uniformity in the maps of the west, the same scale (4 miles to an inch) was adopted. The geographical work is as accurate as is consistent with the rapid prosecution of the work. The mean error of locations of the stations in the primary triangulation is probably not over 25 feet, and that of the secondary stations not greater than 100 feet.

In 1877, the survey of Colorado being completed, it was decided to carry the work of the survey north of that of the survey of the fortieth parallel, into Wyoming, Idaho, and Utah, per instructions from the Department of the Interior (*vide* copy of the letter of the Secretary of the Interior, Appendix A, No. 18), and during that season rectangles 56, and parts of 45, 46, 55 and 57 were surveyed.

The resolution calls for information on the following points:

I. Statement of the areas surveyed during the past ten years, and the year in which each district or area was surveyed.

II. Cost incurred by direct appropriation of Congress.

III. What aid and supplies, and the value thereof, have been furnished by the Ordnance, Commissary, and Quartermaster's Departments, outside of said appropriations.

IV. From what funds transportation and office rents have been paid.

V. List of the publications made and in progress as a result of these surveys.

VI. Whether these surveys have duplicated other public surveys made by authority of Congress, the cost of such duplications, if any have occurred, and the reason why they were made.

I shall consider these points in the order given above.

I.

1867.—The work of the year 1867 was confined to Nebraska. (*Vide* copy of act of Congress, Appendix A., No. 1.)

1868.—The work of the year 1868 embraced portions of Nebraska and Wyoming. (*Vide* copy of act of Congress, Appendix A, No. 2.)

1869.—The work of the year 1869 consisted of a reconnaissance from Cheyenne, Wyo., along the eastern foot of the Rocky Mountains to Santa Fé, N. Mex., returning through the parks of Colorado. (*Vide* copies of act of Congress, and of letter of instructions from the Secretary of the Interior, Appendix A, Nos. 3 and 4.)

1870.—In 1870, a reconnaissance was made from Cheyenne, Wyo., northward along the eastern base of the Laramie Range via the Chugwater, North Platte, and Sweetwater to South Pass. Frequent excursions were made on each side of the route of travel, and the Sweetwater mines and the southern portions of the Wind River Mountains were visited. From South Pass the expedition passed down the Little and Big Sandy Creeks to Green River, and thence by way of Church Buttes to Fort Bridger. A permanent camp was established at the latter point,

and numerous excursions were made up Bear River, Muddy Creek, Black's Fork, and Smith's Fork, thus exploring with considerable care the northern slopes of the Uinta Mountains. From Fort Bridger the course was southward to Henry's Fork, and via that stream to Green River station on the Union Pacific Railroad. From Green River station the party followed the old stage road up Bitter Creek over Bridger's Pass and the Medicine Bow Mountains, across the Laramie plains and through the Laramie Range by way of Cheyenne Pass, to the point of departure. (*Vide* copies of act of Congress, and letter of instructions of the Secretary of the Interior, Appendix A, Nos. 5 and 6.)

1871.—During the year 1871, a reconnaissance was made from Ogden, Utah, northward through Idaho into Montana, extending as far north as Bozeman, and including a large portion of the drainage of the Upper Yellowstone, and the Gallatin, Madison, and Jefferson Forks of the Missouri, within the limits of the present boundaries of the Yellowstone National Park. Returning from this region, a reconnaissance was made along the Jefferson Fork, of the Missouri, and from Fort Hall, Idaho to Evanston, Wyo., via Bear Lake Valley and Bear Lake. (*Vide* copies of act of Congress, and letter of instructions of Secretary of the Interior, Appendix A, Nos. 7 and 8.)

1872.—During the year 1872 two large parties were organized for the field-work. One started from Fort Ellis, Montana, and explored the headwaters of the Yellowstone, Gallatin, and Madison Rivers in more detail than during the previous year. Another party explored the headwaters of Snake River (Lewis's Fork of the Columbia), in Idaho and Wyoming. (*Vide* copies of act of Congress and letter of instructions of Secretary of the Interior, Appendix, A, Nos. 9 and 10.)

1873.—In 1873 work was begun in Colorado on a systematic plan, in accordance with verbal instructions, made official, as per letter of the Secretary of the Interior (*vide* Appendix, A, No. 19); and the area surveyed during the year extended from latitude 38° to $40^{\circ} 30'$, and from longitude $104^{\circ} 30'$ to 107° , including about 23,000 square miles. (*Vide* copies of act of Congress and letter of instructions from Secretary of the Interior, Appendix, A, Nos. 11 and 12.)

1874.—The following year (1874) the work was extended westward and southwestward in Colorado. (*Vide* copy of act of Congress, Appendix, A, No. 13.) About 13,000 square miles were surveyed. Owing to circumstances beyond my control it was late in the season before the parties took the field, hence the small area as compared with the previous year.

1875.—In 1875 the work was carried still farther westward and southward in Colorado and portions of the adjacent Territories. (*Vide* copy of act of Congress, Appendix, A, No. 14.) An area of 24,000 square miles was completed.

1876.—During the year 1876 10,000 square miles were surveyed in Colorado and Eastern Utah, completing the survey of Colorado. (*Vide* copies of act of Congress and letter of instructions of the Secretary of the Interior, Appendix, A, Nos. 15 and 16.) The field season was very short.

1877.—During the year 1877, 30,000 square miles, embracing parts of Wyoming, Idaho, and Utah Territories, were surveyed. (*Vide* copies of act of Congress and letter of instructions of the Secretary of the Interior. Appendix A, Nos. 17 and 18.)

The areas indicated above are shown in colors on the accompanying map. (*Vide* Appendix A, No. 20.)

II.

1867	\$5,000
1868	5,000
1869	10,000
1870	25,000
1871	40,000
1872	75,000
1872 (engraving)	10,000
1873	75,000
1873 (engraving)	20,000
1874	75,000
1874 (engraving)	20,000
1874 (deficiency)	20,000
1875	75,000
1875 (engraving)	20,000
1876	65,000
1877	75,000

Total amount received by direct appropriations from Congress. 615,000
(*Vide* Appendix B, Nos. 1-16.)

A tabular statement showing the annual distribution of expenditures, under different headings, of the appropriations by Congress specified above, from 1869 to 1877, inclusive, is herewith submitted. (*Vide* Appendix B, No. 17.)

III.

1. Neither aid nor supplies have been furnished the survey under my charge by the Ordnance Department, outside of the direct appropriations by Congress; all aid and supplies received from said department having been paid for, in cash, out of direct appropriations. (*Vide* Appendix C, No. 1.)

2. No supplies have been furnished the survey by the Commissary Department outside of the direct appropriations by Congress. All supplies obtained from said department have been paid for, in cash, out of the appropriations. (*Vide* Appendix C, Nos. 2-7.)

3. In the years 1867 to 1873, inclusive, aid and supplies of condemned material were furnished the survey by the Quartermaster's Department, which were returned, and the loss incurred by deterioration of value paid out of the direct appropriations by Congress. It is impossible to estimate the value of such aid and supplies, as they consisted of condemned material. (*Vide* Appendix C, Nos. 2-7.) Since 1873, no aid or supplies have been received either directly or indirectly from either the Commissary or Quartermaster's Departments.

During the field season of 1873, Lieut. W. L. Carpenter, Ninth Infantry, United States Army, was detailed by order of the Secretary of War to accompany the survey under my charge, in the capacity of assistant naturalist, but received no compensation from the survey except transportation and rations in the field.

In July, 1876, Capt. Elliott Cones, assistant surgeon, United States Army, was detailed by order of the Surgeon-General on duty with the survey, and he has since acted in the capacity of naturalist, receiving his pay proper from the Army, the survey paying his commutation for quarters and fuel.

IV.

Transportation and office rents have always been paid out of the direct appropriations by Congress.

V.

List of the publications of the United States Geological and Geographical Survey of the Territories:

OCTAVOS.

Annual reports.

- Annual report for 1867—Nebraska, }
 Annual report for 1868—Nebraska and Wyoming, } Constitute one
 Annual report for 1869—Colorado and New Mexico, } volume of 261
 Annual report for 1869—Colorado and New Mexico, 155 pp. }
 Annual report for 1870—Wyoming, 511 pp. and 21 wood-cuts.
 Annual report for 1871—Montana, &c., 544 pp. and 71 illustrations and maps.
 Annual report for 1872—Portions of Montana, Idaho, Wyoming, and Utah, 856 pp., 88 illustrations.
 Annual report for 1873—Colorado, 731 pp., 110 illustrations.
 Annual report for 1874—Colorado, 524 pp., 88 illustrations.
 Annual report for 1875—Colorado, 534 pp., 144 illustrations.
 (Vide Appendix D, No. 1.)

Miscellaneous.

- No. 1. Lists of Elevations, first edition, 31 pp. (12 mo.).
 No. 1. Lists of Elevations, second edition, 47 pp.
 No. 1. Lists of Elevations, third edition, 74 pp.
 No. 1. Lists of Elevations, fourth edition, 177 pp. and 1 map.
 No. 2. Meteorological Observations, 120 pp.
 No. 3. Birds of the Northwest, 802 pp.
 No. 4. Flora of Colorado, 185 pp.
 No. 5. Descriptive Catalogue of Photographs; first edition, 88 pp.
 No. 5. Descriptive Catalogue of Photographs, second edition, 81 pp. and 14 illustrations.
 No. 6. Meteorological Observations, 57 pp.
 No. 7. Ethnography and Philology of the Hidatsa Indians, 245 pp.
 No. 8. History of the North American Mustelidae, 362 pp. and 20 plates.
 No. 9. Historical and Biographical Catalogue of Photographs of North American Indians, 130 pp.
 (Vide Appendix D, No. 2.)

Bulletins.

- Vol. 1. First series, No. 1, 28 pp.
 First series, No. 2, 77 pp.
 Second series, No. 1, 48 pp. and 15 illustrations.
 Second series, No. 2, 94 pp.
 Second series, No. 3, 69 pp. and 5 illustrations.
 Second series, No. 4, 17 pp. and 10 plates.

- Vol. I, second series, No. 5, 183 pp., and 3 plates.
 second series, No. 6, 85 pp., and 5 plates.
 Vol. II, No. 1, 88 pp., 29 plates, and 1 map.
 No. 2, 107 pp., 2 plates.
 No. 3, 81 pp., 10 plates, and 1 map.
 No. 4, 115 pp., 6 plates, and 2 cuts.
 Vol. III, No. 1, 186 pp., 16 plates, and 17 cuts.
 No. 2, 344 pp., 2 plates, and 2 cuts.
 No. 3, 209 pp., and 11 plates.
 No. 4, 118 pp.
 Vol. IV, No. 1, 311 pp., and 1 cut.
 (Vide Appendix D, No. 3.)

Unclassified.

- Final report on Nebraska, 264 pp., and 11 plates.
 Catalogue of Publications, first edition, 20 pp.
 Catalogue of Publications, second edition, 38 pp.
 Synopsis of New Vertebrata from the Tertiary of Colorado, 19 pp.
 Fossil Flora, 22 pp.
 Preliminary report of the field-work for 1877, 35 pp.
 Catalogue of photographs (18 mo.), 51 pp.
 (Vide Appendix D, No. 4.)

QUARTOS.

Monographs.

- Vol. I. Extinct Vertebrate Fauna of the Western Territories. Leidy, 358 pp., and 37 plates.
 Vol. II. Vertebrata of the Cretaceous Formations of the West. Cope, 306 pp., 57 plates, and 10 cuts.
 Vol. V. Synopsis of the Acrididæ of North America. Thomas, 262 pp., 1 plate, and 2 cuts.
 Vol. VI. Cretaceous Flora. Lesquereux, 136 pp., and 30 plates.
 Vol. VII. Tertiary Flora. Lesquereux, 352 pp., and 65 plates.
 Vol. IX. Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country. Meek, 693 pp., 45 plates, and 85 cuts.
 Vol. X. Monograph on the Geometrid Moths. Packard, 611 pp., and 13 plates.
 Vol. XI. Monograph on North American Rodentia. Coues and Allen, 1113 pp., and 77 illustrations.
 (Vide Appendix D, No. 5.)

Unclassified.

- Profiles, sections, and other illustrations. 65 plates, mostly folded.
 Grotto Geyser. Oblong folio. 2 pp., 1 illustration, and 1 map.
 (Vide Appendix D, No. 5.)

MAPS.

1871.

1. Yellowstone Lake.
2. Lower Geyser Basin of Firehole River.

3. Upper Geyser Basin of Firehole River.
4. Yellowstone National Park.
5. Parts of Idaho, Montana, and Wyoming. Preliminary map, mainly for field use.

1872.

6. Map of the Lower Geyser Basin on Firehole River, resurveyed in 1872, and engraved on stone.
7. Upper Geyser Basin of Firehole River.
8. Henry's Lake and the sources of Henry's Fork of the Snake River.
9. Shoshone Geyser Basin and Lake.
10. Sources of Snake River (reduced from the final map).
11. Portions of Montana and Wyoming Territories, embracing most of the country about the sources of the Madison, Gallatin, and Yellowstone Rivers, in contour lines. (Final map on a scale of four miles to one inch.
12. Sources of Snake River and its tributaries. (Final map on a scale of five miles to one inch.)
13. Field map of Colorado, based on the work of the land surveys, for use in the field.
14. Geological maps of Montana, &c. (Topographical basis is No. 11.)
15. Geological map of the sources of Snake River. (Topographical basis is No. 12.)

1873.

16. Preliminary map of Central Colorado, showing the region surveyed in 1873.
17. Sketch showing the Primary and Secondary Triangulation of 1873.
18. Map (compiled) showing the Railroad and Canal lines used in the Determinations of Elevations, by J. T. Gardner.

1874.

19. Preliminary map of the San Juan Country.
20. Geological map of the Elk Mountains, Colorado.
21. *Geological map of Colorado Springs and vicinity, Colorado.*
22. *Preliminary map of the Eastern Base of the Rocky Mountains, Colorado.*
23. Map of the Moraines of the Upper Arkansas Valley, Colorado.
24. Preliminary map of Central Colorado (in hachures) showing the area surveyed in 1873 and 1874.

1875.

25. Preliminary map of Southwestern Colorado, and parts of adjacent territory, showing locality of ancient ruins.

1876.

26. Hypsometric sketch of the United States, in contours of 1,000 feet.

1877.

27. Drainage map of Colorado.
28. Hypsometric map of the United States, in contours of 1,000 feet apart.

- 29. Outline map of South Park.
- 30. Outline map of the Middle Park region, &c.
- 31. Map showing the primary triangulation of 1877.

(Maps already enumerated comprise Appendix D, No. 6.)

1878.

- 32. Geological and geographical Atlas of Colorado and portions of adjacent territories.

This atlas comprises the topographical and geological work of the survey from 1873 to 1876, inclusive, and consists of the following sheets :

General sheets.

(On a scale of twelve miles to one inch.)

- I. Triangulation map.
- II. Drainage map.
- III. Economic map.
- IV. General geologic map.

Detailed sheets.

(On a scale of four miles to one inch.)

TOPOGRAPHICAL.

- V. Northwestern Colorado.
- VI. Northern Central Colorado.
- VII. Central Colorado.
- VIII. Western Colorado.
- IX. Southwestern Colorado.
- X. Southern Central Colorado.

GEOLOGICAL.

- XI. Northwestern Colorado.
- XII. Northern Central Colorado.
- XIII. Central Colorado.
- XIV. Western Colorado.
- XV. Southwestern Colorado.
- XVI. Southern Central Colorado.

- XVII and XVIII. Geological sections.
- XIX and XX. Panoramic views.

(The atlas constitutes Appendix D, No. 7.)

WORKS IN PRESS.

- Annual Report for 1876.
- Bulletin, Vol. IV, No. 2.
- Miscellaneous Publications, No. 10.
- Miscellaneous Publications, No. 11.

WORKS IN PREPARATION.

Octavos.

- Annual Report for 1877.
- Miscellaneous Publications, No. 12.
- Miscellaneous Publications, No. 13.

Quartos.

- Vol. III. Vertebrate Paleontology of the Eocene Formation.
- Vol. IV. Vertebrate Paleontology of the Miocene Formation.
- Vol. VIII. Parts I, II, and III. Final Geological Reports.
- Vol. XII. Recent fishes of the Western Territories.
- Vol. XIII. Fossil Insects.
- Vol. XIV. North American Mammals.
- Vol. XV. Rhizopods.
- Vol. XVI. Invertebrate Fauna of the Laramie Group.

Maps.

1. Map of the region occupied by the ancient ruins in Southwestern Colorado, Utah, and Northern New Mexico and Arizona.
2. Atlas sheets Nos. 55, 56, and 57 (work of 1877.)

VI.

In regard to duplication of work, I claim, and believe the claim to be susceptible of proof, that there has been no duplication on the part of this survey of the work of other public geological and geographical surveys, made by authority of Congress.

It is true that in 1873, 1874, and 1875, while the survey under my charge was working in Colorado, some of the parties of Lieutenant Wheeler's geographical explorations west of the one hundredth meridian were also working in the same Territory. Estimating the area from Lieutenant Wheeler's published reports of progress, he has surveyed about fifty thousand square miles of Colorado. Of this, only about twelve thousand square miles has been surveyed by parties of the two organizations during the same year. The remaining *three-fourths of this large area has been resurveyed by Lieutenant Wheeler's parties after my parties had performed their work there. It is necessary for me to explain, then, the cause of this apparent duplication of 12,000 square miles. In the first place, the character of Lieutenant Wheeler's work is entirely distinct from that under my charge. His is a geographical survey for military purposes; mine a careful detailed geological and geographical survey. His geographical maps would be of little or no use to me for the representation of geology. (*Vide* Appendix E., No. 1.)

Secondly. In each year I was authorized either by the Secretary of the Interior or by act of Congress, or both, to survey the region which I did. (*Vide* Appendix A, Nos. 12, 13, and 14.)

In 1876, there can be no question of duplication of work.

In 1877 an area of about three thousand five hundred square miles was surveyed in duplicate by my parties and those of Lieutenant Wheeler. This area lies in the northern part of Utah and the southeastern corner of Idaho, between the meridians of 111° and 112° and the parallels 41° 45' and 43°. My authority for the survey of this area is contained in my letter of instructions from the Secretary of the Interior. (*Vide* Appendix A, No. 18.)

Very respectfully, your obedient servant,

F. V. HAYDEN,
United States Geologist.

Hon. CARL SCHURZ,
Secretary of the Interior.

APPENDIX A.

No. 1—1867.

"That the unexpended balance of the appropriations heretofore made for defraying the expenses of the legislative assembly of the Territory of Nebraska is hereby diverted and set aside for the purpose of procuring a geological survey of Nebraska, said survey to be prosecuted under the direction of the Commissioner of the General Land Office." (U. S. Statutes at Large, vol. 14, p. 470, sec. 2.)

No. 2—1868.

"That the Commissioner of the General Land Office is hereby authorized to continue the extension of the geological explorations as begun in Nebraska under the provisions of the second section of the deficiency act of Congress, approved March two, eighteen hundred and sixty-seven, United States Statutes eighteen hundred and sixty-six and eighteen hundred and sixty-seven, page four hundred and seventy, to other portions of the public lands; and for that purpose the sum of five thousand dollars is hereby appropriated, out of any money in the Treasury not otherwise appropriated." (U. S. Statutes at Large, vol. 15, page 119, sec. 6.)

No. 3—1869.

"For the continuance of the geological survey of the Territories of the United States, by Professor Hayden, under the direction of the Secretary of the Interior, ten thousand dollars." (U. S. Statutes at Large, vol. 15, page 306.)

No. 4.

WASHINGTON, D. C., April 1, 1869.

SIR: At the close of the last session of the Fortieth Congress, in "Act making appropriations for sundry civil expenses for the government for the year ending June thirty, eighteen hundred and seventy, and for other expenses," the following appropriation was made: "For continuation of the geological survey of the Territories of the United States, by Professor Hayden, under the Secretary of the Interior, ten thousand dollars."

In accordance with this act you are hereby appointed United States geologist for the Territories of Colorado and New Mexico, for the period of one year from the first day of May next, with a salary of three thousand dollars.

With the limited means at your disposal you will be permitted to select your own assistants, and it is expected by this department that you will make your expenditures of the public money with the most rigid economy and care.

You will proceed to the field of your labors as soon as the necessary arrangements can be made and the season will permit, and your attention will be especially directed to the geological, mineralogical, and agricultural resources of the Territories herein designated; you will be required to ascertain the age, order of succession, relative position, dip, and comparative thickness of the different strata and geological formations, and examine with care all the beds, veins, and other deposits of ores, coals, clays, marl, peat, and other mineral substances as well as the fossil remains of the different formations, and you will also make full collections in geology, mineralogy, and paleontology to illustrate your notes taken in the field.

In order that the Secretary of the Interior may be able to present a portion of the results of the survey to Congress at an early day, you will be required to forward to this department a preliminary report of your labors in the field by the first of October next.

It is expected that your final report will embody the entire results of the survey, and be accompanied by a geological map, with carefully prepared sections and diagrams, with drawings and descriptions of the characteristic fossil remains of the different groups of strata.

The collections in geology and natural history, illustrative of your reports, will be forwarded to Washington from time to time, there to be classified and arranged in the museum as required by law.

Very respectfully, your obedient servant,

J. D. COX,
Secretary of the Interior.

Prof. FERDINAND V. HAYDEN,
Washington, D. C.

No. 5—1870.

"For continuing the geological survey of the Territories of the United States by Professor Hayden, under the direction of the Secretary of the Interior, twenty-five thousand dollars." (U. S. Statutes at Large, vol. 16, page 306.)

No. 6.

DEPARTMENT OF THE INTERIOR,

Washington, D. C., July 13, 1870.

SIR: In accordance with an act of the third session Forty-first Congress, making appropriations "for the continuation of the geological survey of the Territories of the United States," dated July, 1870, you are appointed United States geologist, to date from the 1st day of July, 1870, with a salary of \$3,000 per annum.

You will be permitted to select your own assistants, who will be entirely subject to your orders, and all your expenditures of the public funds are expected to be made with judicious economy and care.

The area of your exploration must necessarily be discretionary to some extent, but owing to the lateness of the season and the limited time for field-work, it is thought advisable by this department that the field of your labor be confined principally to Wyoming and such portions of contiguous Territories as may be deemed desirable.

You will be required to secure as full material as possible for the illustration of your final report, such as sketches, photographs, &c. It is desirable that your collections in all departments should be as complete as possible, and you will forward them to the Smithsonian Institution to be arranged according to law.

You will be expected to prepare a preliminary report of your labors, which will be ready for publication by January 1, 1871.

You are referred to your instructions of last season for the details of your duties in the field.

Very respectfully, your obedient servant,

J. D. COX, *Secretary.*F. V. HAYDEN, Esq., *Present.*

No. 7—1871.

"For continuing the geological survey of the Territories of the United States by Professor Hayden, under the direction of the Secretary of the Interior, forty thousand dollars." (U. S. Statutes at Large, vol. 16, page 503.)

No. 8.

DEPARTMENT OF THE INTERIOR,

Washington, D. C., May 1, 1871.

SIR: In accordance with the act of the third session of the Forty-first Congress, making appropriations "for the continuation of the geological survey of the Territories of the United States," dated March 4, 1871, you are appointed United States geologist, to date from the 1st day of July, 1871, with a salary of \$4,000 per annum.

You will be permitted to select your own assistants, who will be entirely subject to your orders, and all your expenditures of the public funds are expected to be made with judicious economy and care.

The area of your explorations must be to some extent discretionary, but in order that you may continue your labors of preceding years, geographically, your explorations of the present season will be confined mostly to the Territories of Idaho and Montana. It is probable that your most available point of departure will be Salt Lake City, proceeding thence northward along the mail-route as a base to Helena, Montana, and completing the season's work about the sources of the Missouri and Yellowstone Rivers.

You will be required to make such instrumental observations, astronomical and barometrical, as are necessary for the construction of an accurate geographical map of the district explored, upon which the different geological formations may be represented with suitable colors.

As the object of the expedition is to secure as much information as possible, both scientific and practical, you will give your attention to the geological, mineralogical, zoological, botanical, and agricultural resources of the country. You will collect as ample material as possible for the illustration of your final report, such as sketches, sections, photographs, &c.

Should your route lead you in the vicinity of any of our Indian tribes you will secure such information in regard to them as will be useful to this department or the country.

It is desirable that your collections in all departments shall be as complete as possible and you will forward them to the Smithsonian Institution to be arranged according to law

You will be expected to prepare a preliminary report of your labors, which will be ready for publication by January 1, 1872.

You are referred to your instructions of previous years for the details of your duties in the field.

I am, sir, very respectfully, your obedient servant,

C. DELANO,
Secretary.

FERD. V. HAYDEN, Esq.,
United States Geologist, Washington, D. C.

No. 9—1872.

"For the continuation of the geological survey of the Territories of the United States by Prof. F. V. Hayden, under the direction of the Secretary of the Interior, during the fiscal year ending June thirtieth, eighteen hundred and seventy-three, seventy-five thousand dollars."—(U. S. Statutes at Large, vol. 17, page 350.)

No. 10.

DEPARTMENT OF THE INTERIOR,
Washington, D. C., May 31, 1872.

SIR: In accordance with the act of Congress (second session, Forty-second Congress) making appropriation for the continuation of the geological survey of the Territories of the United States, you are hereby appointed United States geologist for the fiscal year ending June 30, 1873.

Your salary will be at the rate of \$4,500 per annum, and it is expected that your expenditures will be made with rigid economy and care.

For the details of your instructions, which are necessary to guide your operations in the field, you are referred to those which have been issued to you in your previous expeditions under direction of this department.

The object of a geological survey, as understood by this department, comprises all branches of natural science. You will, therefore, give your attention, as far as it may be in your power, to all sources of information which may be rendered useful to this department, to the country, or to science.

The department leaves it to your discretion to judge in what manner the objects of the expedition can be best promoted. You will report to this department the progress of your labors in the field as often as your facilities will permit.

I am, sir, very respectfully, your obedient servant,

B. R. COWEN,
Acting Secretary.

Prof. F. V. HAYDEN, *Present.*

No. 11—1873.

"For the continuation of the geological and geographical survey of the Territories of the United States by Professor F. V. Hayden, under the direction of the Secretary of the Interior, during the fiscal year ending June thirtieth, eighteen hundred and seventy-four, seventy-five thousand dollars, to be available on the passage of this act."—(U. S. Statutes at Large, vol. 17, page 513.)

No. 12.

DEPARTMENT OF THE INTERIOR,
Washington, D. C., May 13, 1874.

SIR: In reply to your verbal inquiry, in relation to the instructions from this department for your guidance in continuing the geological survey of the Territories during the season of 1873, I have to say that no written instructions were deemed necessary, but you were verbally referred to the general instructions for the previous year. The area of your labors during said season was indicated in my letter of January 27, 1873, to the Speaker of the House of Representatives, wherein your proposition to make the eastern portion of the Rocky Mountain Range in Colorado and New Mexico the field of your survey, was approved by this department.

I am, sir, very respectfully, your obedient servant,

B. R. COWEN,
Acting Secretary.

Prof. F. V. HAYDEN,
United States Geologist.

Letter of the Secretary of the Interior to Speaker of House of Representatives, January 27, 1873, with inclosure referred to in preceding letter.

DEPARTMENT OF THE INTERIOR,
Washington, D. C., January 27, 1873.

SIR: I have the honor to transmit herewith a copy of a letter of this date from Prof. F. V. Hayden, United States geologist, submitting an estimate of appropriations, copy also herewith, required for the continuation of the geological survey of the Territories of the United States under the direction of this department.

The results of Professor Hayden's labors in his several surveys, made under the direction of this department, are most important and useful to the country at large, and in view of the immense field yet unexplored, a continuance of his operations, looking toward the development of our vast territorial domain, is deemed a subject worthy of favorable consideration by Congress.

Concurring in the views contained in Professor Hayden's letter, I earnestly recommend the appropriation of the sum asked for by him.

I am, sir, very respectfully, your obedient servant,

B. R. COWEN,
Acting Secretary.

Hon. JAMES G. BLAINE,
Speaker of the House of Representatives.

DEPARTMENT OF THE INTERIOR,
Washington, D. C., January 27, 1873.

SIR: I would most respectfully ask the attention of the Secretary of the Interior to the following views, in behalf of an appropriation for the expense of continuing the geological survey of the Territories of the United States during the fiscal year ending June 30, 1874.

The success which has attended its efforts during the past six years, the publication and distribution of its annual reports, which have been received with great favor, not only by the people in our own country, but in all parts of the world, would appear to entitle it to the confidence of Congress. I therefore venture to ask that additional power be given it to increase its efficiency, that it may continue to command the respect not only of men of science, but of the intelligent world generally.

For the last two years the survey has operated about the sources of the Missouri and Yellowstone Rivers, but the expenses of transportation, subsistence, and labor are so great, that it seems desirable to delay the further prosecution of the work in the Northwest until railroad communication shall be established. The Indians, also, are in a state of hostility over the greater portion of the country which remains to be explored. It seems desirable, therefore, to transfer the field of labor, for the coming season, to the eastern portion of the Rocky Mountain range, in Colorado and New Mexico. I propose to commence with the southern limit of the belt of the survey of the fortieth parallel, so successfully completed under the direction of Mr. Clarence King. The north limit of the area marked out is latitude $40^{\circ} 30'$; the western limit, the east bank of the Green and Colorado Rivers; the eastern limit, the 103^d meridian west of Greenwich, extending the belt southward to the south line of the United States.

There is probably no portion of our continent, at the present time, which promises to yield more useful results, both of a practical and scientific character. This region seems to be unoccupied, at this time, as far as I am aware, by any other survey under the government, and the prospect of its rapid development within the next five years, by some of the most important railroads in the West, renders it very desirable that its resources be made known to the world at as early a date as possible.

To render the organization more perfect, and to guarantee that it can meet the demands of the government, so far as its duties are concerned, Mr. J. T. Gardner, so long favorably known as the chief topographer of the geological survey of the fortieth parallel, under the direction of Mr. Clarence King, has become associated with me as chief of the topographical staff. Mr. Gardner brings with him to this work the ripe experience of ten years of topographical work, extending over an area from the Pacific coast to the east base of the Rocky Mountains.

Mr. Gardner thus expresses his conception of a true topographical map for geological purposes:

"For making maps suited to geological purposes it is necessary to carry over the country a systematic trigonometric and topographical survey, checked by astronomical observations. The maps must represent the features of the country accurately, and in bold relief; or, in other words, they must be a picture of the earth's surface as one would see it looking down from above."

The work of the survey as contemplated by the present organization demands the very highest order of talent. To command this, it is necessary that the young men who may embark in this enterprise should feel a confidence in the permanency of the work, instead of regarding it as a stepping-stone to more lucrative positions. Each professional assistant is

worth to the government from fifty to one hundred per cent. more every succeeding year. To make thorough astronomical, topographical, meteorological, geological, and botanical researches, and to develop the mining and agricultural resources properly, trained experts in all the different departments are absolutely essential. Such men, to identify themselves permanently with the survey, must be paid in proportion to their abilities.

I venture to assure you that the most rigid economy will be exercised in the expenditure of the public money under all circumstances.

In support of these views I would most earnestly beg your sanction to the estimate of \$100,000 for the continuation of the survey.

I have the honor to be, your obedient servant,

F. V. HAYDEN,
United States Geologist.

Hon. C. DELANO,
Secretary of the Interior.

No. 13—1874.

"For the continuation of the geological and geographical survey of the Territories of the United States by F. V. Hayden, to continue the work westward toward the Green and Colorado Rivers, seventy-five thousand dollars, under the direction of the Secretary of the Interior, during the fiscal year ending June thirtieth, eighteen hundred and seventy-five."—(U. S. Statutes at Large, vol. 18, page 207.)

No. 14—1875.

"For the continuation of the geological and geographical survey of the Territories of the United States, under the direction of the Secretary of the Interior, during the fiscal year ending June thirtieth, eighteen hundred and seventy-six, under F. V. Hayden, in Colorado and such adjacent portions of Utah and New Mexico as were not explored the preceding year, seventy-five thousand dollars, to be immediately available."—(U. S. Statutes at Large, vol. 18, page 384.)

No. 15—1876.

"For the continuation of the geological and geographical survey of the Territories of the United States, under the direction of the Secretary of the Interior, by Professor F. V. Hayden, sixty-five thousand dollars."—(U. S. Statutes at Large, vol. 19, page 120.)

No. 16.

DEPARTMENT OF THE INTERIOR,
Washington, D. C., August 2, 1876.

SIR: Pursuant to the provisions of an act of Congress entitled "An act making appropriations for sundry civil expenses of the government for the fiscal year ending June thirtieth, one thousand eight hundred and seventy-seven, and for other purposes," approved July 31, 1876, wherein an appropriation of \$65,000 is made "for the continuation of the geological and geographical survey of the Territories of the United States," you are hereby authorized and directed to continue in charge of the United States geological and geographical survey of the Territories for and during the fiscal year ending June 30, 1877. Your salary will be at the rate of \$4,500 per annum, and it is expected that the expenditures incidental to the survey will be made with economy and care.

You will be permitted to retain those assistants, now connected with the survey, whose continued services are necessary to its efficiency, and to fill such vacancies as may occur by employing persons who possess the necessary qualifications for the discharge of the special duties that will be required of them. Your assistants will act under your immediate direction and be amenable to you alone, while you will be held strictly responsible by this department for the whole trust hereby confided to you.

Your operations during the present season will be devoted firstly to the completion of Colorado, and such portions of the adjacent Territories of Utah and New Mexico as are necessary to the completion of the six sheets which are to compose your geological atlas. Should your time and means permit, you will direct your further labors to such portions of Wyoming, Idaho, and Montana Territories as were not examined in your previous explorations. The survey will be conducted after the manner of that conducted by you during the past year, with such improvements, in its details, as may suggest themselves to you.

In the prosecution of your surveys you will, when necessary, consult such public land surveys as have been made under this department in the field of your work, for the purpose of connecting the established lines with your system of triangulation, and of accurately designating on your maps the position of mineral claims. You will determine, as far as

possible, the boundaries of Territories and Indian reservations, and mark the same by suitable monuments. You will also ascertain the position of all agricultural lands, and of such mineral lands as you may discover, by trigonometrical measurements, placing suitable monuments thereon for the guidance of the surveyors-general of the several districts which may be explored by you.

It will be borne in mind that the ultimate design to be accomplished by these surveys is the preparation of suitable maps of the country surveyed for the use of the government and of the nation, which will afford full information concerning the agricultural and mineral resources, and other important characteristics of the unexplored regions of our Territorial domain. To this end, a general plan for mapping the area of your survey should be followed. Such a plan was adopted by this department last year, and accompanied your instructions for that year. You will continue to conform to said plan, and will make such scientific observations, touching the geology, geography, mineralogy, and meteorology of the country surveyed by you, as may be necessary for the preparation of such maps. In addition thereto, you will obtain the necessary information for the preparation of charts, upon which shall be indicated the areas of grass, timber, and mineral lands, and such other portions of the country surveyed as may be susceptible of cultivation by means of irrigation; and will ascertain and report upon the best methods for accomplishing this result.

For more specific directions as to your duties in the field, you are referred to the instructions given by this department for your guidance in conducting similar surveys in past years.

You will please report to this department, from time to time, the progress of your survey.

I am, sir, very respectfully your obedient servant,

Z. CHANDLER,
Secretary.

Prof. F. V. HAYDEN,
Washington, D. C.

No. 17—1877.

"For the continuation of the geological and geographical survey of the Territories of the United States, under the direction of the Secretary of the Interior, by Professor F. V. Hayden, seventy-five thousand dollars, to be immediately available."

No 18.

DEPARTMENT OF THE INTERIOR, OFFICE OF THE SECRETARY,
Washington, D. C., March 10, 1877.

SIR: Pursuant to the provisions of an act of Congress entitled "An act making appropriations for sundry civil expenses of the government for the fiscal year ending June thirtieth, one thousand eight hundred and seventy-eight, and for other purposes," approved March 4, 1877, wherein an appropriation of \$75,000 is made "for the continuation of the geological and geographical survey of the territories of the United States," you are hereby authorized and directed to continue in charge of the United States geological and geographical survey of the territories, for and during the fiscal year June 30, 1878. Your salary will be at the rate of \$4,500 per annum, and it is expected that the expenditures incident to the survey will be made with economy and care.

You will be permitted to retain those assistants now connected with the survey whose continued services are necessary to its efficiency, and to fill such vacancies as may occur, by employing persons who possess the necessary qualifications for the discharge of the special duties that will be required of them. Your assistants will act under your immediate direction and be amenable to you alone, while you will be held strictly responsible by this department for the whole trust hereby confided to you.

Your operations during the coming season will be devoted to such portions of Wyoming, Idaho, and Montana as lie between latitude $41^{\circ} 45'$ and $45^{\circ} 30'$, and between longitude 107° and 115° , embracing atlas sheets numbers 35, 36, 37, 44, 45, 46, 55, 56, and 57. The survey will be conducted after the manner of that conducted by you during the past year, with such improvements in its details as may suggest themselves to you.

In the prosecution of your surveys you will, when necessary, consult such public land surveys as have been made under this department, in the field of your work, for the purpose of connecting the established lines with your system of triangulation, and of accurately designating on your maps the position of mineral claims. You will determine as far as possible the boundaries of Territories and Indian reservations, and mark the same by suitable monuments. You will also ascertain the position of all agricultural lands, and of such mineral lands as you may discover, by trigonometrical measurements, placing suitable monuments thereon for the guidance of the surveyors-general of the several districts which may be explored by you.

It will be borne in mind that the ultimate design to be accomplished by these surveys is the preparation of suitable maps of the country surveyed for the use of the government and

of the nation, which will afford full information concerning the agricultural and mineral resources, and other important characteristics of the unexplored regions of our territorial domain. To this end, a general plan for mapping the area of your survey should be followed. Such a plan was adopted by this department last year, and accompanied your instructions for that year. You will continue to conform to said plan, and will make such scientific observations, touching the geology, geography, mineralogy, astronomy, and meteorology of the country surveyed by you, as may be necessary for the preparation of such maps. In addition thereto, you will obtain the necessary information for the preparation of charts upon which shall be indicated the area of grass, timber, and mineral lands, and such other portions of the country surveyed as may be susceptible of cultivation by means of irrigation; and will ascertain and report upon the best methods for accomplishing this result.

For more specific directions as to your duties in the field, you are referred to the instructions given by this department for your guidance in conducting similar surveys in past years.

You will please report to this department, from time to time, the progress of your survey.

I am, sir, very respectfully, your obedient servant,

Z. CHANDLER, *Secretary.*

Prof. F. V. HAYDEN,
Washington, D. C.

No. 19.

DEPARTMENT OF THE INTERIOR,
Washington, D. C., July 1, 1874.

Instructions for the government of the geological and geographical surveys of the Territories of the United States (authorized by acts of Congress to be made under the direction of the Secretary of the Interior), in the preparation of suitable maps for the construction of an atlas of said Territories.

The following plan for the construction of an atlas of the territory of the United States west of the meridian of 99° 30' has been adopted by this department:

As the area mentioned embraces the greater part of the arid region of the United States, and has within its limits the greater number of mining districts therein, it is necessary that the maps composing the atlas contemplated shall be on a scale of sufficient magnitude to exhibit all the important geographical and geological features of the country, and, in order that the several parties working under the direction of this department may properly connect their work, that the progress made in their surveys may at all times be understood, and that the several surveys may be conducted on a uniform system, this plan has been adopted:

1. There shall be two classes of maps—one known as “general,” the other as “special” maps—and the “general” maps shall be subdivided into two classes, viz: “Topographical” and “geological.”

2. The general maps shall be on a scale of four miles to an inch, or $\frac{1}{25000}$. The sheets thereof shall be 26 inches long by 37 inches wide, including the border, and to be folded once. The area to be represented on each sheet shall be two and one-half degrees in longitude, and one and one-fourth degrees in latitude. The one hundred and twelfth meridian shall be taken as the standard from which the maps are to be projected in an easterly and westerly direction, and the thirty-eighth parallel as the standard from which they shall be projected in a northerly and southerly direction, these lines forming the division lines between the atlas-sheets adjacent thereunto.

3. Maps or charts of the second or “special” class may be constructed on other scales and embracing other areas, wherever it shall be found necessary, for the purpose of properly representing mining districts, mineral, agricultural, pasture, or timber lands, or other special purposes.

C. DELANO,
Secretary of the Interior.

No. 20.

Map showing in colors the area surveyed each year from 1867 to 1877, inclusive, transmitted with this letter.

APPENDIX B.

No. 1—1867.

“That the unexpended balance of the appropriations heretofore made for defraying the expenses of the legislative assembly of the Territory of Nebraska is hereby devoted and set aside for the purpose of procuring a geological survey of Nebraska, said survey to be prosecuted under the direction of the Commissioner of the General Land Office.”—U. S. Statutes at Large, vol. 14, p. 470, sec. 2.)

H. Ex. 81—2

No. 2—1868.

"That the Commissioner of the General Land Office is hereby authorized to continue the extension of the geological explorations as begun in Nebraska under the provision of the second section of the deficiency act of Congress, appropriated March two, eighteen hundred and sixty-seven, United States Statutes, eighteen hundred and sixty-six and eighteen hundred and sixty-seven, page four hundred and seventy, to other portions of the public lands, and for that purpose the sum of five thousand dollars is hereby appropriated out of any money in the Treasury not otherwise appropriated."—(U. S. Statutes at Large, vol. 15, page 119, sec. 6.)

No. 3—1869.

"For a continuance of the geological survey of the Territories of the United States, by Professor Hayden, under the direction of the Secretary of the Interior, ten thousand dollars."—(U. S. Statutes at Large, vol. 15, page 306.)

No. 4—1870.

"For continuing the geological survey of the Territories of the United States, by Professor Hayden, under the direction of the Secretary of the Interior, twenty-five thousand dollars."—(U. S. Statutes at Large, vol. 16, page 306.)

No. 5—1871.

"For continuing the geological survey of the Territories of the United States, by Professor Hayden, under the direction of the Secretary of the Interior, forty thousand dollars."—(U. S. Statutes at Large, vol. 16, page 503.)

No. 6—1872.

"For the continuance of the geological survey of the Territories of the United States, by Professor Hayden, under the direction of the Secretary of the Interior, during the fiscal year ending June thirtieth, eighteen hundred and seventy-three, seventy-five thousand dollars."—(U. S. Statutes at Large, vol. 17, page 350.)

No. 7—1872.

"For the preparation and publication of the maps, charts, geological sections, and other engravings necessary to illustrate the final report of the United States geological survey of the Territories, by Professor Hayden, ten thousand dollars, to be expended under the direction of the Secretary of the Interior."—(U. S. Statutes at Large, vol. 17, page 131.)

No. 8—1873.

"For the continuation of the geological and geographical survey of the Territories of the United States, by Professor F. V. Hayden, under the direction of the Secretary of the Interior, during the fiscal year ending June thirtieth, eighteen hundred and seventy-four, seventy-five thousand dollars, to be available on the passage of this act."—(U. S. Statutes at Large, vol. 17, page 513.)

No. 9—1873.

"For the preparation and publication of the maps, charts, geological sections, and other engravings necessary to illustrate the annual and final reports of the United States geological survey of the Territories, twenty thousand dollars, to be expended under the direction of the Secretary of the Interior, to be available for immediate use."—(U. S. Statutes at Large, vol. 17, page 513.)

No. 10—1874.

"For the continuation of the geological and geographical survey of the Territories of the United States, by F. V. Hayden, to continue the work westward toward the Green and Colorado Rivers, seventy-five thousand dollars, under the direction of Secretary of the Interior, during the fiscal year ending June thirtieth, eighteen hundred and seventy-five."—(U. S. Statutes at Large, vol. 18, page 207.)

No. 11—1874.

"For the preparation and publication of the maps, charts, geological sections, and other engravings necessary to illustrate the reports of the United States geological survey of the Territories, twenty thousand dollars, to be expended under the direction of the Secretary of the Interior."—(U. S. Statutes at Large, vol. 18, page 207.)

No. 12—1874.

"For completion of the work of the geological and geographical survey of the Territories of the United States, by Professor F. V. Hayden, during the fiscal year ending June thirtieth, eighteen hundred and seventy-four, to be expended under the direction of the Secretary of the Interior, twenty thousand dollars."—U. S. Statutes at Large, vol. 18, page 143.)

No. 13—1875.

"For the continuation of the geological and geographical survey of the Territories of the United States, under the direction of the Secretary of the Interior, during the fiscal year ending June thirtieth, eighteen hundred and seventy-six, under F. V. Hayden, in Colorado and such adjacent portions of Utah and New Mexico as were not explored the preceding year, seventy-five thousand dollars, to be immediately available."—(U. S. Statutes at Large, vol. 18, p. 374.)

No. 14—1875.

"For the preparation and publication of the maps, charts, geological sections, and other engravings necessary to illustrate the reports of the United States geological and geographical survey of the Territories, twenty thousand dollars, to be expended under the direction of the Secretary of the Interior."—(U. S. Statutes at Large, vol. 18, page 374.)

No. 15—1876.

"For the continuation of the geological and geographical survey of the Territories of the United States, under the direction of the Secretary of the Interior, by Professor F. V. Hayden, sixty-five thousand dollars."—(U. S. Statutes at Large, vol. 19, page 120.)

No. 16—1877.

"For the continuation of the geological and geographical survey of the Territories of the United States, under the direction of the Secretary of the Interior, by Professor F. V. Hayden, seventy-five thousand dollars, to be immediately available."—(U. S. Statutes at Large, not yet published.)

Tabular statement of the annual expenditures of the United States Geological and Geographical Survey of the Territories from 1869 to 1877, inclusive:

Year.	Preparation and engraving of illustrations and maps.	Salaries of scientists in office and field.	Office and general expenses.				Salaries of employees.	Transportation.
			Office rent.	Purchase and repair of instruments.	Stationery.	Furniture, fuel, draysage, carpenter's work, and other incidental expenses for the office.		
1869	\$30 00	\$7, 150 00	.....	\$40 55	\$90 99	\$37 00	\$731 73	.....
1870	1, 050 46	12, 740 00	\$175 00	1, 015 25	334 27	198 17	2, 253 05	\$1, 537 15
1871	2, 023 11	20, 270 86	453 00	1, 005 70	614 16	820 47	4, 863 96	2, 022 34
1872	10, 419 68	31, 873 40	895 00	2, 176 20	915 51	2, 126 90	8, 703 47	7, 563 18
1873	21, 338 26	27, 715 82	1, 703 00	1, 033 08	879 05	1, 021 98	6, 257 19	6, 409 23
1874	22, 380 27	47, 462 91	2, 910 00	1, 841 24	508 27	2, 306 15	9, 718 78	6, 032 86
1875	22, 288 69	40, 570 89	3, 390 00	277 92	809 94	1, 171 37	9, 699 57	3, 734 56
1876	11, 606 51	29, 730 99	3, 586 67	984 25	1, 128 68	963 57	4, 932 59	3, 325 18
1877	21, 768 69	27, 011 40	1, 795 00	655 50	982 90	1, 427 09	6, 600 09	4, 819 99
Total	112, 905 67	244, 526 27	14, 907 67	9, 029 69	6, 263 77	10, 072 70	53, 760 43	35, 444 49

The amounts of \$5,000 each for the years 1867 and 1868, were expended under the Commissioner of the General Land Office, and incorporated in his accounts.

Year.	Field expenses.					Total amount of vouchers.	Amount appropriated by Congress.	Sale of government property.	Total amount expended.
	Subsistence and medical supplies.	Freight and expressage.	Purchase and ranching of animals.	Purchase and repair of field equipage.	Blacksmithing, toll, horse-feed, wood, telegrams, and other incidental expenses in the field.				
1869.....	\$824 73	\$220 35	\$658 50	\$269 45	\$224 00	\$10,277 30	\$10,000 00	\$277 30	\$10,277 30
1870.....	2,159 61	535 67	98 65	1,708 18	1,281 29	25,086 75	25,000 00	86 75	25,086 75
1871.....	3,053 13	1,608 49	1,143 50	1,354 04	1,217 24	40,450 00	40,000 00	450 00	40,450 00
1872.....	6,788 17	2,292 53	6,579 25	1,795 81	1,667 15	83,796 25	*81,000 00	2,796 25	83,796 25
1873.....	7,107 08	2,658 28	12,264 54	4,670 92	1,941 57	95,000 00	95,000 00	.....	95,000 00
1874.....	5,116 94	1,795 77	9,421 80	3,901 01	1,604 00	115,000 00	115,000 00	.....	115,000 00
1875.....	4,969 37	1,884 01	3,279 19	1,410 89	1,668 60	95,155 00	95,000 00	155 00	95,155 00
1876.....	2,163 39	1,407 21	2,389 75	1,437 11	1,444 10	65,100 00	65,000 00	100 00	65,100 00
1877.....	3,544 95	1,480 48	2,245 17	1,803 18	981 32	75,115 76	75,000 00	136 38	75,136 38
Total.....	35,727 37	13,882 79	38,080 35	18,350 59	12,029 27	604,981 06	601,000 00	4,001 68	604,981 06
Total amount appropriated by Congress from 1867 to 1877, inclusive.....								.....	615,000 00
Total amount of sales of government property from 1867 to 1877, inclusive.....								.....	4,001 68
Amount of vouchers apportioned as per statement.....								.....	619,001 68
Amount of vouchers for years 1867 and 1868 not accounted for.....								604,981 06	.....
Amount of bill (chap. 217, U. S. Stat. at Large, vol. 18, part 3, p. 663), relief of Dr. Hayden.....								10,000 00	.....
Amount of cash on hand in Treasury.....								3,825 00	.....
Amount still owing Treasury personally by Dr. Hayden.....								20 62	.....
								175 00	14,020 62
								619,001 68	619,001 68

† In Treasury 20.62, making 75,115.76.

APPENDIX C.

No. 1.

ORDNANCE OFFICE, WAR DEPARTMENT,

Washington, June 27, 1874.

SIR: In reply to your request of 26th instant, I have to inform you that the commanding officer of Washington arsenal has been instructed to sell to you such arms and ammunition as you may need in prosecution of the surveys with which you are charged.

The arms, &c., may be had at any time, upon application at that arsenal.

Respectfully, your obedient servant,

S. V. BENÉT,

Brigadier-General, Chief of Ordnance.

F. V. HAYDEN,

United States Geologist, Washington, D. C.

No. 2.

WAR DEPARTMENT.

Washington City, July 5, 1870.

SIR: The Secretary of War instructs me to inform you that directions have been given to the Quartermaster-General of the Army to allow you, in the prosecution of your geological surveys in the Rocky Mountain region, to use public transportation when the same can be spared, on your giving proper security for its return and for payment of deterioration or loss; and also to the Commissary-General of Subsistence, to permit you to purchase subsistence

stores, when they can be spared, for cash, at cost prices, including transportation thereof.

Very respectfully, sir, your obedient servant,

ED. SCHRIVER,
Major-General.

Prof. F. V. HAYDEN,
Washington City.

No. 3.

WAR DEPARTMENT,
Washington City, March 25, 1871.

To commanding officers of posts on the route of the geological explorations by Professor Hayden:

You are hereby authorized to allow Professor Hayden to purchase such necessary subsistence stores as can be spared from those provided for the Army, at cost price, including transportation, for cash. Also, to lend to him means of transportation, on proper security being given for its return and payment of deterioration or loss, if it can be spared. Also, a small escort, when deemed necessary, and the public service will permit.

WM. W. BELKNAP,
Secretary of War.

Professor HAYDEN.

No. 4.

WAR DEPARTMENT, ADJUTANT-GENERAL'S OFFICE,
Washington May 20, 1872.

SIR: I have the honor to inform you the Department of the Interior represents that Professor Hayden is about to take the field again the coming season, to continue his explorations in the region about the sources of the Missouri River, and would be glad to secure such aid from the military authorities of the West in the way of transportation, the purchase of subsistence stores, repairs, &c., as can be afforded without manifest injury to the service.

The Secretary of War directs that such aid as can be furnished without detriment to the military interests be extended to Professor Hayden and his party in their proposed exploration, and you will please cause the necessary instructions to be issued to that end.

A copy of the instructions of the department in the matter last year is herewith inclosed.

Very respectfully, your obedient servant,

E. D. TOWNSEND,
Adjutant-General.

To the COMMANDING GENERAL,
Military Division of the Missouri, Chicago, Ill.

Official copy respectfully furnished for the information of Prof. F. V. Hayden, Interior Department.

E. D. TOWNSEND,
Adjutant-General.

No. 5.

WAR DEPARTMENT, ADJUTANT GENERAL'S OFFICE,
Washington, April 4, 1873.

SIR: I have the honor to inform you it is stated by the Interior Department that Dr. F. V. Hayden, United States Geologist, is about to take the field again under its direction for the purpose of continuing geological and geographical explorations in Colorado Territory, between the one hundredth parallel west longitude and the Colorado and Green Rivers, and is desirous of securing such aid from the military authorities of the Department of the Missouri as can be afforded without detriment to the service.

The Acting Secretary of War directs that similar assistance to that granted last year (under the Secretary's instructions communicated in letter of May 20, 1872, from this office), in the way of transportation, the purchase of subsistence stores, repairs, &c., be extended to Dr. Hayden and party the coming season, so far as the interests of the military service will permit; and you will please cause the necessary instructions to be issued to the parties concerned.

Very respectfully, your obedient servant,

E. D. TOWNSEND,
Adjutant-General.

To the COMMANDING GENERAL,
Military Division of the Missouri, Chicago, Illinois.

Official copy respectfully furnished for the information of Dr. F. V. Hayden, Interior Department.

E. D. TOWNSEND,
Adjutant-General.

No. 6.

QUARTERMASTER-GENERAL'S OFFICE,
Washington, May 3, 1873.

Lieutenant-General SHERIDAN,
Chicago, Illinois:

Dr. Hayden, under authority of the order of the Secretary, as last year, asks that depot quartermaster at Cheyenne be immediately telegraphed to allow him to have, on same terms as last year, Army saddles, pack-harness, tents, and camp equipage of any kind, which are not in condition to be issued as serviceable to the Army, but which his agent may desire as able to serve on the slow marches of the survey; also, any mules which are not fit for Army use, and which would be sold, but which he might be able to get some service out of, and even to recuperate, as was done last year. This will not interfere with available Army transportation, and yet last year this sort of aid saved his appropriation much expenditure, and the account was balanced by his paying the Quartermaster's Department less than three hundred dollars for deterioration on his returning the property. There is always much about a depot of this character very useful to such an expedition, but which would not serve a military march. I request that you do this.

M. C. MEIGS,
Quartermaster-General.

True copy.

M. I. LUDINGTON,
Quartermaster, United States Army.

No. 7.

OFFICE COMMISSARY-GENERAL OF SUBSISTENCE,
Washington City, May 13, 1874.

SIR: Referring to your letter of the 11th instant, requesting information as to the money value of Army supplies furnished by this department to Professor Hayden since the year 1866, I have the honor to report that prior to the issuance of General Order No. 81, of August 13, 1872, sales of subsistence stores to citizens employed with the Army and to citizens under special authority from the War Department were entered on the same abstract, and that, inasmuch as all the supplies furnished by officers of this department to Professor Hayden were paid for at the time of sale, no separate account of the sale was kept. It is, therefore, impossible to furnish the desired statement prior to 1873.

In the month of May, 1873, subsistence stores to the value of \$353.38 were sold for cash to Professor Hayden by Capt. A. K. Long, commissary of subsistence United States Army, at Cheyenne depot, Wyoming Territory.

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

A. E. SHIRAS.
Acting Commissary-General of Subsistence.

The Hon. SECRETARY OF WAR.

APPENDIX D.

Nos. 1-7.

Consist of a full set of the publications of the survey, including reports, maps, charts, &c., from 1867 to 1878, transmitted with letter.

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