

GEOLOGICAL AND GEOGRAPHICAL SURVEYS.

L E T T E R

FROM

THE SECRETARY OF THE INTERIOR,

TRANSMITTING

A report of Professor Powell in regard to surveys, in response to a resolution of the House of Representatives.

APRIL 30, 1878.—Referred to the Committee on Appropriations and ordered to be printed.

DEPARTMENT OF THE INTERIOR,
Washington, D. C., April 29, 1878.

SIR: In reply to the request of the House of Representatives contained in a resolution, passed on the 8th ultimo, for information in regard to the Geological and Geographical surveys conducted under or by authority of the Interior Department during the past ten years, I have the honor to transmit herewith a report from Maj. J. W. Powell upon the subject-matter of said resolution so far as it relates to the survey under his charge.

Very respectfully,

C. SCHURZ,
Secretary.

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

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOGRAPHICAL AND GEOLOGICAL
SURVEY OF THE ROCKY MOUNTAIN REGION,
Washington, D. C., April 27, 1878.

SIR: The following statement is made in reply to your letter of the 11th ultimo, requesting from me an answer to the resolution of the House of Representatives, made on motion of Mr. Atkins, as follows:

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, from what funds transportation and office rents have been paid, together with a list of publications made and in progress, as a 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 reason why they have been made.

Answer is made to the several questions contained in the letter of inquiry *seriatim*, under the following heads:

- I. Areas of territory surveyed.
- II. The years in which the districts or areas were surveyed.
- III. The cost incurred by direct appropriations made by Congress.
- IV. Aid received from the Ordnance, Commissary, and Quartermaster's Departments, outside of direct appropriations.
- V. The funds from which transportation and office rents have been paid.
- VI. List of publications made and in progress as the results of such surveys.

VII. Duplication of other public geological and geographical surveys made by authority of Congress.

For the purpose of giving a graphic representation of some of the more important facts set forth in the statement, I transmit herewith a map of the United States on which the area west of longitude $99^{\circ} 30'$ has been plotted to exhibit the atlas-sheet districts as established by the Department of the Interior for the guidance of all parties carrying on geographic surveys under the direction of that department. The following is a copy of the instructions received by me in relation to this matter:

* * * * *

The following plan for the construction of an atlas of the territory of the United States, west of the meridian of $99^{\circ} 30'$, 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 $\frac{1}{253440}$. 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 112th meridian shall be taken as the standard from which the maps are to be projected in an easterly and westerly direction, and the 38th 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 thereto.

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

C. DELANO,
Secretary of the Interior.

I.—THE AREAS OF TERRITORY SURVEYED.

The areas of territory surveyed under my direction are as follows:

	Square miles.
I. The eastern portion of the Uinta Mountains and the region of country adjacent thereto, embraced within meridians $108^{\circ} 30'$ and $109^{\circ} 52'$ west longitude, and parallels $40^{\circ} 15'$ and $41^{\circ} 40'$ north latitude, containing an area of	7, 750
The survey of the area mentioned above was made prior to the establishment of the atlas-sheet districts.	
II. District 76, embraced within meridians $109^{\circ} 30'$ and 112° , and parallels $39^{\circ} 15'$ and $40^{\circ} 30'$, containing an area of.....	11, 467. 094
III. District 85, embraced within meridians $109^{\circ} 30'$ and 112° , and parallels 38° and $39^{\circ} 15'$, containing an area of.....	11, 674. 005
IV. The eastern portion of district 86. This district is embraced within meridians 112° and $114^{\circ} 30'$, and parallels 38° and $39^{\circ} 15'$, containing an area of 11,674.005 square miles. The part over which the trigonometric survey has been completed embraces	2, 335
V. District 95, embraced within meridians 112° and $114^{\circ} 30'$, and parallels $36^{\circ} 45'$ and 38° , containing an area of	11, 874. 836
VI. A part of district 96. This district is embraced within meridians $109^{\circ} 30'$ and 112° , and parallels $36^{\circ} 45'$ and 38° , containing an area of 11,874.836 square miles. The part over which the trigonometric survey has been completed embraces	6, 410
VII. A part of district 105. This district is embraced within meridians $109^{\circ} 30'$ and 112° , and parallels $35^{\circ} 30'$ and $36^{\circ} 45'$, containing an area of 12,069.166 square miles. The trigonometric survey over this region embraces an area of	1, 400
VIII. A part of district 106. This district is embraced within meridians 112° and $114^{\circ} 30'$, and parallels $35^{\circ} 30'$ and $36^{\circ} 45'$, containing an area of 12,069.166 square miles. The trigonometric survey over this region embraces an area of	7, 025
Total of completed surveys	59, 935. 935
An imperfect reconnaissance has been carried over the remaining portions of 96, 105, and 106, making an area of	21, 178
Total area of completed surveys and reconnaissance surveys.....	81, 113. 935

II.—THE YEARS IN WHICH THE DISTRICTS OR AREAS WERE SURVEYED.

The survey of district No. 1, being the eastern portion of the Uinta Mountains, and a region of country adjacent thereto, so far as the geographic work was concerned, was a reconnaissance; that is, it was not based upon a triangulation extended from measured lines. The time when this region was explored is set forth in my "Report on the Geology of the Uinta Mountains, and a district of country adjacent thereto," as follows:

In the fall of 1868, with a small party of men, I crossed from the White River to the Yampa, and camped at the foot of Junction Mountain; thence I passed northward across the Snake River to the Pine Bluffs, and thence westward across Aspen Mountain to the Green River, and up the bank of that stream to Green River Station; thence I crossed to Bryan, on Black's Fork, and down that stream to its mouth; then went south to the Cameo Mountains; thence eastward to Quien Hornet Mountain; thence to Flaming Gorge, and from this latter point to Ashley Park, and from Ashley Park to Brown's Park. From Brown's Park I went through the Escalante Peaks, near the junction of the Yampa with the Green; thence eastward past Junction Mountain to the White River.

The course thus laid down is the general one of the pack-train, but I myself branched from it in many ways. Early in the spring of 1869 I again crossed from the White River to the Yampa, camped at the foot of Junction Mountain, and spent a few days in the study of the adjacent region. I proceeded thence to Brown's Park, in which I camped for a few days, reviewing the geological studies of the previous fall. I then passed out of the park through Red Creek Cañon, from its head, crossed the divide, and proceeded westward to the Green River, and camped again at Flaming Gorge for a few days. Thence I went up Henry's Fork, studying the region on my way, and crossed the divide to Fort Bridger.

A few weeks subsequent I started on a boat-trip to explore the Lower Green and the Colorado River of the West. On my way I passed through the Uinta Mountains, stopping from time to time to make sections, and to make geological studies of the country along the walls of the cañons.

Again, in 1871, I had a boat-ride down the river. On this trip Mr. John F. Steward, of Plano, Ill., was my assistant. We extended our studies on either side of the river for a distance of from ten to twenty miles.

In 1874 I started with a pack-train from Green River Station, went up Little Bitter Creek, across Quien Hornet Mountain, through Red Creek Cañon into Brown's Park; thence southeastward to the junction of the Snake River with the Yampa, where it was crossed; thence across the Yampa Plateau to the foot of Split Mountain Cañon, and thence to the Uinta Valley. Returning from the Uinta Valley I visited the region drained by Ashley's Fork and Brush Creek, crossed the Uinta Mountains to the head of Sheep Creek, and returned to Green River Station.

The course thus marked down was that followed by the pack-train, which moved but slowly, usually resting two days out of three; while my own line of travel was in diverse directions from this general route.

In 1875, I again started with a pack-train from Green River Station, went east to Rock Springs and Salt Wells; thence south to the mouth of the Vermilion; thence to the eastern foot of the Dry Mountains; thence west through Brown's Park, past Flaming Gorge, to the head of Sheep Creek; and thence through the Cameo Mountains to Green River Station. On this trip, also, the train moved slowly, and my studies were extended many miles in either direction from the general route.

A few days later I made a trip to Salt Wells and Bitter Creek Stations, and particularly examined the region about Black Butte.

In the spring of 1869, and again in the spring of 1871, my parties were compelled to wait several weeks for the rise of the river before embarking at Green River Station for the trips through the cañons. During these times the principal part of the geographical work on the northern end of the district under consideration was performed.

In respect to the areas embraced in the numbered districts, as mentioned above, the following statement is made. In 1869, I descended the Green and Colorado Rivers, embarking at the point where the Union Pacific Railroad crosses the former at Green River Station, and ending the boat journey at the mouth of the Rio Virgen in the southeastern corner of Nevada. On this trip a reconnaissance survey was made of the river, together with considerable portions of the adjacent country. Abandoning my boats at the mouth of the Rio Virgen, I proceeded up this river to Saint Thomas; from thence to Saint George in Utah Territory; from Saint George to Fillmore, and from Fillmore to Salt Lake City; making a reconnaissance on the way, and stopping to establish astronomic stations. In 1870, I started again from Salt Lake City, and proceeded southward, making a reconnaissance of the San Pete Valley, Sevier Valley, Paria Valley, Kanab Valley, Virgen Valley, and all the region from the heads of these streams southward to the Colorado River. I then crossed the Colorado, and made a reconnaissance of the country eastward and southward to the Province of Tusayan, or Moqui Towns. In 1871, I again descended the Green and Colorado Rivers with boats, making a more thorough and final survey of the Colorado itself, and a general reconnaissance to the westward as far as the valleys of the San Pete and the Sevier, and the headwaters of the Rio Virgen; carrying on the work distant from the river by land parties. Early in the year 1872, I sent a party to make a reconnaissance of the Henry Mountains and adjacent country. This was completed by the first of July of the same year. By the first of July, 1872, a general reconnaissance of all the territory thus outlined was completed. The region of country thus indicated is identical with that mentioned above as embraced in districts 76, 85, 86, 95, 96, 105, and 106. By that time I had materials for a reconnaissance map of all the region now under discussion, and during the year reconnaissance maps were constructed for the greater part of the country.

Since the 1st of January, 1872, I have been steadily extending a trigonometric survey over the area thus indicated from two base-lines, one at Kanab, on Kanab Creek, the other at Gunnison, on the Sevier River. The latter trigonometric survey has not been extended beyond the bounds of the original reconnaissance survey in any direction, except in district 96, where the work has been carried into the State of Nevada for the purpose of completing the atlas sheet. But in the region east and south of the Colorado River, in districts 96, 105, and 106, a trigonometric survey has not been carried. Here only reconnaissance surveys have been made, and these less thorough than those made over the regions north and west of the river.

III.—THE COST INCURRED BY DIRECT APPROPRIATIONS MADE BY CONGRESS.

The appropriations made for this work are as follows:

For the fiscal year ending June 30, 1871.....	\$12,000
1872.....	12,000
1873.....	20,000
1874.....	10,000
1875.....	30,000
1876.....	45,000
1877.....	30,000
1878.....	50,000
Total.....	209,000

IV.—AID RECEIVED FROM THE ORDNANCE, COMMISSARY, AND QUARTERMASTER DEPARTMENTS OUTSIDE OF DIRECT APPROPRIATIONS.

Ordnance Department.

From the Ordnance Department of the Army I have drawn no stores.

Commissary Department.

By a joint resolution of Congress, approved June 11, 1868, authority was given to the Secretary of War to issue rations for twenty-five men engaged in work under my direction. Under that authority I have drawn rations for twenty-five men, during all the time I have been engaged in field-operations, which has been on an average about seven months each year. I do not know the cost of these rations.

Quartermaster Department.

From the Quartermaster's Department I have drawn no stores.

Assistance from Army officers.

Two officers of the Army have assisted me in my work from time to time without receiving pay from my direct appropriation, viz:

Capt. C. E. Dutton has been engaged as a geological assistant from May 27, 1875, to October 15, 1875; from August 26, 1876, to November 1, 1876; from May 29, 1877, to October 23, 1877; and from December 23, 1877, to the present, with the pay of his rank in the Army.

Capt. and Brevet Lieut. Col. Garrick Mallery has been engaged as assistant in ethnographic work from June 11, 1877, to the present, with the pay of his rank in the Army.

V.—THE FUNDS FROM WHICH TRANSPORTATION AND OFFICE RENTS
HAVE BEEN PAID.

Field transportation.

All field transportation has been paid for from the direct appropriations mentioned above.

Railroad transportation.

The railroad transportation has been almost entirely without expense to the government. The railroads have generally furnished passes to myself and my assistants, but sometimes we have been required to pay half-fare rates. In these cases the half-fare rates were paid for by the individuals and not by the government. Express charges have been paid on instruments and important collections from the direct appropriations, and, in a few cases, fares for employes have been paid between Chicago and Washington, and also on the Utah Central Railroad.

Office rents.

From 1868 to November, 1874, I had no offices in a government building, nor in any building rented by the government; up to that time I used rooms in my own dwelling, having rooms to spare, and desiring also to use the greatest economy in the expenditure of the small appropriations made for my work. From November, 1874, to May 30, 1877, the fourth story of the building rented by the government, and known as "Wright's Building," on the corner of Eighth and G streets, northwest, was occupied by me. The rent of these rooms was not paid out of the direct appropriation.

From June 1, 1877, to October 30, 1877, a room in the basement of the Interior Department building was occupied as a store-room and office for the survey under my direction. From November 1, 1877, to the present the upper story of Wright's building has been again occupied as work-rooms and offices by parties working under my direction. Three rooms on the second floor of the same building have been occupied in like manner, and two rooms in the basement. No part of the rent of this building has been paid from the direct appropriation made for the work under my direction.

VI.—LIST OF THE PUBLICATIONS MADE AND IN PROGRESS AS THE
RESULT OF SUCH SURVEYS.

Reports completed.

Preliminary Report to the Secretary of the Smithsonian Institution, 8°, 1870-'72.

Preliminary Report to the Secretary of the Smithsonian Institution, 8°, 1872-'73.

Preliminary Report to the Secretary of the Smithsonian Institution, 8°, 1873-'74.

Preliminary Report to the Secretary of the Interior, 8°, 1876-'77.

Report on the Exploration of the Colorado River of the West and its Tributaries, 4°, 1874.

Report on the Geology of the eastern portion of the Uinta Mountains, and a region of country adjacent thereto, 4°, with atlas, 1876.

Contributions to North American Ethnology, vol. I, 4°, 1877.

Contributions to North American Ethnology, vol. III, 4°, 1877.

Introduction to the Study of Indian Languages, 4^o, 1877.

Report on the Geology of the Henry Mountains (in hands of binder), 4^o, 1878.

Chart of Geological Time, exhibiting the correlation of Geological Formations recognized in different portions of the United States, 1878.

Report on the Lands of the Arid Region of the United States made to the Commissioner of the General Land Office, and transmitted to Congress by the honorable the Secretary of the Interior, 1878.

Reports in course of preparation.

Report on the Geology of the High Plateaus of Utah, 4^o, with atlas.

Report on the Geology of the Grand Cañon District, 4^o, with atlas.

Report on the Economic Geology of the Valley of the Colorado, 4^o, with atlas.

Report on the Physical Geography of the Valley of the Colorado, 4^o, with atlas.

Report on the Methods of Survey, with discussion of the Astromomy, Measurement of base lines, Triangulation, Hypsometry, and Topography, 4^o.

Report on the Indians of Oregon, vol. II, Contributions to North American Ethnology, 4^o.

Report on the Linguistic Stocks of North American Indians, with Bibliography, vol. IV, Contributions to North American Ethnology, 4^o.

Report on the Indians of the Tinné Stock, vol. V, Contributions to North American Ethnology, 4^o.

Report on the Indians of the Numa Stock, vol. VI, Contributions to North American Ethnology, 4^o.

Report on the Indians of the Dakota Stock, vol. VII, Contributions to North American Ethnology, 4^o.

Report on the Indians of the Yuma Stock, vol. VIII, Contributions to North American Ethnology, 4^o.

Report on the Pueblo Indians, vol. IX, Contributions to North American Ethnology, 4^o.

Manual of North American Ethnology, 8^o.

In addition to the materials designed for the volumes of Contributions to North American Ethnology mentioned, I have on hand a large number of vocabularies, with grammatical notes, and manuscripts relating to general ethnological subjects, as the habits, customs, social and governmental organizations, mortuary observances, &c., &c., and also large collections deposited on exhibition at the Smithsonian Institution, from which illustrations are to be made for the volumes of this series.

For the reports in course of preparation the following engraving has already been done: Five sheets of the Physical Atlas, districts 85, 95, 96, 105, 106 are being engraved on copper and are about one-half completed. The drawings for district 75 are nearly completed, but the engraving has not been commenced. When the engraving of these sheets is completed, maps can be reproduced for the purposes of other reports to any desired extent, at the cost of printing and paper.

Two hundred and thirty-seven engravings, designed to illustrate the ethnographic reports above mentioned, are now ready.

Plan of publication.

The preliminary reports mentioned above are brief accounts of the progress of the work, submitted from time to time for the information of Congress.

In the publication of the reports of the survey the plan has been adopted of publishing monographs, each one being a final report on the subject to which it relates, and thus embodying all the results of investigations made on a particular subject. This plan was adopted from the following considerations. The cost of the publications would be much less than by the method of elaborate annual reports composed of hastily prepared materials, crude and undigested. A few months' delay in the publication of the results of scientific research is a matter of little moment. The value of any contribution to science depends upon the careful examination of the facts relating thereto, and a thorough discussion of the same, and this cannot be properly accomplished by a hasty presentation to the public for the purpose of claiming priority of discovery. Any abnormal haste in scientific research leads to a heterogeneous collection of facts and confused or erroneous conclusions. There seemed to be no substantial reason why these considerations, universally recognized, should be neglected in the prosecution of scientific work for the general government.

In pursuance of the plan adopted all the parties engaged in the work under my direction have made re-examinations in the field whenever it seemed necessary or wise, in order that the reports of the survey might embody the results of careful research and deliberate judgment, and all injudicious haste has been carefully avoided.

VII.—DUPLICATION OF OTHER PUBLIC GEOLOGICAL AND GEOGRAPHICAL SURVEYS MADE BY AUTHORITY OF CONGRESS.

Overlap of work by Hayden and Powell.

On the 22d of May, 1877, the following letter was addressed to the honorable the Secretary of the Interior, which fully sets forth the facts relating to the duplication of work by Dr. Hayden and myself:

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOGRAPHICAL AND GEOLOGICAL
SURVEY OF THE ROCKY MOUNTAIN REGION,
Washington, D. C., May 22, 1877.

SIR: In obedience to instructions received from the Secretary of the Interior, in the interview given by him to Dr. F. V. Hayden and myself on the 19th instant, I have the honor to make the following statement in relation to the subjects under consideration at that time.

The work performed by the corps under the direction of Dr. Hayden and that of the corps under my direction may be properly thrown into two categories.

First, Geography and Geology. This is the principal work and is practically bounded by definite geographic limits, in the following manner: That portion of the United States west of the meridian $99^{\circ} 30'$, exclusive of Alaska, was by a former Secretary of the Interior divided into districts defined by meridians and parallels, each rectangle thus formed embracing an area of $2\frac{1}{2}$ degrees of longitude by $1\frac{1}{2}$ degrees in latitude. The map of each district thus designated will form a sheet in the general physical atlas now in process of construction by the Interior Department.

Dr. Hayden with his corps is engaged in the survey of certain of these districts; my corps in the survey of certain other districts.

Second. The subordinate and collateral investigations, chiefly embraced under the following heads:

- (A) Natural history, under which are embraced paleontology, zoology, and botany.
- (B) Ethnography.

These investigations, unlike those of the first category, cannot easily be limited to small and accurately defined areas of territory. A proper division of labor and economic publication of results must necessarily rest on some other basis.

That the force of this statement may be properly understood, I beg leave to make the following more specific statements with regard to all the more important fields of subordinate investigation pursued by Dr. Hayden and myself.

NATURAL HISTORY.

PALEONTOLOGY.

A. *Invertebrate Paleontology*.—During the series of years in which Dr. Hayden has been at work in the Western territory he has made extensive collections of invertebrate fossils. A large part of these collections have been studied by Professor Meek, and the results of his studies have been published by Dr. Hayden in an exceedingly valuable quarto volume. The fossils collected since the publication of that volume have not been worked up.

During the time which I have been engaged in field operations much attention has been given to the collection of like material. In the earlier years of my work this was submitted to Professor Meek while he was preparing the volume above mentioned for Dr. Hayden, but Professor Meek was not able to give time to their examination sufficient for the elaboration of a report; but in the year 1875, Dr. C. A. White traveled with me in the field for a few months, and worked the remainder of the year in my office making a preliminary study of my collections.

He has since made a preliminary study of those fossils collected by Dr. Hayden and not reported upon by Professor Meek. As the collections of Dr. Hayden and myself herein referred to are in adjacent regions of country, and belong to geological horizons to a greater or less extent common to both areas, it would be greatly to the advantage of science, and much more economic, if these fossils could be intrusted to the same person and the results of their study combined in one report.

I am not accurately informed of the amount of this material now in Dr. Hayden's hands, but the amount in my hands is very large. Both of us will increase the material this summer, Dr. Hayden probably more than myself. I would be pleased to have Dr. Hayden provide for the more thorough study of this material and the publication of the results, and would be equally pleased to do it myself.

B. *Vertebrate Paleontology*.—In vertebrate paleontology I have made no collections of importance, as this field was so fully occupied by Professors Marsh, Cope, and Leidy.

C. *Fossil Plants*.—In this branch of the work Dr. Hayden has made large collections, and has published one volume on the Cretaceous Flora, prepared by Professor Lesquereux, and brief preliminary notices of certain new species of the Tertiary Flora. He has also, if I am rightfully informed, a volume nearly ready for publication on the Tertiary Flora, prepared by Professor Lesquereux. In addition to this, the doctor has collections of fossil plants in the hands of Prof. J. S. Newberry, and which are to be studied by him.

The parties under my charge have also collected largely in this department from geological horizons, the same as those in which Dr. Hayden obtained his fossils, and of this material I have a large amount. Of the amount and character of the like material which Dr. Hayden has placed in the hands of Professor Newberry, I am not fully informed.

It would manifestly be in the interest of science and economy to consolidate this work, and I would be pleased to have Dr. Hayden take all and provide for its study and to publish the results, or I would be equally pleased to do the same myself.

Dr. Newberry, in whose hands this work has been placed, deems it wise that he should visit certain localities for the purpose of determining with greater certainty the stratigraphic relation of the beds from which some of the plants were taken. In this opinion I fully concur, and believe that the publication should not proceed until such examination is made. I had hoped to provide for this examination by Dr. Newberry, especially as he had signified his willingness to go as a temporary member of my corps.

ZOOLOGY.

A. *Mammalogy*.—In the earlier years of my explorations, before receiving assistance from the general government, I made somewhat extensive collections of mammals, and these collections were deposited in the Smithsonian Institution or distributed among different scientific and educational institutions who aided me in my work. As Dr. Hayden has already commenced a series of publications in this field, I have concluded to publish nothing.

B. *Ornithology*.—In like manner, during the earlier years of my explorations, I made collections of birds. These materials have been placed in the Smithsonian Institution, and Dr. Coues has prepared a report on "The Birds of the Valley of the Colorado River of the West," and the Secretary of the Interior has ordered its publication; about two hundred pages have already been set up.

C. *Herpetology*.—In the earlier years of my work I also made collections of reptiles. This work was done by Mr. Garman, who traveled with me as a volunteer assistant, and he is now engaged in preparing a small series of monographs on some of the more important genera found in the region embraced in my survey.

D. *Entomology*.—I have done no work in this department since the survey under my charge has been carried on by appropriations made by Congress.

In the different branches of zoölogy mentioned above, I am not specifically informed of what Dr. Hayden is doing, but I know in a general way that he is pushing these investigations with vigor, and has done, and is still doing, much more than myself, and I have no doubt that a consolidation of this work would be advantageous and economic.

BOTANY.

In this department I have made large collections through all the years in which I have been at work, and I have materials for a valuable contribution to science, all of which have been distributed among specialists for preliminary study, and the new species have been noticed in the American Journal of Science, for the purpose of fixing the nomenclature.

Some years ago Dr. Hayden published a volume on the botany of Colorado. If I am rightly informed, the doctor has not pursued this branch of investigation since that time.

ETHNOGRAPHY.

Dr. Hayden, previous to the present organization of the United States Geological and Geographical Survey of the Territories under his direction, prepared much material on the ethnography and linguistics of various Indian tribes in the valley of the Missouri; and this material was published in Philadelphia. Since that time I am not aware that the doctor has himself engaged in ethnographic studies.

Mr. E. A. Barber, a member of Dr. Hayden's corps, has collected some material on the Ute language, a part of which has been published, and another part, I believe, is now in the hands of the printer.

In Bulletin No. 1 of volume 3, Dr. Hayden has published three ethnographic papers—one by Brevet Lieut. Col. Garrick Mallory, of the Signal Corps; one by Paul Schumacher, and one by Rev. M. Eells.

In the region surveyed by Dr. Hayden, he has discovered many interesting ruins—a part of a system extending over a very large area in the southwestern part of the United States and into Mexico. The doctor has published notices of these ruins, and has constructed restorations in plaster of some of them.

The photographer of his party, Mr. Jackson, has also in former years visited certain of the pueblos of New Mexico and Arizona, and is now engaged in another expedition for the purpose of studying the same.

The Secretary of the Interior has also ordered the publication of a vocabulary and grammar of the Haidatsa language, prepared by Mr. Matthews, which is to appear as one of Dr. Hayden's reports. This is a reprint, the original having been published by Mr. Shea, of New York. But it is more than that, for it has been enlarged and revised by Mr. Matthews, and it will be a valuable contribution to science.

The doctor has also made a very large and valuable collection of Indian photographs. What other ethnographic material Dr. Hayden has in his hands I am not informed.

To the department of ethnography I have devoted much attention. The ruins found so abundant in Colorado, Arizona, Utah, New Mexico, California, and southward in old Mexico, have been special subjects of study; and as there are yet remnants of these town-building people in the Pueblos of the United States, I have devoted much time and study to these latter Indians, visiting them myself, and sending various of my assistants among them, and making large collections illustrating their arts and industries, habits and customs, and especially their language and mythology, and have in my possession vocabularies of all the Pueblo languages. In the study of the ruins found within what is now the State of Colorado, Dr. Hayden has made an addition to our knowledge of this branch of ethnography which could not have been made by myself in the area to which I was restricted in my geographic work, but in his and my researches among the Pueblos we are duplicating work.

Of the nomadic tribes of North America I have organized an elaborate system of investigation, having as volunteer collaborators many of the most eminent linguists and ethnologists of America. The Smithsonian Institution and other scientific bodies, and a number of scientific men throughout the country, have placed in my hands a large amount of linguistic and other ethnographic material in order that I might, with my corps of assistants, arrange the whole in one systematic account of the North American tribes.

It is almost impossible to study any of the Indians of the United States without in part duplicating what has already been done and is now in my possession, as I have vocabularies and ethnographic notes relating to every Indian tribe in the United States excepting the Pan-a-mints, of Southern California, the Coaninis, of Northern Arizona, and possibly two tribes of Oregon.

While collecting this material relating to the languages of the Indian tribes, I have not neglected the other branches of ethnography, but have collected much material relating to their social and governmental organization, their means of subsistence, their general habits and customs, and their arts and industries, and to this work I have devoted much of my personal attention.

The materials in this department already in my hands will make more than twenty medium-sized quarto volumes.

My reasons for pushing this branch of collateral investigation beyond all others were twofold:

First. At the instance of a former Commissioner of Indian Affairs, the then Secretary of the Interior requested me to make a special study of this subject for the benefit of the Indian Bureau, and my reports to the Commissioner on this subject have been published from time to time, such reports comprising the ethnic classification of the Indians, and the census of the several tribes, as rapidly as their numbers could be accurately determined. Since this work began, important changes in the *reported* numbers of the Indians under the management of the bureau have been made.

Second. The other parties engaged in Western exploration were doing comparatively little in this field, and hence I determined to push these investigations the harder as I greatly desired to avoid unseemly rivalry and to waste energy and money in duplicating the work of others.

I have commenced the publication of the results of this work, and the Secretary of the Interior has ordered the printing of two quarto volumes, and I am daily reading the proof of the same.

It will be seen from the statements I have made, and which I believe to be substantially correct, that it would be unwise for Dr. Hayden and myself to pursue indiscriminately these ethnographic investigations. The work should be either consolidated under Dr. Hayden or myself, or it should be divided between us. I will be pleased to have Dr. Hayden take all my material to consolidate with his own, or I will be equally pleased to take his materials and consolidate them with mine, as the Secretary of the Interior in the exercise of his judgment may decide.

In the event of the work being turned over to Dr. Hayden it will be necessary for me to return the material which I have received from the Smithsonian Institution and other scientific bodies and men; but he could probably make the same arrangement with them that I have made.

The materials which I have collected in the field should be edited by myself, though published as one of Dr. Hayden's reports.

I am also engaged in the preparation of a "Manual of North American Ethnography," which is well under way. The object of this is to give a general outline of the subject, and the best methods of pursuing investigations. As a very much larger edition of this work should be published than that usually ordered by the government, the Smithsonian Institution has undertaken its publication, and whether I continue in this field or not, I am under obligation to complete the preparation of the volume.

It will be seen from the statements which I have made above that I am desirous of having some division of labor in the two great departments of collateral investigation in which we are both engaged, viz, natural history and ethnography.

In the event of a failure to make such a division, I respectfully request that I may be permitted to drop all collateral investigations and devote my own work and that of my parties to the purely geographic and geological field, and would cheerfully accept this limitation of my work or any division which the honorable the Secretary of the Interior may deem wise.

Finally, I beg permission to suggest a division of labor for future work which I think will be very simple and do no injustice to either of the interested parties, viz: that natural history, including paleontology in its several branches, zoölogy in its several branches, and botany, be assigned to one division, and that ethnography in its several branches be assigned to the other division, and that all the material hereafter collected by both parties be consolidated, the one party taking all the natural history material, the other all the ethnographic; and I will cheerfully accept either branch of the same.

Should such a division be made it might be well to take into consideration the fact that Dr. Hayden has already an elaborate organization for natural history work, while I have an elaborate organization for ethnographic work.

Earnestly requesting that the honorable the Secretary of the Interior may give early consideration to this subject,

I am, with great respect, your obedient servant,

J. W. POWELL,
*In charge United States Geographical and
Geological Survey of the Rocky Mountain Region.*

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

On the 9th of November, 1877, the following instructions were received from the honorable the Secretary of the Interior:

DEPARTMENT OF THE INTERIOR,
Washington, D. C., November 9, 1877.

SIR: In regard to the division between yourself and Professor Hayden of the subordinate and collateral investigations pursued in connection with the United States

Geological and Geographical Surveys, I would state that the division proposed by yourself and assented to by Professor Hayden is approved by the Department.

The researches in ethnography will therefore in future be pursued in connection with the survey under your charge, and the researches in natural history, including paleontology in its several branches, zoölogy in its several branches, and botany, will be pursued in connection with the survey under the charge of Professor Hayden. You will therefore please deliver to Professor Hayden all material relating to the branches of investigation assigned to him which may hereafter be collected by you, as he will be directed to turn over to you all material relating to your branch which may hereafter be collected by him.

Professor Hayden has been informed of the action of the department in this matter.

Very respectfully,

A. BELL,
Acting Secretary.

Maj. J. W. POWELL,

*In charge U. S. Geological and Geological Survey of the
Rocky Mountain Region, Washington, D. C.*

From the above it will be seen that there has been no duplication of geographical work by Dr. Hayden and myself. In other departments there has been some duplication as there set forth.

It appears from a report from Dr. Hayden to the honorable the Secretary of the Interior, dated December 1, 1877, that a geological party under his direction traversed a part of the region previously surveyed by myself on the south side of the Uinta Mountains. The object for which this geological study was made is set forth by Dr. Hayden in the report above mentioned, page 26 *et seq.*, as follows :

The necessity of a careful examination of the various geological formations in the field, and a review by a practical paleontologist of the various districts that have from year to year been surveyed by the different geologists of this and other surveys, has been long felt. Such a work, indeed, was imperatively necessary before a consistent and comprehensive classification of the formations could be established. This duty was assigned to Dr. C. A. White, the palæontologist of this survey, and he took the field at the beginning of the past season and continued his labors until its close. The special duty with which he was charged was to pursue such lines of travel as would enable him to make critical examination of the geological formations in succession as they are exposed to view on both sides of the Rocky Mountain chain, and also on both sides of the Uintah chain; to collect and study the fossils of these formations in such detail as to settle, as far as possible, the questions of the natural and proper vertical limits of the formations, their geographical range, their correlation with each other, and to define the palæontological characteristics of each.

It thus appears that the purpose of this work was to correlate the geological work of Dr. Hayden with that carried on by myself. It was manifestly in the interest of science, alike beneficial for the work under Dr. Hayden and myself, if properly executed.

OVERLAP OF WORK BY KING AND POWELL.

By an examination of the map accompanying this statement, as mentioned above, it will be seen that in the survey of the Uinta Mountains and the region adjacent thereto, made under my direction, there is an overlap on that made by Clarence King under the direction of the War Department. The area of this overlap is in extent 6,957.32 square miles. By an examination of the statement previously made it will appear that the survey of this region, made by myself, began in the fall of 1868, and was continued from time to time to the fall of 1875. It was thus made at intervals chiefly in passing to and from the larger district at the south which was the principal theater of my work. Mr. King commenced work in this region some time after August 26, 1871, as appears from his report to the Chief of Engineers dated October 3, 1871. (See Report of the Chief of Engineers embraced in the report of the Secretary of War,

on page 1030 of Ex. Doc. H. R. second session Forty-second Congress, vol. 1; part 2, 1871-'72.) Subsequently, from time to time, field parties under his direction extended surveys over the district under consideration until the latter part of 1872, as appears from the report made by Clarence King to the Chief of Engineers, on page 1203 *et seq.* in Ex. Doc. H. R. first session Forty-third Congress, vol. 2, part 2, 1873-'74.

It has already been stated that my geographical work in this district was a reconnaissance, but it was elaborate and made by many and diverse routes of travel. In the early part of my survey I had hoped eventually to extend a trigonometric survey over this region, but in the mean time Clarence King, who was engaged in carrying a trigonometric survey from the Sierra Nevada eastward to the Great Plains along the fortieth parallel included this district in his work.

My reconnaissance was not sufficiently refined and the results not sufficiently accurate for his purpose. Mr. King having made the trigonometric survey indicated, I abandoned the plan and published the results of my geographical work in the map accompanying my report on the "Exploration of the Colorado of the West and its Tributaries," and subsequently in my report on the "Geology of the Uinta Mountains." In the latter it was used for geological purposes, and also to exhibit the classification of the lands of the district.

My geological work in the district under consideration was more elaborately and carefully made than the geographic, for the following reasons: In the earlier years of the survey, I here first discovered the succession and relation of the sedimentary groups of the great geological province in which I was at work. A general reconnaissance of the province exhibited the fact that the relations of these geological formations were better shown in this region than in any other. For this reason it seemed wise to adopt localities where the several formations were best exposed in this region, as types to which all other studies of the same formations elsewhere in the province could be referred for comparison. Again, the region is crossed by the Union Pacific Railroad; hence it had been visited by many persons engaged in scientific research, other than those in the employ of the government.

Paleontological discoveries were made previous to and during the continuance of my survey, and the region had become one of great importance in the history of geological discovery. Very many of the Cretaceous and Tertiary fossils discovered by Marsh, Cope, and Leidy were yielded to science by the rocks of this district while yet the stratigraphic relations of the geological formations in which these fossils were found were to a great extent unknown. Lastly, I desired to carefully correlate the geological work of my parties in the great region to the south with the work of the parties under the direction of Clarence King in the broad belt surveyed by him. I believed this to be in the interest of science and I have reason to think that it has met with the approval of scientific men. In this course I conferred with Clarence King himself, and from time to time we compared the results of our studies and rendered each other mutual aid. I at least am indebted to him for his courtesy and co-operation.

Of the cost of this work it is impossible to state the amount with absolute accuracy. In the earlier years I had no appropriations, but rations only. In all the years but one I traversed the ground on my way to the more southern field, as the nearest and most available route, and the studies which I made delayed my arrival there to no very considerable extent. The last trip, made in 1875, was solely for the purpose of visiting this district to clear up some doubtful points, prior to

the publication of the geological report. By taking that part of the cost of the several trips proportioned to the time spent in this district and adding thereto the cost of publication, the total cost of my geographic, geological, and ethnographic work in this district is about, but not greater than, \$16,000. Had I neglected the region after Clarence King entered upon it, one-half of that amount, at least, would have been entirely lost; as it is, I believe that the overlap has been advantageous, and, to a great extent, it was unavoidable. Clarence King was justified in extending his trigonometric survey over the region from the fact that he was making a survey of a broad zone of which this was an integral part, and from the further fact that my geographic work was not based on trigonometric methods.

OVERLAP BY WHEELER AND POWELL.

By an examination of the map it will be seen that the work of Lieutenant Wheeler overlaps that of mine on the western portion of district 76, the western portion of district 85, the eastern portion of district 86, the whole of district 95, the western portion of district 96, the western portion of district 105, and the whole of district 106, being an area of about 55,000 square miles. It will be seen from the statement above, covering the time that my surveys were made, that a reconnaissance survey of all this country had been completed by the first of July, 1872. Lieutenant Wheeler entered the southwest part of this field in the year 1871 and extended his surveys into the districts previously occupied by myself, near the Colorado River, to a slight extent. (See preliminary report concerning explorations and surveys, principally Nevada and Arizona, by Lieut. George M. Wheeler, dated March 19, 1872.)

In 1872 other parties under his direction extended surveys still farther up the Colorado River and in the region drained by the Rio Virgen and Sevier, within the same district. (See Report of Lieut. George M. Wheeler upon Explorations and Surveys * * * in Nevada, Utah, Colorado, New Mexico, and Arizona for the fiscal year ending June 30, 1873, being Appendix E E of Report of Chief of Engineers. In Ex. Doc. H. R., vol. 1, part 2, first session Forty-third Congress, p. 1211 *et seq.*) In 1873 his surveys in the district under consideration were completed. (See Report of Lieut. George M. Wheeler upon Explorations and Surveys * * * in California, Nevada, Utah, Arizona, Colorado, New Mexico, Wyoming, and Montana, being Appendix F F of Report of Chief of Engineers. In Ex. Doc. H. R., vol. 1, part 2, second session Forty-third Congress p. 481 *et seq.*)

From these facts it appears the work done by Lieutenant Wheeler was performed subsequently to the reconnaissance made by myself, and about 12,500 square miles of my trigonometric survey also was made in advance of his reconnaissance. The remaining portion of my trigonometric survey was done subsequently to his work, and I carried this latter work beyond the boundaries of my original reconnaissance in that portion of district 95 which lies within the State of Nevada, embracing an area of 1,200 square miles.

Lieutenant Wheeler's survey was a reconnaissance, in most respects similar to my own. Reconnaissance surveys are made by establishing a few points in latitude and longitude and by traveling over the country by routes more or less separated, meandering these routes, measuring these distances by the use of an odometer corrected by estimates, or by estimating the distances directly. From these routes of travel the topographer sketches such of the adjacent country on his maps as he may be able to see, estimating distances to topographic features on either

hand and correcting these estimates from time and time by determining the intersection of compass bearings or lines determined by some other instrument used for observing horizontal angles. In this way the routes of travel themselves may be mapped with an approach to accuracy, but the country on either hand will be mapped only to that degree of accuracy that the traveler along the same route may be able to recognize the more important features of the topography as seen by the person originally mapping the route. But if a new reconnaissance survey is made by other routes of travel, the new maps will coincide with the old only to a limited extent. For this reason one reconnaissance survey cannot be said to duplicate another unless it is made by the same person traveling over the same routes. No such survey can be considered as final, and no such survey is of sufficient accuracy for scientific purposes, as for geology and physical geography, or for the more important economic purposes.

As my own reconnaissance was not final, but preliminary to more thorough work, I did not consider that the reconnaissance made by Lieutenant Wheeler superseded the necessity for the work which I had planned, as neither his work nor mine was sufficiently accurate or sufficiently elaborate for the purposes for which my survey was carried on. The results of his work were speedily published on a scale of eight miles to the inch, or sixty-four square miles to the square inch, and in extending my final survey over the region I used Lieutenant Wheeler's maps in planning and executing my work, as well as the preliminary maps constructed by myself.

The final maps of my work are on a scale of four miles to the inch, or sixteen square miles to the square inch. They exhibit topographic features, with contour lines, designed to show the approximate altitude of every square mile mapped. All this is necessary for the proper discussion of the geology of the country.

The geological work is primarily the investigation of the geological structure of the country, and only secondarily of its paleontology and lithology. In an important sense geological structure is expressed in topographic forms, and hence the most accurate topography is essential to correct geology. For this reason much of the geographic work in the interior of this continent has been performed directly by or at the instance of geologists. Broad generalizations of topographic features may serve well the purposes of other branches of natural science; but the student of structural geology requires the most thorough knowledge of all the topographic forms, for standing in the midst of hills and mountains he reads their history in the reliefs which they present. While he must not neglect the lithology, mineralogy, or paleontology, yet the topography is of primary importance.

It was from these considerations that the more thorough survey, originally begun before Lieutenant Wheeler entered the field, has been continued until the present time.

Lieutenant Wheeler, with his accustomed generosity, recognized the more thorough character of my final work, and in the publication of his maps incorporated such part of my material as had been completed at the time he was engaged in the preparation of his maps, as will appear from an examination of his atlas where he gives me due credit for the materials furnished by me.

A further statement is necessary to a proper understanding of this matter. The field surveys proper do not overlap on the entire area given, but in part only, as south of the Colorado River Lieutenant Wheeler used the materials of a reconnaissance previously made by Lieutenant Ives, in the construction of his maps. And further, if I am

rightly informed, Lieutenant Wheeler used some of my materials where he himself had not carried his reconnaissance. In this way a part of the overlap is in mapping only.

Again, here, the cost of my work in the area of overlap cannot be given with absolute accuracy. The work on that portion of the river not included in this area was by far the most expensive, as it was the most difficult of access, and was farthest from settlements; but I think after a careful examination that the cost of the reconnaissance and final survey is about ninety-five thousand dollars, including the geographic, geological, and ethnographic work. The cost of the original geographic reconnaissance of the area was less than seven thousand dollars, and this is properly the only overlap.

Lieutenant Wheeler did not do elaborate geological work. It may properly be said that geology is a study which is never completed; and it so chanced that the geologists employed by him in the region under discussion were subsequently employed by myself; as my assistants, they continued the studies which they began with Lieutenant Wheeler, and thus their previous study was immediately available for my work; hence, there was no improper duplication in this department.

In the determination of the longitude of the base-line at Kanab, Lieutenant Wheeler co-operated, he having, at that time, a party in Salt Lake City, and I one at Kanab. The longitude was determined by the exchange of telegraphic signals. Through his courtesy I was furnished with his determination of the longitude of Gunnison, which I used.

The classification of public lands, now carried on by the different parties, originated in my survey, though the method adopted by Lieutenant Wheeler, Dr. Hayden, and myself are slightly diverse. This part of the work was not carried on by Clarence King, nor by Lieutenant Wheeler during the earlier years of his work. For the past three years this classification has come to be of importance in the administration of the affairs of the General Land Office, and it seemed desirable to extend this branch of the work over that portion of Utah surveyed by Clarence King and Lieutenant Wheeler. Mr. Gilbert, one of my geological assistants, was engaged in this work during the past season, completing the classification over a district of country of about 20,000 square miles.

In traversing this district he had opportunities for the geological study of the vestiges of an ancient lake once occupying much of the region traversed by him, and in the terraces, or successive beach planes of the ancient lake, he discovered evidences of many comparatively recent orographic displacements. In this way his geological work was, in one part, in a region previously examined by himself for Lieutenant Wheeler, and in another, previously examined by Clarence King, but it was made while traversing the country for other purposes and with very slight additional cost, and is not a duplication, but a continuation of work previously done.

In order to more thoroughly understand the geology of the country which was the immediate field of my survey, I have made extended excursions north, south, east, and west, for the purpose of discovering the general geological relations of the smaller area to the larger, and for correlating my work with that of others. I have already stated that such a course is deemed wise, and is generally practiced by geologists.

FINAL REMARKS.

For a better understanding of the general subject embraced in the resolution of inquiry it seems proper to make some additional statements.

The survey under the direction of Lieutenant Wheeler was carried on during the earlier years solely by reconnaissance methods, as described above. They were carefully made, and I believe much more elaborate than any work of the same kind ever done before on this continent. In one important respect the refinement of the work was great; *i. e.*, in the determination of a great number of geographic co-ordinates, longitudes, and latitudes, by astronomic and telegraphic methods. The scale on which the maps were plotted, and for which the field-work was done, was eight miles to the inch. In later years, trigonometric methods have been introduced, and in some cases the scale has been enlarged, and if I am rightly informed, a small portion of his work has been more elaborate and refined than that of any of the other parties engaged in surveys.

Clarence King's work has for its foundation base lines measured with a steel tape at a constant tension, corrected for temperature, on which a system of triangulation is based, but the points in the triangulation are natural ones, as the summits of mountains, lone peaks, &c. In this way in the measurement of angles, monuments or cairns of stone were erected at the time when the points were visited. In his topography, sketch books and descriptive notes were used.

The scale on which the maps were projected is four miles to the inch, and the topography is represented on the geological maps by contour lines; on the general maps, by shading.

The zone surveyed by Mr. King, extending from the Sierra Nevada to the Great Plains, was not bounded by continuous parallels, but was broken into five districts by four offsets, so that in devising a plan for the districting of the entire area of the western region it was not practicable to adjust the boundaries of the districts to the boundaries of the area surveyed by him.

Previous to the year 1873 the only geographic work done by Dr. Hayden was in the Yellowstone region, where he made a reconnaissance in the years 1871-'72. In the year 1873 he commenced trigonometric work in Colorado, and adopted the methods previously devised by Clarence King. His general maps were constructed on a scale of four miles to the inch. His topography is represented by contour lines, and for special purposes drainage maps are used.

My own work commenced as an elaborate reconnaissance. Being dissatisfied with the results, I attempted trigonometric work from long base-lines measured by astronomic methods; with this, also, I was dissatisfied, and in the fall of 1871 commenced the trigonometric work proper by the measurement of the base-line at Kanab, by the following methods:

The line was measured with rods, leveled and aligned in a refined way. The triangulation was at first carried on exclusively by the use of artificial points, flag-staffs supported by cairns. Subsequently the attempt was made to a limited extent to use natural points on which flag-staffs were erected when the points were visited, but where this method was introduced it has not proved satisfactory. Perhaps my want of success was due to the fact that the topography was unfavorable.

In the topographic work the gradientor and sketch-book were early superseded by the plane-table and orograph—instruments devised for the work by one of my assistants—with which the details of topography can be placed on the maps in the field with great rapidity and accuracy.

My general maps are constructed on a scale of four miles to the inch. Topography is represented by contours and accessory hatchings. For

special purposes maps are made by lithographing or heliotyping relief maps, constructed in plaster.

It will be seen by the statements above, that the work of the different parties now in the field, is carried on by different methods. The cartography, or map system, also is diverse.

Lieutenant Wheeler represents topography by hatchings, and for some special purposes constructs contour maps. Dr. Hayden represents topography by contour lines. Powell represents topography by contour lines and accessory hatchings.

Lieutenant Wheeler's maps are projected on a polyconic system, the maps of the Interior Department are on a secant-conic projection.

The War Department maps are on a scale of eight miles to the inch, with some exceptions projected on larger scales. The general maps of the Interior Department are on a scale of four miles to the inch.

The Atlas sheets of the War Department are smaller than those of the Interior Department, and they differ in form. For these reasons the districts into which the country has been divided by the two departments do not coincide, and the work cannot be separated by parallels and meridians, without compelling one or the other to use incomplete sheets.

The system of districting used by Lieutenant Wheeler was not used by Clarence King, and hence the former sometimes overlaps the latter.

The War Department system of districting was established before the system used by the Interior Department, but the latter could not use the former from the fact that the small scale adopted by the War Department was not adequate to the purposes for which the Interior Department maps were made.

If the surveys of both departments are carried on over the entire region, there will be two general Atlases of the whole area, and the work will be twice done. If the surveys are confined to different areas, there will be an Interior Department Atlas of one region, and a War Department Atlas of the other, and neither Atlas can be completed for the entire region without reconstructing the maps of the other.

In view of all these facts, it is manifest that the work should be unified and a common system adopted. This may be accomplished either by act of Congress, by executive direction, or by placing the work under one management.

I am, with great respect, your obedient servant,

J. W. POWELL,

*In charge United States Geographical and
Geological Survey, Rocky Mountain Region.*

Hon. CARL SCHURZ,
Secretary of the Interior, Washington, D. C.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOGRAPHICAL AND GEOLOGICAL
SURVEY OF THE ROCKY MOUNTAIN REGION,
Washington, D. C., April 27, 1878.

SIR: The results of the survey of the Black Hills made by Mr. Walter P. Jenney having been placed in my hands for completion and publication, I called on Mr. Jenney for the facts necessary to answer the questions embraced in the resolution introduced in the House of Representa-

tives by Mr. Atkins, and the following statement is made from memoranda furnished by Mr. Jenny :

SURVEY OF THE BLACK HILLS.

The area surveyed, lying partly in Dakota and partly in Wyoming Territories, aggregates 6,000 square miles. This survey was made in the year 1875.

The expense of this survey was made from the following appropriations :

A direct appropriation by Congress of \$14,000.

An indirect appropriation from the "beneficial-object fund for certain tribes of Northern Sioux," \$11,000.

Supplies (rations) purchased at cost from the Commissary Department, and paid for from above appropriations.

Arms loaned by Ordnance Department, and returned in good order.

Wagons, camp-equipage, and horses loaned by Quartermaster's Department, and returned in good order.

Transportation paid from direct appropriations.

No payments made on account of office-rent.

PUBLICATIONS.

"Mineral Wealth, Climate, and Rainfall, and Natural Resources of the Black Hills of Dakota," by Walter P. Jenney, constituting chapters V, VI, and VII of the forthcoming final report. Government Printing Office, 1876.

The final report, with the accompanying maps, illustrations, and plates, is now ready for publication.

The area surveyed was in great part wholly unknown; only portions had previously been explored by scouts and reconnaissances by the Army.

I am, with great respect, your obedient servant,

J. W. POWELL,

*In charge United States Geographical and Geological Survey,
Rocky Mountain Region.*

Hon. CARL SCHURZ,

Secretary of the Interior, Washington, D. C.