2-22-1859

Report of the Secretary of War: Wagon Road Routes in Utah Territory

John B. Floyd

J. C. Breckinridge

J. C. Woodruff

U.S. Senate

Bureau of Toppographical Engineers

35TH CONGRESS, 2d Session. } SENATE. { Ex. Doc. No. 40.

REPORT

OF

THE SECRETARY OF WAR,

COMMUNICATING,

In compliance with a resolution of the Senate, Captain Simpson's report and map of wagon road routes in Utah Territory.

FEBRUARY 26, 1859.—Referred to the Committee on Military Affairs and the Militia.
FEBRUARY 28, 1859.—Report in favor of printing submitted and referred to the Committee on Printing.
MARCH 2, 1859.—Report in favor of printing the usual number submitted, considered, and agreed to.

WAR DEPARTMENT, *February* 22, 1859.

SIR: In compliance with a resolution of the Senate of the 10th instant, I have the honor to transmit, herewith, a report from the Chief Topographical Engineer, communicating a copy of "the report and map of the wagon road routes extending from Bridger's Pass to City Rocks, in Utah Territory," recently transmitted by Captain Simpson, of the Topographical Engineers.

Very respectfully, your obedient servant,

JOHN B. FLOYD,
Secretary of War.

Hon. J. C. BRECKINRIDGE,
President of the Senate.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, February 22, 1859.

SIR: I have the honor of transmitting herewith a copy of the report and map of Captain J. H. Simpson, corps of Topographical Engineers, of the wagon road routes from Bridger's Pass to City Rocks, in Utah Territory, called for by a resolution of the Senate of the 10th instant.

Respectfully, sir, your obedient servant,

J. C. WOODRUFF,
Capt. Top. Eng'rs, Asst. to Bureau, in charge.

Hon. JOHN B. FLOYD,
Secretary of War.

TABLE OF CONTENTS.

Report by Captain J. H. Simpson, corps of Topographical Engineers, of reconnaissances, &c., in the Territory of Utah, in the months of August, September, and October, 1858, under instructions from Brevet Brigadier General A. S. Johnston, U. S. A., commanding the department of Utah.

OFFICE OF TOPOGRAPHICAL ENGINEERS, DEPARTMENT OF UTAH,
Camp Floyd, Utah Territory, December 28, 1858.

SIR: I have the honor to submit below a report of the several reconnaissances and labors I have been engaged in since August 19, the date of my reporting for duty, at these headquarters. These are a reconnaissance and opening of a new wagon route from Camp Floyd to Fort Bridger, and an exploration over a portion of the Great Salt Lake desert, in order to the melioration and shortening of the great northern emigration and post route to California. For a brief synopsis of the report I refer you to the table of contents.

Accompanying the report will be found a map illustrative of the routes explored.

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

J. H. SIMPSON,
Captain Corps of Topographical Engineers.

Brevet Major FITZ JOHN PORTER,
Assistant Adjutant General.

On the 24th of August last I had the honor to receive the following instructions:

HEADQUARTERS, DEPARTMENT OF UTAH,
Camp Floyd, Utah Territory, August 24, 1858.

SIR: With a view of ascertaining the practicability of opening a wagon road to Fort Bridger, the commanding general directs that you proceed to morrow to examine the route to that place known as the Provo or Timpanogos route. It is represented that the main obstacle to success has been overcome by the Mormons opening a road some eight miles up the Provo river. Little, however, of the features of the country beyond are known, except through Lieutenant Beckwith's report, (a copy of which is furnished to you,) so that your attention will be principally directed to the facilities and difficulties presented by the remaining portion of the route for the movement of trains (pack and wagon) and bodies of troops, camping places, as well as the resources of the country for fuel, grass, and water.

From the mouth of Morin's Fork (White Clay creek) and the sources of Yellow creek, the commanding general wishes you to push your examinations to the main Salt Lake road, that, if found practicable, and your excursion meets with success, connecting roads may be opened, and, if necessary, the old road, in part, used. Also, as soon as you cross the Muddy, he wishes you, instead of immediately

taking the road due east to Black's Fork, to see if you cannot easily ascend to the table land and go direct to Fort Bridger by the south end of the large buttes west of that place.

The commanding general will be pleased to have your observations directed to the comparative heights of the ridges over which you will pass, that you may form some idea of the practicability of the route, late in the fall and early in the spring, for bringing pack animals and herds of cattle into this valley.

You will probably find parties of Ute Indians in the vicinity of Kansas prairie. As some of them visit that portion of the country in winter and early in spring, you may obtain much information of the nature of the winters in these mountain valleys.

An escort of one officer and twenty men will accompany you, supplied with fifteen days' provisions on pack mules.

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

F. J. PORTER,
Assistant Adjutant General.

Captain JAMES H. SIMPSON,
Topographical Engineers, Camp Floyd, Utah Territory.

Consequent upon the above were issued the following orders:

Special orders, No. 41.

HEADQUARTERS 2D DRAGOONS,
Camp Floyd, August 24, 1858.

Pursuant to instructions from the headquarters of the department of Utah, of this date, requiring one officer and twenty men as escort to Captain James H. Simpson, Topographical Engineers, charged with examining the Provo route to Fort Bridger, a detail will be made of one sergeant, one corporal, and eighteen privates from the command, for said purpose. The command will take fifteen (15) days' provisions.

Brevet Second Lieutenant Samuel W. Ferguson is assigned to command the escort.

First Lieutenant J. P. Holiday, regimental quartermaster, will furnish the necessary pack animals.

By order of Lieutenant Colonel M. S. Howe.

G. A. GORDON,
First Lieutenant and Acting Adjutant 2d Dragoons.

In obedience to instructions I left Camp Floyd August 25, Lieutenant S. W. Ferguson, 2d dragoons, in command of a detachment of twenty dragoons, accompanying me as an escort, and the necessary provisions, blankets, &c., being carried on ten pack mules. We took with us no tents. I have already, September 3 and September 30, reported to you briefly the character of the route projected by me, under the instructions of the general commanding, but proceed now to give a more detailed description of it. The reconnaissance was made in eighteen days, the party returning to Camp Floyd September 12, and between the 16th of September and the 6th of October the road, as located, was opened and graded by the troops. Without going into the particulars of every day's travel, which might prove tedious, and would fail to give a clear view of the route I selected, I will state that the ground was quite thoroughly looked over, and though the route which has been since opened may, in two or three places which will be mentioned in the sequel be somewhat shortened, yet, as a whole, it is believed to be as well located as the country will permit. Accompanying this report will be found a map, upon which, in red ink, will be noticed the road as located and opened, and in dotted lines the other portion of country passed over in the reconnaissance. The guide who accompanied me was Mr. Isaac Bullock, of Provo, whose services I found valuable.

Description of the portion of the route from Camp Floyd to the mouth of the Timpanogos River cañon, a distance of 29¼ miles.

The route from Camp Floyd pursues a course east of north for about 8 miles, when it passes over a low ridge, and, gradually turning more eastwardly, leaves Cedar valley, and gets into the valley of Jordan river, which river it crosses in 6 miles, by a toll-bridge sixty feet long; and thence, continuing its course eastwardly along and 2 miles from the foot of Utah Lake, in 2¾ miles reaches Lehi city; thence, turning gradually southwardly, and slightly diverging eastwardly from a parallelism to the shore of Utah Lake, which it leaves to the right at about an average distance of 3½ miles, and, skirting the Wahsatch mountains on your left, in 3 miles it passes through American Fork settlement, (Lehi city on the maps:) in 3½ miles more Battle creek, (Pleasant Grove on the maps,) and in 6¼ miles reaches the mouth of Timpanogos River cañon, which it crosses by a good ford—whole distance from Camp Floyd 29¼ miles.

The road to this point, except occasionally where irrigating ditches cross it, is excellent, the only hills being those 8 miles out from Camp Floyd. The soil of Cedar valley, as also that of Utah valley, which is generally of a yellowish color, is of an areno-argillaceous character, superposed on sand, and the consequence is that, although containing all the elements of fertility, the rains are not of themselves copious and constant enough to keep it sufficiently moist to sustain vegetation. Where the land therefore cannot be irrigated, which is the case in Cedar valley, except in two or three localities of small area, the soil, for agricultural purposes, is utterly worthless. Along the road, however, in Utah valley, in the neighborhood of the towns named, there are extensive fields which, on account of the irrigation they receive, are quite productive. The irrigation is made possible by the availability of the mountain streams, Dry Fork, American Fork, and Battle creek, the waters of which are distributed in *acequias* or ditches, from which the fertilizing element is carried over the soil in numerous rills. The two first streams are tributary to Lake Utah, and Battle creek loses itself in the soil. It is something notable that a large number of the fields have been abandoned from the soil becoming saline

by use, and it is quite possible that, from this cause, a large portion of it will, in time, be rendered worthless. Indeed, while the country in the Territory, as a whole, presents *a very insignificant fraction* of cultivable soil, (that which can be cultivated,) experience shows it likely to become barren from use.

The great staple is wheat, of which as many as seventy-five bushels have been raised to the acre. This, however, is rare; forty bushels are more common, and generally not more than twenty. Oats and barley do well. Corn does not mature sufficiently, on account of the early frosts of autumn, and therefore but little is planted. Potatoes and garden vegetables generally grow quite luxuriantly. Fruits like the melon, peach, and apricot mature tolerably well, and the apple also grows here, but as yet I have seen none to assure me that they at all equal those which can be raised in the States. It is also to be borne in mind, in the cultivation of the cereals, vegetables, and fruits, that frequent irrigation is necessary, and to this, of course, is superadded all the other labor of tillage, which makes the aggregate of work necessary to make the soil produce to any advantage excessive. The fields are generally enclosed by mud walls, which not unfrequently give evidence of dilapidation. The ordinary tract of land owned and cultivated by a single hand is twenty acres, though larger tracts are owned and cultivated by those who can afford to buy more and command the necessary labor. There is no grass along the route, except on the Jordan, and no wood. The fuel which is used by the inhabitants of the towns named is brought from the cañons in the mountains at a very great expense. Forage and fuel, however, are purchasable by the government.

Lehi City is a walled town, containing probably 100 houses and 1,000 inhabitants. The houses are of adobes, (sun-dried bricks,) and in some instances of logs. The appearance of the town is rather indifferent, and indicates no great thrift.

American Fork Settlement (Lake City) has some 50 houses and probably some 500 inhabitants. The houses are generally adobe, quite small, and of but one story, all indicating a poor and shiftless population.

Battle Creek Settlement contains probably 60 houses, all small, mean-looking adobe huts, and the population is about 600. A very common mode of building in these towns is to take the earth of the inside of the building to make the adobes, and thus have one story below and one above ground. The generality of the houses is far below in character what obtains among the poorest of our population in the States. The roofs are generally of mud, and give frequent evidences of tumbling in, and the doors and windows all indicate penury and an inattention to cleanliness.

Provo is a city in the valley of Lake Utah, about 5 miles south of the Timpanogos cañon. It derives its name, according to Mr. Bullock, from a Frenchman of that name from St. Louis, who was the first white man that ever came from Fort Bridger by way of the Timpanogos river. The Timpanogos river has been, therefore, known among the inhabitants as the Provo river, and hence the origin of

the name of the town near. It is much better built than the towns I have described. The guide, who lives there, says it contains about 400 houses and probably 600 families, 7 to a family, or about 4,200 inhabitants in the whole town, to make a large estimate. It, like the other towns I have seen in Utah, is built principally of adobes, the houses, however, being generally small. Each town has a large building which they call the tabernacle, and which is devoted to religious and secular purposes, the theatre, I noticed, being held in one of them. The main street of Provo is probably eight rods wide, the others six. This town, like all the others I have described, is laid out in regular squares. They are all inhabited by farmers, who cultivate the land contiguous to the town, and the yards are filled with the implements of husbandry, stacks of wheat and hay, and in the evening, during harvest, there is to be seen a constant succession of wagons filled with the produce of the field, and cattle driven in for security. The guide says originally the people lived on their farms, but the Indians became so troublesome as to oblige them to collect in towns for mutual defence. The inhabitants send out their cattle in herds to pasture, the herdsman passing in the morning from one end of the town to the other, and, as he does so, sounding his horn as a signal for the owners to turn their stock into the general herd. The charge is about two cents per animal per day.

From the mouth of Timpanogos cañon to the top of the divide between the Timpanogos and Silver creek, 31½ *miles.*

The Timpanogos river is a splendid, dashing, mountain stream of pure water of a width ranging in places from 30 to 100 feet, and generally about 2 feet deep. Large trout are found in it. Its bottom is rocky. Its sources are in the Uinta mountains, from which it flows for about half its length (which probably is 60 miles) in a westerly direction, and then, breaking through the Wahsatch mountains, in a southwest direction for the balance of the way (30 miles) into Utah lake. The road takes up the valley of this river, which is deeply cañoned for about 7 miles above its debouchement into Utah lake valley. The rocks on either side, commensurate with the cañon, especially on the south, are magnificent, and encroaching, as they do, very nearly on the stream, show themselves in their full proportions. Those on the south side have their escarpments very nearly vertical, while those on the north are girted at their base by terraces of narrow breadth. About four miles up the cañon, on its south side, may be seen a beautiful waterfall of from 800 to 1,000 feet in height, and coming as it does from such an altitude, and apparently fed by nothing, it is an object of a great deal of interest; I have called it on the map "Beautiful cascade." Through this cañon, and five miles further, say for a distance of 12 miles from the mouth, there is at present a road which the people of the Territory constructed last spring and summer. Previous to the opening of this road persons could pass only upon horseback along an Indian trail; the rocky promontories or points of the confining walls, as well as the narrowness of the

cañon, effectually obstructing wheel carriages. A company of citizens, however, have, by dint of great labor, cut through these promontories, made deep excavations along the steep, and in many instances rocky side hills, and have built up revetted embankments, the consequence of which is, they have an excellent mountain road, and one that does them a great deal of credit. The width of the roadway, however, in many places and for considerable distances, is not sufficient for teams to pass each other, and the turns are sometimes so short that heavy six-yoke ox-teams are liable, except the driver use the greatest care, to a capsize into the stream below. The drainage of the mountain streams and rills from the upper side of the road is defective, and the consequence is that pools of water have been allowed to collect in the road, and the road at these places made boggy. With these defects obviated, the road would be as good as is to be found anywhere. It was constructed by the inhabitants to open the communication to Round Prairie, (an expansion of Timpanogos valley, 14 miles above the the mouth of the cañon,) and to enable the people of Provo to carry away the wood found along the river and in the side cañons. About one mile from the mouth of the cañon the road crosses the Timpanogos by an excellent bridge, 60 feet long. The tolls upon the road are here collected, and as it is of interest to know the rates, I here insert a notice which I saw stuck up on the post of the toll-gate:

"*Rates of toll on the Provo cañon road.*

"For one cord of wood or timber hauled out	$1 00
"For one pair of horses, mules, and carriage	50
"For one horse, mule, and rider	10
"Cattle, horses or mules, driven up or down, for each head	5
"Sheep and hogs	3
"For each load of brick or hay	1 00

"The above is a correct list of rates of toll as fixed by the county court. And all persons are hereby notified and instructed that no one will be permitted to travel the road without an order from Bishop E. H. Blackburn, and the gate-keeper will take due notice of the above instructions, and govern himself accordingly.

"Done by order of the county court of Utah county.

"E. H. BLACKBURN,
"*General Agent.*"

In this connexion I think it proper to say that no permission was asked by me to go through the cañon, and no objection ever made; and this I believe has been the experience of all the government and contractor's trains which have passed over the route.

To resume my account of the route. Four miles from the mouth of the cañon is the first sufficiently wide place for a small command to encamp, and here will be found plenty of grass. Two miles further is the first sufficiently wide place for *ox-teams* to *corral*, and grass also exists here in abundance. Indeed, from this point as far as the

road extends along the Timpanogos, a distance of twenty-three miles, at short distances can be found most excellent camping places for the largest commands and trains. The river is well timbered from the mouth of the cañon up, and there is every other requisite needed.

As I have before remarked, the turnpike extends from the mouth of the cañon for a distance of twelve miles. Thence the route continues along the Timpanogos, crossing it about a mile above Wall's ranch, and through Round prairie for a distance of ten miles, when it enters another cañon, or rather narrow valley, four miles long, where the river is in places obstructed for about three miles by beaver dams, and where the road for a few hundred yards is rather soft. This cañon gone through, the route leaves the main Timpanogos, which here takes a sudden turn to the right, and passing along a small tributary, in 4½ miles commences going up the divide between the Timpanogos and Silver creek, and in a distance of 1½ miles, with a pretty fair grade and on rather a stony slope, reaches the top. The crossings of the Timpanogos, of which there are four, are all by good fords. The principal timber on the creek is the oak, cottonwood, box elder, sugar maple, birch, and willow. Pine and the fir tree are to be seen on the mountains. Currants, red and black, and a blue berry like the small winter grape, and which the Mormons call the mountain grape, is also found in considerable quantities in the valley.

In *Round Prairie*, near where Rattlesnake creek debouches from the mountains, on the north side of the valley, are to be seen a number of hot springs, the highest point the thermometer indicating in any one of them being 109½ degrees. These springs well up from the surface, and, running over, deposit a residuum or tufa which accumulates about their mouths and forms tumuli, in one instance of about 60 feet in height and 200 feet in diameter at base. These tumuli are hemispherical in some instances, and in others conical, and after attaining a certain height the water ceases to flow, and they begin to disintegrate, and eventually are lost in the general level of the country. For several miles the substratum, for a depth in some places of 60 feet, as far as could be discovered, was composed entirely of this calcareous rock, and there is no doubt it is entirely due to an origin of the same sort. Rattlesnakes abound about these springs, and in a warm summer's day you cannot tread near some of them without hearing their sharp rattle. Traces of coal are to be seen in the lower cañon near its mouth, and the guide informs me that he has picked up specimens in the creek, which on that account has been called Coal creek. The Timpanogos valley is remarkably well watered, and the traveller will be greatly pleased, particularly on a hot summer's day, with the many cold, gushing, pure streams which he will cross, all flowing into the Timpanogos.

The grass, particularly in Round Prairie, where there is a great deal of meadow land, is abundant: and I know no place where stock could be better fed, sheltered, and watered during summer and winter. Already have stock grazers gone into this valley and secured a considerable quantity of hay for the winter. The soil is, a great deal of

it, of excellent character, and, as it is capable of being easily irrigated, I doubt not it will prove very productive.

From the top of the divide between Timpanogos river and Silver creek to White Clay creek, a distance of 24¼ miles.

The road descends northwardly from the top of the divide between the Timpanogos river and Silver creek, into the valley of the latter, with a fair grade, and in two miles reaches Silver creek, along which it continues 3¾ miles, until it intersects the old Parley's Park road from Salt Lake City. Here it becomes coincident with this road, and, leaving Silver creek, crosses, in an east of north direction, in six miles, the divide between Silver creek and Weber river, and, turning down the Weber, in 7½ miles, leaves the Parley's Park road, crosses the Weber at a good ford, and, continuing down it, reaches, in 5 miles, the mouth of White Clay creek.

Silver creek takes its rise in the Wahsatch mountains, and, after running a north of east course some 15 or 20 miles, falls into the Weber river, 3½ miles below where the road strikes the Weber. It is cañoned for 6 miles before entering the valley, and in this distance is full of beaver dams, which, with the enclosing escarpments, prevents a wagon road being made through it. It is, however, practicable for pack animals, my party having passed through in this way. It is a beautiful, clear stream, of an average width of 10 feet, and one-half foot deep. Its bottom is of a clean silvery color, owing to the particles of quartz debris with which it is covered. Willows line the low banks, and, although the margin is rather soft, wagons can ford almost anywhere. The valley in which it flows is a shallow one, of a few hundred yards wide, but, covered as it is with luxuriant grass, and watered by a clear and beautifully flowing stream, it presents a pleasing prospect to the eye. The fuel for camps along it would be only the willow and wild sage, or artemisia. In a south of west direction, about five miles distant, is Snyder's saw-mill, situate on Snyder's creek, or, as Captain Stansbury calls it, Beauchemin's Fork. A considerable quantity of timber is transported from this mill to Salt Lake City, and a portion of it has been used in the building of Camp Floyd. The valleys of Snyder's creek and tributaries have a great deal of meadow land, and large quantities of hay are cut and cured upon it for the winter. I noticed herds of cattle and sheep grazing here. Last winter Mr. Harmon, who lives near Snyder's mill, says they had in the valley from two to three feet of snow; and when I passed through the valley the settlers were then cutting hay to provide for their animals during the severest portion of the winter. The mails, when in the winter they could not be carried over the Big mountain route on account of snow, have been carried over the Parley's Park and Weber route; and, in one or more instances, when the snow was such as to prevent the mail rider from getting over the divide between Silver creek and Weber river, he has successfully gone down the cañon of the former to the valley of the Weber.

Weber river discharges itself into Salt Lake, and has its sources in the Uinta mountains, from which it flows generally in a northwest direction. It is a rapid mountain trout stream, about 100 feet wide, 1½ deep, and of rocky bottom. Commensurate with the location of the road along the river, a distance of 12¼ miles, the valley is from 1½ to 2 miles wide, and is abundantly clothed with grass. Cottonwood lines the banks of the river, and cedar is to be seen very thickly sprinkling the side-hills. The soil of this valley is quite rich, and the land lies well for irrigation. It is a fine stock-grazing valley, fine meadows being seen all along it, and if not too cold, which is yet to be tested, will prove a good grain country. Already settlers are beginning to claim the land, and during the last summer there were persons harvesting hay upon it. The ground is good for a road through the whole section of it, and only requires causewaying at a single point, and that but for a very few yards.

From the mouth of White Clay creek to Bear river, a distance of thirty-four and a half miles.

The road leaves the Weber at the mouth of White Clay creek, (Morin's Fork, according to Stansbury,) and turning up said creek in a direction north of east, in 30½ miles reaches the top of the divide between it and the sources of Yellow creek; and in four miles further, in the same general direction, after passing over two or three ridges of tolerable grade, reaches Bear river.

White Clay creek has its sources in the Uinta mountains; and at its mouth is about 20 feet wide and 1 deep, and has but one affluent of any volume, which you will please permit me to name in honor of yourself. Trout are caught in it. The road goes up along the creek for a distance of 19 miles, when, the creek suddenly turning to the right, the road continues on its usual course up a small branch of the creek. The creek is distinguished at its mouth by its whitish vertical outcrop of rocks on its north side. Indeed, this whitish clay color characterizes the rocks all along the creek, and is probably the source of its name. The rocks along the Weber river and Echo cañon are generally of a red hue. The valley, for three miles from its mouth, is over a mile wide; then the creek, for ¾ of a mile, is very narrowly cañoned. It then gradually widens to a breadth of several hundred yards, and between mountain heights on either side continues this breadth for 15 miles. At this point it is again cañoned for two miles, when it again opens out to a breadth of a few hundred yards, and continues this breadth to the divide between it and Yellow creek. Except in the cañons there is plenty of grass in the valley; and the table-lands and side-hills abound with it. This valley I regard as good for stock-grazing purposes, but not so good as either the Timpanogos or Weber valleys. The creek, for a distance of 21 miles from its mouth, is lined with cottonwood and willows, and the side-hills are covered with cedars. I found coal of fair quality in the bank of a grassy ravine on the north side of the creek, about six miles above its mouth; its character is bituminous, (see Geological Re-

port of Mr. Engelmann herewith.) Above the upper cañon willows alone fringe the creek. Beaver dams are quite frequent above the lower cañon; and these, with the cañons, make the road quite difficult to construct. The beaver dams force you upon the side-hills, where there is necessarily a great deal of grading; and when you are obliged to keep the bottom on account of the work on the side-hills being too severe, the foundation of the road is in many places found to be quite soft. The willows, too, are quite thick in some localities, and it is no little job to cut them down thoroughly. Water is found at intervals in holes above the point where the road leaves the main White Clay creek, for a distance of about five miles. Beyond this, until you reach Bear river, a distance of ten miles, there is no water. It will be noticed that there are two red lines on the map connecting White Clay creek with Bear river. That furthest south furnishes the best grade, and should be the one taken going east; the other, indicated by the broken line, is the shortest, and could be taken by trains going west. Between White Clay creek and Bear river there is plenty of grass at intervals; but the beds of the sources of Yellow creek are generally dry. Up to and inclusive of White Clay creek the road has been generally threading the valleys; but now that it leaves White Clay creek it crosses the streams and divides, and not unfrequently on that account is hilly. The hills, though long in some instances, are not steep.

From Bear river to Fort Bridger, on Black's Fork, a distance of thirty-six and a quarter miles.

From Bear river the road takes a general course of northeast, and crosses in three miles Cottonwood Fork of Bear river; in 5¼ miles, the West Fork of Sulphur creek; in 3½ miles, the East Fork of Sulphur creek; in 11½ miles, the Muddy Fork of Black's Fork of Green river; and in 13¼ miles, through the ravine which Major Whiting took to the south of the Big Butte, reaches Fort Bridger—making the whole distance from Camp Floyd 155 miles.

Bear river is a noble, swift stream of pure water, flowing over a rocky bottom, and has its sources in the Uinta mountains; from which, after running in a direction west of north for about two degrees of latitude, it turns quite sharply to the south, and running west of south one degree of latitude, it disembogues into the Great Salt Lake. Its width varies from 30 to 75 feet, and at the ford is about 2 feet deep. My party caught some fine trout in it. A grove of cottonwood and willows, interspersed with some fir trees and pines, characterizes it at the crossing. An abundance of grass is to be found on this stream as well as on the Cottonwood branch, which is also a rapid stream, 20 feet wide and one half foot deep; bottom stony; ford good. Some cottonwood trees border it.

The *valley of Bear river*, where the road crosses it, is 4 miles wide and about 12 long, and lies quite flat. Its soil is agillaceous, and in places gravelly. It lies well for irrigation; and no doubt a portion would prove productive if the locality were not too cold.

The *valley of the west branch of Sulphur creek* is about 4 miles wide, quite level, and is covered with the wild sage. There is no water in the branch above the road, and, indeed, none below of any account till you reach the junction of the east and west branches. The valley, therefore, can never be of any value for agricultural purposes, as it cannot be irrigated.

Crossing the divide between the east and west branches of Sulphur creek by a gentle grade you reach the shallow valley of the east branch, where you find water in holes, or rather springs, grass abundant, and no fuel but wild sage and willows. Here the road becomes coincident for about a mile with the old Fort Supply road, when it leaves it and takes over the divide by a long tolerable ascent, and then descends by as long a slope, not exceptionable, through a shallow ravine, to the Muddy. This ravine abounds in excellent grass, and at intervals has some fine springs. A large number of cattle was herded there in the summer and fall. It is, however, not sheltered sufficiently in the winter, though stock might take refuge in case of storms among the willows on the Muddy. The only fuel along the ravine is wild sage.

Muddy Fork, at the crossing, is but three or four feet wide and one deep, and this water it receives from the small affluent which joins it just above the crossing. Above the junction water is to be found only in holes in the main branch. The valley of the Muddy is a few hundred yards wide; the creek is lined with willows and occasionally with cottonwood, and the grass along it is tolerably abundant. From the Muddy the road goes up a rather steep ravine to a high table land or plateau, over which it runs five miles, when it descends by a ravine to the south of the Big Butte, and in 7½ miles reaches Fort Bridger. The plateau is covered with wild sage, and the soil is somewhat gravelly and in some places stony. Water is to be found alongside of the road within six miles of Fort Bridger, and some grass in the vicinity.

General remarks.

The black dotted lines, as well as the red lines, indicate the country traversed by me in looking up the best route for the road. All these are practicable for wagons, except that down the cañon of Silver creek; that from the Parley's Park road to the Weber, just below the junction of its two forks; and that from the Timpanogos valley and across Kamas prairie and the divide to White Clay creek. The reconnoissance across Kamas prairie to the Timpanogos was made with the view of cutting off the detour by the mouth of White Clay creek; but the route was found barely practicable for pack mules. The ascent from White Clay creek and descent to the Weber, and the descent from Kamas prairie to the Timpanogos valley, were found entirely too steep for wagons. Grass is abundant on Kamas prairie, and already have large quantities of hay been cut upon it. A very considerable portion of the soil is the product of beaver dams, and this portion is very soft. We noticed, when we crossed the prairie,

that some hay which had been cut had, during the absence of the mowers, been submerged by the water of the creek; all the work of the busy beaver. The streams coursing through the prairie are voluminous and the land lies well to be irrigated by them.

On reaching Fort Bridger, after my first reconnoissance, I offered to bring the column of Utah forces, commanded by Lieut. Col. Morrison, through to camp Floyd; but the colonel, believing that he had not the necessary authority, declined. Mr. Henry Engelmann, geologist of the topographical party, having arrived at Fort Bridger the same day I did, I directed him to accompany me on my return to Camp Floyd.

Before entering upon my report in relation to the opening and construction of the route, I think it proper to bear testimony to the very efficient manner in which Lieutenant Ferguson, in charge of the escort, performed his duties. Though a graduate of but one year's standing, he discovered an energy, firmness and sensibility which will make it his own fault if he does not win still higher laurels in his profession.

Opening and construction of the road.

In the foregoing remarks I have said little in relation to the portions of the road where labor would be required to make it practicable for wagons, for the reason, as I have before stated, that the work has already been done; and, as I intended to make a report upon this portion of my duty, I have left it to be introduced in the following pages.

On the 14th of September I had the honor to receive the following orders:

Special orders, No. 84.

[Extract.]

HEADQUARTERS DEPARTMENT OF UTAH,
Camp Floyd, U. T., September 14, 1858.

* * * * * * * * *

4. A detail of one officer, five non-commissioned officers, and fifty privates, to march on the 16th instant, will be made from the infantry portion of the command in the camp, to be employed on extra duty in the quartermaster's department, under the direction of Captain J. H. Simpson, Topographical Engineers, charged with opening a road by the Timpanogos river, White Clay creek, &c., to Fort Bridger. The party will be provisioned for 25 days.

The depot quartermaster will furnish all necessary transportation above that which can be supplied from the garrison, and all the tools required.

A like detachment of one officer and 30 men will, on receipt of this order, be put in motion by the commander of Fort Bridger, to work

the road from that point to connect with the party from this camp. This detachment will be provisioned for 20 days.

The depot quartermaster at Fort Bridger will supply the necessary tools.

The guide who accompanied Captain Simpson over the projected route will be directed to report at Fort Bridger as guide to this party.

By order of Brevet Brig. Gen. A. S. Johnston.

F. J. PORTER,
Assistant Adjutant General.

In accordance with the above the following orders were issued:

Special orders No. 22.

HEADQUARTERS, CAMP FLOYD, U. T.,
September 15, 1858.

I. Pursuant to special orders, No. 84, from the headquarters department of Utah, of the 14th instant, the following detail for extra duty is made:

From the 5th infantry: 1 sergeant, 2 corporals, and 28 privates.
From the 7th infantry: 4 privates.
From the 10th infantry: 1 sergeant, 1 corporal, and 18 privates.

Second Lieutenant A. T. A. Torbert, 5th infantry, will command the party, and will report in person to-day to Captain Simpson, Topographical Engineers, and will immediately take measures to procure the tools, subsistence, &c., for his party.

II. The regimental quartermasters will each furnish two wagons, and the depot quartermaster one.

III. Pursuant to special orders, No. 85, headquarters department of Utah, of this date, Assistant Surgeon Joseph C. Bailey, medical department, is assigned to duty with this detachment. He will report to the commander of the detachment, Lieutenant Torbert, for instructions.

By order of Brevet Colonel C. F. Smith.

CLARENCE E. BENNETT,
Second Lieutenant 10th infantry, Adjutant.

At Fort Bridger were issued the following orders:

Special orders, No. 77.

HEADQUARTERS, FORT BRIDGER,
September 22, 1858.

A working party of 1 officer, 3 non-commissioned officers, and 27 privates will proceed to-morrow morning on the new road to Utah valley.

The party will be provisioned for 20 days, and will take only the necessary camp and garrison equipage.

The depot quartermaster will furnish the transportation, (three wagons,) tools, and common tents required by the party.

The dragoons (mounted) will be detailed.

By order of Lieutenant Colonel Canby.

W. R. PEASE,
Second Lieutenant 7th infantry, acting adjutant of post.

The officer detailed under the foregoing orders was Lieutenant E. C. Jones, 7th infantry, who received from Bvt. Lieut. Col. Canby, commanding Fort Bridger, the following detailed instructions:

HEADQUARTERS, FORT BRIDGER, U. T.,
September 23, 1858.

SIR: Your party has been detailed, under instructions from the headquarters of the department of Utah, to work the new road from this place to Utah valley, by the way of the Timpanogos, or Provo river, and to render it practicable for heavily-loaded trains.

The route for this road has already been selected by Captain Simpson, Topographical Engineers, and Mr. Bullock will accompany you as a guide to point out the route selected. The other end of the road is now being worked by a party from Camp Floyd, under the direction of that officer, and the two parties will probably meet in White Clay creek, about fifty miles from this point. As the whole road is under the superintendence of Captain Simpson, you will report to him when the parties meet for instructions.

Until you meet him, the essential condition of a road practicable for heavily-loaded trains (the contractors', for instance,) will govern you in working the road, avoiding as much as possible all steep grades, short turns, stony grounds, &c.

You will be careful to mark the road by stakes, or other suitable means, when the trail is indistinct, or when from any other cause there is a liability to mistake. The crossings of other roads will be distinctly marked by guide posts, and the proper direction plainly indicated. Where the trail of the 5th and 6th columns diverges from the right road you will, in addition, place some obstructions on their trail. The means of marking the road should be taken with you.

Your party will take their arms, 20 rounds of ammunition, knapsacks, and the camp and garrison equipage only that may be absolutely necessary.

Your party will be reported upon extra duty in the quartermaster's department, and will be entitled to extra pay if employed for more than 10 days.

You will, accordingly, keep the prescribed rolls. Three dragoons (mounted) will be attached to your party for express purposes, &c. You will please report by them any difficulties or unusual occurrence.

Very respectfully, sir, your obedient servant,

EDWARD R. S. CANBY,
Major 10th infantry, &c., commanding.

First Lieut. E. C. JONES,
Seventh infantry, commanding working party.

In the due course of events I received from Lieutenant Colonel Canby the following letter:

HEADQUARTERS, FORT BRIDGER, U. T.,
September 21, 1858.

SIR: The working party for the new road will leave to-morrow morning, under the direction of First Lieutenant E. C. Jones, 7th infantry. The party is not so fully supplied with tools as I consider desirable, but there are very few at the post, and none can be purchased in the neighborhood. I shall be obliged to suspend a part of our work here, in order to supply those that they will take with them. I hope that there will be enough to meet their wants in this case.

Very respectfully, sir, your obedient servant,

EDWARD R. F. CANBY,
Major 10th Infantry, Commanding.

Captain J. H. SIMPSON,
Topographical Engineers.

Agreeably to special orders, No. 84, of September 14, given above, I left Camp Floyd September 16; Lieutenant Torbert in command of the working party, consisting of 5 non-commissioned officers and 50 privates, and Assistant Surgeon J. C. Bailey having been assigned to duty with the detachment. Five wagons transported the provisions and baggage of the party, and the necessary tools. In the afternoon we encamped at Lehi, a distance of 16¾ miles from Camp Floyd. No work required on the road.

September 17.—The party to-day reached as far as half a mile above "Beautiful Cascade," in Timpanogos river cañon. I left in the morning for Provo, to engage the guide, Mr. Isaaac Bullock, to convey the working party from Fort Bridger. Was successful, and after instructing him by letter to report to Lieutenant Canby agreeably to special orders, No. 84, I returned to the camp of my party the same night. Distance from Lehi, 17 miles.

September 18.—Nothing required to-day till we reached the second crossing of the Timpanogos. Here I materially improved the ford by locating it a quarter of a mile above, and bargained with Mr. Bean to open and grade the approaches for ten dollars, it to be finished by the time we returned. The party improved the crossing at Dry creek, and graded the banks of a creek which I have called Torbert creek, in honor of the commander of the working party. Encamped on this creek, having travelled 13½ miles.

September 19.—The work to-day consisted in grading the banks of a creek which I have called Bailey's creek, in honor of the assistant surgeon with us; in grading Coal creek, and doing considerable earth work in the cañon just above and at the crossings of the Timpanogos, and at other points, and in widening the old road which had been but partially cut through the timber. Encamped on Michey's creek, so called in honor of Mr. Michey, who was in company with us to examine the road for Messrs. Russell & Co., contractors, and divert, if found practicable, their trains upon it. Day's journey, 10¼ miles.

September 20.—Improved some of the crossings of a couple of small meadow streams, and effected some side cutting on the divide between the Timpanogos and Silver creek. Encamped on Silver creek where the Parley's Park road intersects it. Day's travel, 10 miles. It was in this valley where we first met the command of Major Whiting from Fort Bridger, on its way to Camp Floyd. They had come mostly on my route to this point, but not knowing that it left the Parley's Park road and turned up the valley of Silver creek, they had crossed my track and were proceeding to Salt Lake City on the Parley's Park road. It appears that the guide, Mariano, had been instructed at Fort Bridger to follow my trail, but not getting on it at the start he had conducted the command much too far to the south, they having encamped the first night on Black Fork. He struck the trail subsequently about 10 miles to the east of Bear river, and had kept right till he reached Silver creek. I here diverted him on the new route again, and furnished him with an itinerary to Camp Floyd. We were glad to meet the troop, and especially to learn that they had done a great deal of work in White Clay creek, the most difficult portion of the road.

September 21.—Engaged in grading and bridging the gullies which cross the route on the divide between Silver creek and the Weber river, and also in some side hill excavations. Encamped on the Weber, 1¼ mile above the mouth of Silver creek. Day's journey, 8½ miles; having met between Silver creek and the Weber Major Paul, 7th infantry, who had also come with his command partially over my route, in the track of Major Whiting. Furnished the major with an itinerary to Camp Floyd.

September 22.—Improved the ford of the Weber where Major Whiting had crossed, by changing its approaches, thus making the ford narrower and the road shorter. The banks, also, of the first crossing of White Clay creek, near where we encamped, were graded. Day's travel, 11¼ miles.

September 23, 24, 25.—Two and a half days spent in cutting through a thick growth of willows and brushwood, in side hill excavations, and in gradings of White Clay creek in the first cañon. The road here crosses the creek in ¾ mile seven times, rendered necessary on account of narrowness of the cañon and the impossibility of getting a practicable grade on the bluffs. Major Whiting excavated a road on the side of the north bluff sufficient to enable him to get up with his wagons, but the grade is entirely inadmissable for heavy trains. The remaining portion of the third day was employed in changing the road as followed by Major Whiting, and thus avoiding two bad hills, one of which we had to double up. Considerable cutting through timber and brush was also effected. The major's command having been rationed for but a short period, the guide not being perfectly assured in respect to the route, and the troops not having come on the road expressly to make it, the major was anxious to get through, and only did that which would enable him to accomplish it. Day's journey, 3 miles.

September 26.—Progressed only 1¼ mile, in consequence of the necessity of diverting the road as made by Major Whiting on side hill, where there are some boggy springs, to the river bottom, where there was a good deal of cutting of willows, and some grading at the crossing of streams was required. Delayed also by a rigid reconnaissance along the valley, rendered necessary for the reasons mentioned, and because the valley at this point is full of beaver dams.

September 27.—Several hours consumed in altering and improving a ford of White Clay creek. Bettered it materially by finding out the beaver dam which dammed up the water and tearing it down. The remaining portion of the day was spent in side-hill excavations. Have to-day made only 2 miles.

September 28.—Did not move camp to day. Party engaged in grading hill back of camp. This is the worst hill in White Clay creek valley, and is about 9½ miles from its mouth, or about 4¾ miles above the lower cañon. Lieutenant Torbert and myself made an ineffectual attempt to evade the hill by getting through the bottom, but the numerous beaver dams prevented it.

September 29.—Sent an express to the upper cañon of White Clay creek, ten miles above, to see if Lieutenant Jones and working party had arrived from Fort Bridger. Reconnoitred in the morning for the best location for the road some six miles ahead. Dr. Bailey in company, and doing valuable service. Express returned about noon with a letter from Lieutenant Jones, who had reached the upper cañon last evening, and was now working the road in the bottom at that point. Express also brought the orders of Lieutenant Colonel Canby, detaching the working party from Fort Bridger, a copy of his instructions to Lieutenant Jones, and a letter from the colonel to me covering his orders. A copy of these documents has already been given. The following is a copy of Lieutenant Jones' letter to me:

SEPTEMBER 29, 1858.

CAPTAIN: I am now camped on the main branch of White Clay creek. I came on to Major Whiting's road about 7 miles back, and followed it to this place with my wagons to get a place to camp. But about one mile back his road struck over the hills. To get up I had to pull the wagons by hand, and let them down in the same way. My party are now working a road through the bottom. I think it will be better than Major Whiting's road; at least down this far.

My instructions are to report to you, which I now do. I send by bearer a letter and two papers from Colonel Canby.

Very respectfully, your obedient servant,

E. C. JONES,
First Lieut. 7th Infantry, com'g working party.

Captain SIMPSON,
Topographical Engineers, commanding party.

In the afternoon Major Prince, paymaster, arrived from Camp Floyd on his way to pay the troops at Fort Bridger, and gave me your note, desiring me as soon as my duties on the road would permit, and I had set the topographical party under Lieutenant J. K. L. Smith properly

to work on the survey of the military reserve at Fort Bridger, and return to Camp Floyd, as the general commanding wished me to make a reconnaissance west of that post, over the Great Salt Lake Desert, before winter.

September 30.—Party still employed in grading hill near camp, and making a bridge across ravine. I left for Fort Bridger; Lieutenant Torbert accompanying me as far as Lieutenant Jones' camp, in order to look over the road with me and receive instructions. He returned to his own camp the same afternoon. I examined the work done by Lieutenant Jones in the bottom of the cañon, and went over a portion of the route with him to point out the best location. At this locality Major Whiting ascended the left or south bluff of the cañon by a very steep hill, and descended again by as steep a one; indeed, so steep was the ascent of the latter, that it required my teams to be doubled, and in addition the assistance of Lieutenant Jones' party to push the wagons up. The road, therefore, here, has been cut through the willows in the river bottom. I encamped for the night with Lieutenant Jones.

October 1, 2, and 3.—Arrived at Fort Bridger about noon, October 3; but little work has been required between White Clay creek and Fort Bridger. The principal is the causewaying the slough just after crossing Bear river, the grading of the hill four miles beyond, (or east,) and the grading of the ravine immediately from the Muddy Fork to the table land beyond, (or east.)

October 4.—The day spent in examining the accounts and paying off some of the party.

October 5.—Severe rain all day; engaged in writing letters and giving instructions to Lieutenant Smith in relation to the survey of the reserve.

October 6.—Left for headquarters, department of Utah; Mr. Engelmann, geologist, in company. Passed, since October 2, several contractors' trains, going in whole or in part on the new route, to all of which I furnished itineraries. Met Lieutenant Jones October 8, near the head of White Clay creek, on his return to Fort Bridger; reiterated orders about bad crossings requiring to be graded more, and specifying some of them. Directed him to "corduroy" or log the slough before referred to, to the east of Bear river, and also, if he had time, to make the side-hill excavations marked out by me for him on the tongue of land four miles to the east of Bear river. On passing down White Clay creek found that Lieutenant Torbert, according to my instructions, had changed the road from the bluff, at the mouth of the creek, to the river bottom; had materially improved the road upon the divide between Weber river and Silver creek, and also obviated two bad fords of the Timpanogos, and otherwise improved the road in the upper cañon of that river. Met three contractors' trains, which had come on the new road from Echo cañon. Overtook Lieutenant Torbert and party at American Fork settlement, on his way back to Camp Floyd. Encamped with him for the night, and the next day the whole party reached Camp Floyd.

Comparison of the new and old route by Echo cañon.

The only wagon route from Fort Bridger to the valley of Great Salt Lake City which the people of this Territory, emigrants to and from California, and Indian traders have, up to the opening of the new route, been in the habit of travelling, has been that by Echo cañon and the Big and Little mountains.

This route has always been very objectionable, both on the score of the deficiency of grass and its exceedingly rough, mountainous character; but as there was none other than that by Soda Springs, which required a detour of about one and a half degree of latitude out of the way, there was no alternative. The new route, however, which I have opened, has no such hills or mountains to go over, and the grades of the divides, generally, are very fair for a mountain road. In point of grass and water it is far superior to the old road; and in respect to fuel, equally good, if not better. The consequence has been, that since the opening of the road nearly all of the government as well as contractors' trains have been travelling it, in whole or in part, in preference to the old one. The agent of the contractors, Messrs. Russell, Major & Co., (Mr. Garrison,) has informed me that some of the trains left Fort Bridger by the new route after others which had taken the old, and the former had reached Camp Floyd and been discharged before the arrival of the latter. There is no doubt that a great deal of draught and beef stock has been saved by the opportune opening of the new route, and to it I think must be attributed no little portion of the success which has attended the efforts of the contractors in getting in their trains before winter. The route, then, is a good one for bringing pack animals and herds of cattle into the Great Salt Lake valley *early* in the spring and *late* in the fall.

Work to be done upon the road next spring.

The working parties under Lieutenants Torbert and Jones were successful in opening the road and making it passable, but still the short period for which they were provisioned did not permit them to do all that was required to make it such as it ought to be. Besides, the teams which have gone over the road have very much cut it up in places, on account of its being new. I would therefore respectfully suggest that working parties, from both extremes of the road, be ordered early next spring to repair it, and put it in the condition it should be. The points which would require special attention are the soft bottom in the upper portion of the upper cañon of Timpanogos river; the divide between Silver creek and the Weber, particularly the sideling place near the Weber; the causewaying of a few yards between the crossing of the Weber and White Clay creek; the bridging of a little miry stream near Porter's creek; the causewaying the bottom of White Clay creek over some beaver dam land, or carrying the road on the table land, or side hills, as might be deemed

best; the causewaying or bridging the slough just beyond Bear river; and the grading of the tongue of land four miles beyond, which Lieutenant Jones was instructed to effect, but which, in all probability, the expenditure of his rations did not permit him to accomplish, and the grading of some of the hills toward Fort Bridger.

Connexions with the old road.

The new road connects with the old by the Parley's Park road down the Weber to the mouth of Echo cañon, in a distance of five miles; also by the Fort Supply road down Sulphur creek, a distance of 3¼ miles; also down the Muddy Fork in 3½ miles. The two first connexions have been in frequent requisition by the trains since the road was opened.

Military features of the route.

These are mainly the lower cañon of the Timpanogos and the two cañons in White Clay creek. These cañons, on account of the impossibility of commanding them from adjacent heights or turning them, are points of prime importance in keeping the road open to our troops, or obstructing it to an enemy.

They, therefore, in case of an emergency, should be the first points seized and fortified. In this connexion, and as conducive to the same end, an excellent position for a post would probably be on the valley of Utah Lake, near the mouth of, and upon the Timpanogos river. The valley of the Timpanogos would prove valuable for stock grazing, and frequently, as I think, all winter, and the position would be such as to command the valley.

The water is pure and abundant, and wood can be obtained near. Should it be the intention of the government ever to occupy this position, the whole of the valley of the Timpanogos should, in my opinion, be a part of the reserve. The necessities of the post in reference to wood and grass would seem to require it.

Another excellent position would be in Weber valley, possibly midway between the mouth of Echo cañon and that of White Clay creek, or, at any rate, in the vicinity of the mouth of White Clay creek, above or below it, in the valley of the Weber. Such a position would be in striking distance of the defiles of both of these cañon creeks; and as grass, wood, and water abound in the vicinity, there would be every facility for the erection and maintenance of such a post. The reserve about the post should include a large portion of the Weber valley and also the whole of White Clay creek valley.

Complimentary.

In concluding this portion of my report, it would do injustice to my feelings if I did not bring to the notice of the commanding general the very efficient aid I received from Lieutenant Torbert, the officer in immediate charge of the working party. Ever prompt in execution, I found him no less judicious in the application of the labor he commanded; and it is a gratification to me that I am enabled to make this honorable mention of him. I have also to acknowledge the valuable assistance I received from Assistant Surgeon Bailey, who was always ready to aid in any mode which might further the work. I also believe it my duty to mention the zeal and good judgment displayed by Sergeant Kopp, company G, 5th infantry, the non-commissioned officer in charge of the party, in the discharge of his duties; as also worthy of special commendation the able, industrious, and persistent manner in which the two privates, J. McConnell, company C, and Flannery, company G, 10th infantry, did their work. The men generally did their work manfully and well, but those two are worthy of special remark for their superior industry and energy.

Itinerary.

Appended will be found an itinerary, marked B, of the new route from Camp Floyd to Fort Bridger, giving all the necessary information in relation to wood, water, and grass.

Exploration southwest of Camp Floyd.

HEADQUARTERS DEPARTMENT OF UTAH.
Camp Floyd, U. T., October 15, 1858.

SIR: As preliminary to more extended examinations in the spring of the country west of Rush valley, in order to ascertain its facilities for grazing purposes and the practicability of opening a road for general travelling direct from the camp to Carson valley or the lower parts of the Humboldt river, the commanding general directs that as soon as the necessary arrangements can be made for carrying out his wishes, you proceed to the examination of the country designated, passing from Rush into Skull valley by the cañon connecting the two near Johnson's settlement, on Clover creek, and extending your explorations as far as you deem it prudent to venture, considering the condition of your animals and the lateness of the season.

From the base of the bench lands in the east of Skull valley to the Goshoot mountains, (about 50 miles,) the country is represented as a vast clay flat, destitute of vegetation and water, except about midway, at the Granite mountains, and in the spring almost impassable for wagons. Anticipating that a practicable road during the travelling season will be found on the southern rim of this basin, the commanding general wishes you on your outward journey to avoid as much of this mud flat as possible, and examine the bench lands to the south, especially with regard to facilities for grazing; and if you think a good natural road possible and advantageous, to ascertain the practicability of obtaining water by sinking wells if needed.

The commanding general authorizes you to employ a few laborers and guides, and also an interpreter, as the country you will be able

to explore this fall is occupied by bands of Indians, many of whom are represented as hostile to the settlers in this country. You may also procure through him much useful information from the Indians in regard to other lands, as well as of the country.

It is in contemplation to establish a military post on the most eligible road to California, and it is in the view of ascertaining the eligibility of this route that the exploration is directed.

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

F. J. PORTER,
Assistant Adjutant General.

Captain JAMES H. SIMPSON,
Topographical Engineers, Camp Floyd, U. T.

Special orders, No. 103.

HEADQUARTERS DEPARTMENT OF UTAH,
Camp Floyd, U. T., October 18, 1858.

An escort of one officer and thirty-five men (1 non-commissioned officer and 10 dragoons and 3 non-commissioned officers and 21 infantry) will be furnished by the commander of Camp Floyd to Captain James H. Simpson, Topographical Engineers, charged with the exploration, for special purposes, of the country west of Skull valley.

The detachment will be rationed for 25 days from to-morrow morning, when it will march. The officer designated will immediately confer with Captain Simpson on the arrangements for fitting out the party. The chief quartermaster will direct the transportation, tools, &c., to be furnished on estimate by the officer.

By order of Brevet Brigadier General Johnston.

F. J. PORTER,
Assistant Adjutant General.

Special orders, No. 46.

HEADQUARTERS, CAMP FLOYD, U. T.,
October 18, 1858.

[Extract.]

I. In compliance with special orders, No. 103, dated headquarters department of Utah, October 18, 1858, First Lieutenant Gurden Chapin, 7th infantry, with one non-commissioned officer and 10 privates from the 2d dragoons, and 3 non-commissioned officers and 10 privates from the 7th infantry, and one non-commissioned officer and 11 privates from the 10th regiment of infantry, will constitute an escort to Captain Jas. H. Simpson, Topographical Engineers, charged with the exploration, for special purposes, of the country west of Skull valley. The detachment will march to-morrow morning, and be rationed for 25 days. Lieutenant Chapin will confer immediately with Captain Simpson on the arrangements for fitting out the party, and make estimate on the chief quartermaster for transportation, tools, &c.

The non-commissioned officers from the dragoons and 10th infantry and the senior non-commissioned officer of the 7th will report to Lieutenant Chapin at 12 o'clock. * * * * * * *

By order of Lieutenant Colonel Morrison.

EDW'D J. BROOKS,
Second Lieutenant 7th Infantry, Adjutant.

I left Camp Floyd, agreeably to the above orders, at 10 o'clock a. m. October 19, First Lieutenant Gurden Chapin, 7th infantry, in command of the escort, consisting of one non-commissioned officer and 10 dragoons and 3 non-commissioned officers and 21 infantry. The subsistence and camp equipage of the party were transported in five wagons, and my astronomical instruments in an ambulance. Mr. Henry Englemann accompanied me as geologist, and Mr. William Bean was our guide. Our course for the first 2½ miles lay a little south of west, up a gentle ascent, in Cedar valley, to the plain pass between Cedar and Rush valleys, which pass I call Camp Floyd Pass, on account of the proximity of the post of that name. Thence turning gradually more westwardly around the point of the Oguirrah mountains, which bound the pass on its north side; in a distance of two miles the route gets into Rush valley, and our course for 11½ miles lay to Meadow creek, where we encamped. Day's travel, 17 miles. *Cedar valley*, so called by the Mormons, *Oguirrah* valley by the Indians, in which Camp Floyd is situated, is an open flatly concave valley, running north and south about 25 miles, and averaging a breadth east and west of about 8 miles. Mountains encompass it, more or less, on every side, though in the northeast and southeast extremities, as well as at the middle of its western boundary, there are passes through which there are good wagon roads into adjoining valleys. The land slopes uniformly with gentle grades from the base of the mountains to the middle portion of the valley, and everywhere the indications are that at one time it was covered with water, and constituted, with other valleys I shall describe, a portion of the Great Salt Lake. The *artemisia*, or wild sage, cover it everywhere, though grass is to be found intermingled with it in patches in the valley, and tolerably abundantly along the benches and sides of the mountains and in the cañons. Cedars and pines are to be seen interspersed upon the mountain slopes. Water is to be found at several points in the valley, the sources being gushing springs, which send out the fertilizing element in considerable volume. Camp Floyd is situated in this valley, about midway north and south, and about three-fourths of the distance across from the east side. Rush valley lies directly west of, and is next to, Cedar valley, and, like the latter, it lies nearly north and south, being about 30 miles long in that direction, and 15 east and west. It is bounded by a high range of mountains both on its east and west side; on its north by a short low range of mountains, which, however, does not extend up to the range on the coast side, thus leaving a passage way in that quarter through which a wagon road runs into Tula valley, and on the southwest by rather a low range of mountains, which make a sweep around from the west towards

the south, and then bears up northerly along the middle of the breadth of 15 miles, and terminates about the middle of the length of the valley. In the southeast angle there is a clear opening, which, at the distance I saw it, appeared several miles wide, but which I am told has a width of only about a mile, on account of encroaching hills. Lieutenant Tyler, 2d dragoons, who has been through this pass with pack animals, informs me that it is practicable for wagons. In the southwest corner of the valley there is a winding pass into Tintic valley, lying south and east of Rush valley, and into Servier valley, lying south of Rush valley. On the west side of the valley there are two wagon road passes, one towards the northwest end of the valley, the other about the middle of the west side of the valley, and both leading into Skull valley, lying directly west of Rush valley. These two last passes will be mentioned again in the course of my journey. The soil, like that of all the valleys, is areno-argillaceous, and wild sage and greasewood everywhere prevail. Grass exists abundantly on the benches and slopes of the mountains, and in the cañons, and along the streams, which are to be found in different portions of the valley, running generally from south to north for a distance and then sinking. Cedar and scrub pines cover the mountain sides. The soil of Meadow creek, where we are encamped, is saline, and though doubtless it affects the grass somewhat, it does not, however, seem to affect the water. The government has a herd of cattle at pasture in the southwest corner of the valley, protected (in December) by a temporary camp of troops, and towards the northwest end of the valley, on Clover creek, near Johnson's settlement, a large herd of mules, also protected (in December) by a camp of troops. This valley, like Cedar valley, gradually declines from the base of the mountains to the middle of the valley, and shows a kind of water line, indicating that at one time it must have been submerged. Its name is said to have been derived from the rushes about the small lakes at its northern extremity. These lakes are included in the small military reserve laid off in that quarter by Colonel Steptoe, of the army. Southwest of our camp I notice a pass, (already referred to,) which bids fair to be practicable for wagons, into Skull valley, and it is in my direct course, (see maps to the Goshoot mountains, whither I am tending;) but as I might fail to get through, and it might then detain me on my outward route, I think it best to defer a reconnaissance of it until my return.

Camp No. 1, Meadow creek, October 20.—Thermometer at sunrise 13 degrees above zero. The snow which fell a few days ago still covering the mountain tops and sprinkled upon the mountain sides; morning bright and cold. The wolves last night disturbed us a great deal by their howling, having been drawn near the camp by the dead animals lying around. Struck camp 7¼ o'clock a. m. Our course lay for the first 8¾ miles about northwest to within one quarter of a mile of Johnson's settlement, on Clover creek; thence more westwardly up Clover creek for about a mile, when we crossed it, and in two miles further, still continuing up the creek, we reached another noble spring, the source of the creek, where we encamped at 10 o'clock

p. m.; day's journey 13 miles. The creek is 5 feet wide and one deep and quite rapid, and just before reaching Johnson's settlement has been diverted almost entirely to an acequia for the purpose of irrigating the fields about the settlement. This settlement is a sort of hay ranch or stock farm. It was first settled by Mr. Johnson in the fall of 1854. There are about 200 acres of good farming land along the creek, some of which has been fenced in and cultivated. Like all the land I have seen in the Territory, however, it must have the incessant labor of irrigation applied to it to make it yield. The settlement is composed of 15 small log-houses. The Indians, the inhabitants informed me, burnt three of the tenements last spring, and they believe it to have been done by the Goshoots. Population of the place 100 persons, "big and little."

There is a good wagon road from here to Tuillah, in the Tuillah valley, 7 miles distant, and to Salt Lake City, 53 miles distant, running through the military reserve at the head of Rush valley and by way of the pass at the northern end of the Oquirrah mountains. I saw in this village two Goshoot Indians (young warriors) and an old woman, who, as usual, was made the pack animal of the party. The warriors were each well clad and armed with a rifle. Their manner appeared impudent and presuming towards the Mormons with whom they were conversing, and with hands full of bread, which, doubtless, they had levied upon some frightened citizen. They acted and talked as if they were entitled to anything they might ask for. The carriage of the Mormons towards them I thought submissive and provocative of the very thing they would most deprecate, an attack upon them. For the last three miles our route has been ascending up the valley of Clover creek in order to thread the cañon or pass, before referred to, into Skull valley. The narrowest portion of the valley thus far is about 100 hundred yards wide, and there are three or four sidling places, each of short distance, which, if ever the route should be much travelled with wagons, ought to be made level transversely. Our camp ground to-day is delightful. The spring near us sends out a copious volume of pure water; willows and wild cherry bushes shade it, and the side hills and benches of the valley in the vicinity are covered abundantly with the finest bunch grass and cedars.

Camp No. 2, Spring head of Clover creek, October 21.—Thermometer at 6½ a. m. at 30½°; marched at 8¼ o'clock. Course generally westwardly through a pass into Skull valley, already referred to, which I call Reynold's Pass, in honor of Major John F. Reynolds, third artillery, who encamped here in the spring of 1855, and who first examined it with a view to its practicability for wagons. In 1½ mile, the ascent pretty steep, we reached the top of the divide, and in about 5 miles more, with about as steep a descent, we debouched into Skull valley, it having been necessary to work the valley in several places. Upon the ascent there are two or three quite sideling places, of short extent, which ought to be graded. The descent to Skull valley is the most difficult portion of the pass. Along it is a narrow gorge about 300 yards long, which at one place is not more than ten feet wide. The narrowness of the gorge, together with its short turns, made it

necessary for us to take out all the mules except those at the wheel; and even then it was with considerable difficulty we got through; besides, at these places the descent is by steps, which would make it entirely impracticable for loaded wagons to go east through the pass. The pass, in fact, is impracticable for heavy trains going either way, and the blasting which would be required to make the road practicable would be quite considerable either way. The rocks of the enclosing wall are a silicious limestone, some of them looking like white marble. Generally, however, they are of a bluish color and impure character. The cañon, after leaving the last narrow gorge, widens to about a hundred yards. Cedars grow on the slopes, and a mile before you debouch into Skull valley, among some poplars on your right, in an arroyo, there is occasionally, the guide informs me, water, though there was none when we passed, and therefore it is not to be relied on. Just before you debouch into the valley, the Great Salt Lake Desert, of which Skull valley is a part, bursts upon your view, traversed immediately in front or west of you by short ranges of mountains, some 35 miles off; in the southwest direction by the famous Granite Mount; and about 60 miles off, in a southwest direction, by the Goshoot mountains. At the north the valley appears to be uninterrupted as far as the Great Salt Lake, and at the south it is hemmed in, more or less, by mountains, which tend southwardly for a distance of 25 or 30 miles, and then apparently approach each other, leaving openings between them into other valleys. This valley, like Rush and Cedar valleys, presents the idea of a kind of basin with a low rim visible at its southern extremity. The descent thence being, though very gradual, towards the Great Salt Lake. The bench of the mountain through which we have just passed on its west side is abundantly supplied with bunch grass, and about 2 miles to the south of the pass there are some springs of slightly brackish water. A stock corral is to be seen in the neighborhood of these springs. My guide informed me that about 8 miles to the north of the pass, on the west slope of the mountain, is a fine stream of pure water descending from the mountain and sinking about mid-valley.

After getting out of this cañon our course lay about southwest, 6 miles to Willow Swamp, where we encamped. Distance made to-day 11¼ miles. The lower portion of the road through the cañon, and until you get off the bench of the mountains, is very sandy. Soil of the valley argillaceous, of a whitish color, and covered with sage and greasewood. Abundance of grass about Willow Swamp, but of impure quality, on account of the alkaline nature of the soil. The water, however, does not seem to be affected by it. Willow and sage fuel. On account of the possibility of our not finding water to-morrow we have had our ten-gallon water-kegs filled.

Camp No. 3, Willow Springs, October 22.—The weather has been boisterous and threatening all night, and continues so this morning. Thermometer at 6¼ a. m. 47½ degrees. It is astonishing to notice the effect of the whirls and gusts of wind upon the magnetic needle, or, more properly speaking, to see the action of the magnetic needle at the time these whirls and gusts are in development. The fact of these disturbances appearing together does not necessarily point to the same cause producing both, but makes it strongly probable that the cause is one and the same in both cases. The needle, whenever these gusts and whirls are in exhibition, would stick either to the north or south end of the bottom of box, and no change of position could make it stir. Sometimes the effect would be to disturb the needle very much, and to make it point indifferently to any point of the compass. When, however, the gusts would cease the needle would act normally as usual. We moved at 7½ o'clock a. m. Our course all day has been very slightly west of south. For a few miles we followed the faint wagon track we have been on since we left Reynold's Pass, and which, the guide says, enters the Beckwith route at Reading Spring. This track, he informs me, was just made in 1855 by a party of Mormons under Deputy Marshall Wall, who went out in that year in search of the murderers of a party of emigrants by a gang of desperadoes under a man by the name of Carlos Murray. It has since been travelled by Sub-Indian Agent Armstrong, in his journey to the Goshoot Indians. Finding the track was taking us off our course we left it, bearing off more southwardly, and in thirteen miles from our last night's camp reached a shallow hollow, where, on account of some of our mules giving out, we were obliged to halt and encamp. The shallow hollow was selected on account of the protection it afforded against the cold wind. Here we have but little grass, no water except what we brought with us, and only sage fuel. There being indication of water in the mountain ahead, that is to the south of us, after giving orders for the encampment, I went off in search of it on its northeast side, but found none. The indications are still better further on the north side, which I will examine to-morrow. The distance travelled by the wagons to-day has been but 13 miles, on account of the low sand-hill ridges, which we commenced crossing 2½ miles this side of our last camp, and which intervened more or less all the way. We are now fairly on the Great Salt Lake Desert, and the indications are that it extends northwardly more than a hundred miles. The valley is quite level, like all we have passed over, up to the benches of the mountains, and it is covered with the *artemisia*. The soil continues of an areno-argillaceous character, and the indications are of its having been at some remote period the basin of a lake. To the southwest and west the rocks appear of an igneous and sometimes scoriaceous character, and in that direction, by the sombre hue which they give to the valley, make it appear as if a gloomy vail or pall had been thrown over it. To the southward the mountains look more cheerful, and give evidences of grass, wood, and water. The desolation which pervades all nature in these deserts is extreme, and can never be appreciated until realized. No signs of man or beast meet the eye, and even the birds seem to avoid it in their ærial flight. We are obliged to-night to give our animals a half ration of oats and a couple of gallons of water from our little stock on hand.

Camp No. 4, Great Salt Lake Desert, October 23.—It rained slightly during the night. All hands up at 4 a. m., in order to get an early

start, and, if possible, procure water and grass. Thermometer, 43 o'clock a. m., 43 degrees. Started on our way as soon as we could clearly see; weather still cloudy and threatening rain. Gave Lieut. Chapin the course of the route, with directions to proceed with the escort and train until he should be directed differently, while I proceeded with the guide and a couple of dragoons to the north face of the mountain I examined yesterday in search of water. We had not gone more than four miles when one of the dragoons I had sent up to the foot of the mountain came towards us with such a rapid gait that I felt sure the long sought for element had been discovered; and so it turned out. He had, as he said, found a little water; but, on examining it, I soon ascertained, by digging a series of wells, it would answer the purposes of our command, and might be made to serve, by a series of troughs, one to receive the drainage of the one above it, a large number of animals. The spring is in an arroyo pretty well up the bench of the mountain, and was in the midst of a growth of rushes, now removed, which, a little lower down, we found deposited, in considerable quantities, as calcareous petrifactions in a very perfect state. The taste of the water is sweet and palatable. Bunch grass of a fine quality is to be found about the spring, and exists in great abundance all along the benches both on its east and north sides. Cedar crowns the side of the mountain. Finding it a good place to recruit our animals, I sent word to Lieutenant Chapin to bring up the command as near the spring as possible, with his wagons, and encamp. This circumstance will account for the sharp angle to be seen on the map of our to-day's route. It being perfectly practicable, however, to come with wagons from our camp to the spring, after allowing our animals to graze for about an hour, I set out, Mr. Engelmann, the guide, and a couple of dragoons in company, to continue our explorations along the face of the mountain further south in search of water, and to obtain a good point of view whence we might reconnoitre the mountains ahead. After going about three miles from the spring we attained a high point whence we could very well observe the mountains in our course and towards the west. At the south could be seen what Mr. Bean calls Kanne-ke-ki-be, or Horse mountain, (a Pawant word,) some 25 miles off. In this mountain, on one of the sloping benches, I could see with my reconnoitreing glass indications of grass and water. South 75° west, 60 miles distant, could be seen over a low intermediate range, the Goshoot mountains; and north 75° west, about 25 miles off, the Granite mountain, nothing intervening between it and ourselves. Captain Beckwith found "a permanent spring of pure cold water" on the north extremity of this mountain, but very little grass; and Mr. C. N. Moeller, secretary of a Mormon company, informs me that he found a few brackish springs on the south side, and some bunch grass, sufficient for a few animals. He also informs me that, according to some California emigrants, some fine water is to be found in a ravine on the north side of Beckwith's route, opposite to the Granite mountain. In a direction north 65° west, and nearly one hundred miles distant, could be seen Pilot's Peak, the most notable landmark

on the horizon, and the extreme western limit of Captain Stansbury's exploration of the Great Desert in 1849. To the southwest of us, about twenty miles off, appears a low gap in the mountain range between us and the Goshoot mountains, the point we are aiming at. This gap, then, is directly in our course. But there are no indications of water in that vicinity, and the grass looks sparse. If, however, we could get through the pass we could doubtless reach the warm springs fifteen or twenty miles beyond, of which the guide is personally cognizant. To the south, in the Kanne-ke-ki-be mountains, the indications of grass and water are decidedly better, but the direction is too far south; and besides, if we should go thither and find no water, the probabilities are we should be so far from the Warm Springs, a necessary point in our course, that we might not be able to reach them the next day, and the consequence would be we should be without water two days. The chances are in favor of our striking for the Cow Pass, or gap, to-morrow. This afternoon we had our kegs filled, to be in readiness for to-morrow's march. The spring where we are encamped I call Pleasant Spring, at the suggestion of Lieutenant Chapin.

Camp No. 5, Pleasant Spring, October 24.—Thermometer, 6¼ a. m., 40¼ degrees. Atmosphere damp and threatening a storm. Left at 7 o'clock; course southwest to gap referred to yesterday. The desert as level as a floor, and in spots perfectly smooth and divested of every vestige of vegetation, and even of that universal plant in this country, the wild sage. The soil is a clay, slightly intermixed with fine sand, and packs hard. Both Captains Stansbury and Beckwith represent the desert further north as quite soft under the influence of snow and rain, but probably on account of the valley being higher where we are, our road will be more passable under these circumstances, and the guide, who has had some experience on these deserts, say it will not cut deep in wet weather. The bare spots referred to are where the water has collected and stood for some time. At the foot of the mountain which we are skirting on our left, at about 8 miles from our last camp. I notice a great deal of bunch grass. At this place the bottom of the valley is broken, and there is quite a low vail, or arroyo, where, if anywhere, water might be possibly got by digging.—(See accompanying report of Mr. Engelmann on this subject.) Indeed, the indications are that there has been water here recently, and the green grass in places show that it might probably be got not far below the surface. The general appearance of the soil of the desert is that of a baked surface checkered by cracks, sprinkled thinly with small artemisia, with now and then a patch smooth and denuded, and looking like a polished clay floor. Went with the guide on a high point of some highly scoriaceous rocks, about 20 miles from our last camp, to see the prospect towards the south; gloomy enough, no signs of water and no assurances of our being able to head the mountain range which we are approaching, except by a journey of 30 miles, and even this is not certain. Our plan, then, is to continue on our course and to try the gap towards which we are approaching. The valley to the south and north of the point of view just referred to

tends east of south; appears to be some 25 or 30 miles long, and varies in width from 5 to 15 miles. The rocks whence our point of view was had are the most scoriaceous and vesicular of any I have seen, and when broken ring and presents a fracture like steel. Struck across to pass to examine its practicability for wagons before dark. Steepest portion near the top, about ¼ mile. Find it impracticable for loaded wagons, but with an expense of say five thousand dollars might be made passable. Ascended the highest eminence adjacent, to take a view of the valley ahead of us. Towards the west, some 35 or 40 miles off, could see the Goshoot mountains ranging about north and south. Intervening between it is the great desert Lieut. Beckwith travelled over. Towards the northwest it appears uninterrupted by any obstacle. Far off in the desert the light sand could be seen drifting under the influence of the wind, and towards the northwest the bottom of the valley appears of a whitish complexion. On account of the steep ascent of the pass, it looks very much as if our expedition had come to an end. We could, by unpacking our wagons and carrying everything up by hand, and doubling the teams, probably be enabled to get over, but this would consume so much of the day to-morrow that we would not be able to reach the spring before late in the night, if at all during the day; so we would probably be kept out of water 48 hours. Another plan is to go up the valley southwardly in which we are, and attempt to head or pass through the range in that quarter; but this would involve a journey of 35 or 40 miles before we could get water, which our teams are not equal to. My best course will be to dismount some of the dragoons, pack 5 or 6 days' rations and some bedding upon them, send the wagons and a portion of the party back to Pleasant Springs, where the animals can recruit till my return, and go myself with the remainder through the pass ahead of us, and explore thence to Fish river, the end of our exploration. On my return I can vary my route, and, making a detour more to the south, examine the practicability of a route in that quarter. With my mind fully made up to this course I retired for the night. One of the ambulance mules gave out before getting into camp, and one of the six-mule teams gave out entirely, so that the wagon had to be drawn on by another set of mules. The pass near our camp I have called *Short-cut Pass*, it furnishing the shortest route to the Goshoot mountains. There being no water and but little grass where we are encamped, we are obliged to deal out our last forage and draw upon our kegs of water.

Camp No. 6, Short-cut Pass, October 25.—Thermometer at 5¾ o'clock 32 degrees. I rose this morning with the expectation of arranging matters so that the exploration might still be continued onward as reasoned in my journal of yesterday; but, much to my disappointment, I found it had been snowing during the night, and a cold and driving wind had set in from the north, which threatened very seriously the safety of our return to Camp Floyd without loss or damage. We had travelled 40 miles or more over the Great Desert, open for about 100 miles to the north; and, in addition to this, on our return we may possibly have to thread Reynold's Pass, into Rush

valley, difficult under any circumstances with wagons, and impossible when choked up with snow. It was just the season when such storms might be expected, and as Pleasant Spring, where I had last night determined to send the wagons, on account of its north exposure and generally unsheltered position was no place for the animals to be herded, or party to encamp to await my return, and the snow might prove a very serious obstacle to my own progress with packs, and it was very certain we could not remain where we were, without water, I determined at once to retrace my steps to Pleasant Spring, and thence return to Camp Floyd by a shorter route, which the topography of the country seemed to make possible. I believe I shall always be found willing to endure necessary evils when they are to be encountered to insure the accomplishment of an important end; but not believing that the enterprise I was engaged in was of more importance than the preservation of my party, I have concluded upon the step just referred to. Accordingly we took up our return march at 7½ o'clock a. m., our course being the reverse of yesterday's. The forepart of the journey was quite cold, and the snow driving in our faces from the north made the journey still more disagreeable. By getting off our horses and walking, however, we managed to keep ourselves tolerably comfortable. The road having a slight descent from the mountain, and the mules feeling conscious that they were going home, the journey was made much quicker than on our outward trip, and we arrived at Pleasant Spring at 4 o'clock p. m., and encamped. On this occasion we got our wagons up to within a few yards of the spring; indeed, wells have been dug both above and below the camp in the spring arroyo. There was rather an unusual incident occurred to-day along the route. Mr. Engelmann, the guide, and myself were riding in advance of the column, well muffled up about our throats and faces to keep off the cold and snow, when the guide was heard to say, in a low, careful tone, "Look to your right! look to your right!" when what should be following us or passing us within 30 feet, apparently unconscious or indifferent about our presence, but a veritable wolf, which on no other occasion have I been able to get within gunshot range of me. It seemed it had been attracted by the pointer dog or rather bitch with us, and was so much taken up as not to be aware of our proximity. Our pistols were out of our holsters in a moment, and Mr. Engelmann and the guide both shooting at once, a ball was put through the side of the wolf, which set him to spinning round—his head, as it were, seeking the place and cause of the sudden shock; recovering, then, for a moment his consciousness, he leaped a few yards from us and fell dead.

Camp No. 7, Pleasant Spring, October 26.—Thermometer at 6½ o'clock a. m. 23¼ degrees. Ice formed during the night. The wind, however, which had been blowing fresh from the northwest yesterday, went down at sunset, and we passed the night comfortably. This morning the atmosphere is unusually clear, and the distant mountains show very plainly. Believing that I can shorten the route back to Camp Floyd by turning a short low range of mountains

ahead of us at the south. I laid my course accordingly, and in 7½ miles our route became tangent to the south point of said range. Passing this point we found ourselves in a valley lying directly south of Skull valley, and separated from it by a low ridge or rim about four miles distant, which would be no obstacle to the passage of wagons from one valley to the other; indeed, so slight is the ridge, they may both be considered almost as one valley. The general width of the valley is about eight miles, and it is characterized, as these valleys are generally, by a shallow rim extending across it at the south, about eight miles distant, and which forms no barrier to a passage by wagons into Sevier valley, directly south of it. The bottom is covered with artemisia, and, like that of the other valleys, the soil is areno-argillaceous, and utterly worthless for agricultural purposes from the want of water to irrigate it. On the east side of the valley, upon the benches, and extending nearly down to the middle, is an abundance of nutritious grass, which, however, wants the accession of water to make it suitable for grazing purposes. Cedars grow on the sides of the mountain. After passing the point of ridge before referred to, our course lay nearly northeast to what appeared to be the pass into Rush valley, which I noticed on the 19th of October, and which I represented I would reconnoitre on my return route to Camp Floyd. In 4½ miles we reached the base of the mountain near the foot of the pass, when, after ordering the party to encamp, I examined the pass entirely through to Rush valley, a distance of about six miles. I find the pass entirely practicable for wagons, without the necessity for any labor, though going east as we are we shall be obliged to double our teams, to get up the last ascent, near the top of the divide. Going west the pass is still better, and loaded wagons will be able to get through without doubling. We are encamped within a mile of the foot of the pass, where there is no water. Grass and cedar fuel abound. Day's journey, 11¾ miles.

Camp No. 8, west foot of Gen. Johnston's pass.—Thermometer, 6 hours 20 minutes a. m., 29¾ degrees. Were off at 7½ o'clock a. m. Weather threatening. Anxious to get through the pass before another snow, our course for the first mile lay about northeast, when we turned the point of the mountain and got into the mouth of the pass; thence our course, somewhat winding, lay generally south of east to the east mouth of the pass, a distance of 5 miles; to top of divide being 4 miles, and 1¼ mile thence to Rush valley. Having passed too far in the gorge to go the near cut I returned by yesterday, the train took up the furthest route, which is to the south of the other, and the roughest. The short cut leads off from the main pass to the left, up a ravine about two miles from the west mouth of the pass, and may be recognized by the thick grove of cedars growing in it. The nearest is certainly the best going west, and, probably, also for trains going east. The steep ascent through the cedar ravine referred to is about a hundred yards in length, and though somewhat sidling and requiring a little side cutting, wagons can now pass over it. We reached the top of the pass at 11½ o'clock a. m., the teams doubling to get up the last ascent. Thence to the mouth of the pass

the grade is quite easy. This pass I have taken the liberty to call General Johnston's pass, in honor of the commanding general. From the foot of the pass our course was northeast by east, until we struck Meadow creek, where we encamped, about 4 miles to the south of our camp of the 19th of October, on this same creek. This creek, as well as Rush valley, having been described in my outward journey, nothing more need be said respecting it.

Camp No. 9, Meadow Creek, October 28.—Thermometer at 6½ o'clock 21½ degress. Got off at 7 o'clock a. m. Our course lay generally northeast for about 11 miles, when we struck our outward track, and in 8 miles reached Camp Floyd. Outward journey from Camp Floyd to Short-cut pass having been 81 miles; inward, 64½, a difference of 16½ miles in favor of the inward route.

Results of the exploration and discussion of the different routes from St. Louis to San Francisco.

There were no experiments made in relation to the practicability of finding water in the desert by digging wells, for the reason that the general commanding dispensed with this portion of my orders before I left Camp Floyd, on account of the lateness of the season. Neither can it be said that I accomplished all I expected in the expedition. I discovered on the desert one new spring, (Pleasant Spring,) of which nothing was known before, and on my return brought my wagons through a new pass (General Johnston's pass,) which I got through without difficulty, and which, in point of practicability for wagons, is far superior to the more northern, or Reynolds' pass. Immediately on my return, Mr. Chorpening, the contractor for carrying the mail on the Humboldt route from Utah to California, at the suggestion of the general commanding, went, with a small party, over my track for the purpose of examining it in reference to the transfer of his stock to a more southern route, a measure which had been rendered necessary by the obstructions from snow on the Goose Creek mountains. This party returned some time since, and Mr. Taft, who was one of the number, has informed me, after a good deal of exploration, they could find no better route to connect with the Humboldt route and avoid the Goose Creek mountains than that I went over. Since then they have transferred their mail stock to this route, and are now making use of it as a winter route towards California. Pleasant Spring is one of their stations, and until the Short-cut pass can be made practicable for wagons they will pack the water to the next spring beyond; thence there is no difficulty from want of water to the Humboldt river.*

It would appear, then, that my reconnaissance accomplished all that could have been, so far as the determination of the best route over the desert to connect with Captain Beckwith's route at the Goshoot mountains was concerned. But still the range through

* Since the above was written Mr. Chorpening has been here, and reports that he has got a good hard wagon route all the way to the Humboldt.

which the Short-cut pass extends requires further examination *to*wards the south to see if water and grass cannot be found in that direction, and the mountain be turned or passed through, and thus the Short-cut pass be avoided. Mr. Taft informed me that the mail party examined this range for a short 20 miles south, and could find no pass through. It appeared, however, to my guide and myself, that some miles beyond where they examined a pass might be found. Be this as it may, I am by no means discouraged in the idea that water and grass can yet be found further south, and though the localities may not be sufficiently convenient to be of service to connect with Captain Beckwith's route, yet they would be of the greatest value in the possible extension of the route. I have already been over all the way through to California, and this in such a direct course as in connexion with the Fort Laramie route, or that of Lieutenant Bryan, *via* Fort Kearney, to Fort Bridger, and the new one I have opened thence to Camp Floyd, might, in all probability, furnish a route all the way through from St. Louis to San Francisco, which would be 500 miles shorter than the present post route between those points, by the way of Fort Smith through northern Texas and Arizona. To make this plain, I here give a *table* of distances between St. Louis and San Francisco on these various routes, carefully prepared from the best sources. And I do this not to disparage said southern post route, but to give the facts just as they are in relation to the northern or Utah routes. California, as well as New Mexico and Arizona, will require a southern mail-route through their territories, and doubtless the facts in relation to that route will be laid before the government. But I think it equally clear that California and Utah will also require one through the Territory of the latter, and therefore it is proper to present the facts of the route just as they are. Besides, the northern route is the great thoroughfare for emigrants to California.

Table of post and other routes from St. Louis to San Francisco.

Designation of route from St. Louis to San Francisco.	Intermediate places.	Intermediate distance in miles.	Authorities.	Total distance between St. Louis and San Francisco.	Difference in favor of the Utah routes over the present southern post route by way of Fort Smith, through Texas and Arizona, from St. Louis to San Francisco.
Present northern travelled route by way of Fort Leavenworth, Fort Kearney, Fort Laramie, South Pass, Echo cañon, Salt Lake City, Hensill's spring, Humboldt river, &c., to San Francisco.	St. Louis.	0	By land estimated.		
	Fort Leavenworth.	350	Capt. J. H. Simpson, Topographical Engineers.		
	Salt Lake City	1,136	Measured by odometer.		
	San Francisco	1,020	Guide Book, by Cain & Brower; distances believed to have been measured by odometer.	2,506	259
Southern Utah route from St. Louis to Salt Lake City, as above; thence by way of Vegas de Santa Clara and Los Angeles to San Francisco.	St. Louis.	0	Estimated.		
	Fort Leavenworth.	350	Captain J. H. Simpson.		
	Salt Lake City	1,136	Guide Book, by Cain & Brower; believed to have been measured by odometer	2,716½	48½
	San Francisco	1,230½			
Route by way of Fort Leavenworth, Fort Kearney, Platte river, Lodge Pole creek, Bryan's Pass, Fort Bridger, new route to Camp Floyd, proposed middle route, thence to San Francisco.	St. Louis.	0	Estimated.		
	Fort Leavenworth.	350	Captain J. H. Simpson.		
	Fort Kearney	281	Lieut. F. T. Bryan, Topographical Engineers.		
	Bryan's Pass	493½	Measured by odometer.		
	Fort Bridger	183½	Captain J. H. Simpson; measured by odometer.		
	Camp Floyd	155			
	San Francisco	800	Estimated	2,265½	499½

TABLE—Continued.

Designation of route from St. Louis to San Francisco.	Intermediate places.	Intermediate distances in miles.	Authorities.	Total distance between St. Louis and San Francisco.	Difference in favor of the Utah routes over the present southern post route, by way of Fort Smith, through Texas and Arizona, from St. Louis to San Francisco.
Southern mail route, by way of Fort Smith, through northern Texas and Arizona, to San Francisco.	St. Louis.	478½	Mr. Ralley, agent of the Post Office Department, as published in St Louis Republican of October 10, 1858	2,765	
	Fort Smith	1,824½			
	Los Angeles	462			
	San Francisco				

In this table it will be noticed I have assumed that a route can be found which would make San Francisco not more than 800 miles from Camp Floyd. At present, the shortest route, which is the northern one, makes the distance 1,020 miles. But the difference of longitude between San Francisco and Camp Floyd is, approximately, 10° 5′; the difference of latitude, 2° 27′ 23′. The air-line distance will then be 557 miles. The difference between this and 800 miles, the assumed distance by the proposed route, is 243, or within 35 miles of half the air-line distance. Surely, then, this is enough allowance for deviations from a direct course. But this is not entirely a conjectural supposition. I have inquired of some of the best guides the country affords, such as Mr. John Reese, George H. Bean, and Thomas D. Pitt, men who have been repeatedly over the various routes between this and California, and they not only are firmly of the opinion that a shorter route than any we now have can be obtained, but that it can be found within a distance of 800 miles. The assumption, then, being well founded, the above table will show that the present northern mail route between St. Louis and San Francisco is shorter than the southern between those places, by the way of Fort Smith and Los Angelos, by 259 miles. That the middle route, *via* Fort Leavenworth, Fort Kearney, Lodge Pole creek, Fort Bridger, Camp Floyd, and the proposed middle route, thence to San Francisco, is shorter by 499¾ miles. And that even the longest route, through Utah, is shorter by 48¼ miles. It assuredly, then, becomes a matter of public moment that the middle route should be extended from Camp Floyd to San Francisco in the direction proposed; and whether the route should be found or not, (and I am of the opinion that it can be,) there will have been something gained in respect to the geography of this immense *terra incognita*, which should no longer remain such under our government and institutions.

Besides the element of distance, which would make the middle route superior to either of the others, the northern is impassable at times in the winter on account of snow on the high mountains between Bear river and the Humboldt river, particularly the Goose Creek mountains, while the middle route would doubtless be passable the whole year. In addition to this, Mr. John Reese, who is well acquainted with this northern route, says that as much as 30 per cent. of the stock driven over this route die every year on account of insufficient and poisonous water and grass at the lower portions of the Humboldt, and between it and Carson river.

The southern Utah route, besides being objectionable on account of its great length, is as much so on account of a large portion of it being a sandy desert and deficient in water and grass. The middle route would be quite direct to Genoa, on the Carson river. Some 50,000 dollars have already been expended by the people of California in the construction of a road from Genoa to Placerville over the Sierra Nevada; and the telegraph is said to be already in operation between these places. When we consider that Placerville is on the direct route to San Francisco, the bearing of the improvements on the expediency of the new route will be readily perceived. In further

illustration of this point I here give a copy of the petition of the citizens of El Dorado county, in California, to Congress in respect to the central overland mail, with the prefatory remarks of the editor of the Valley Tan, a "Gentile" newspaper published in Salt Lake City, from which I extract the memorial:

"*Central Overland Mail.*

"Our Placerville correspondent sends us a copy of the subjoined petition to Congress, and informs us that it is now being generally circulated through El Dorado county, and will probably receive the signature of everybody who sees it.

"We commend the petition to the attention of the citizens of the State, especially those of the central portion of it, who are more particularly interested in the central road across the continent."—(*Valley Tan.*)

"*To the honorable the Senate and House of Representatives of the United States of America:*

"The undersigned, citizens of ———, in the State of California, deeply impressed with the imperative necessity of an intimate and speedy mail connexion with our friends in the Atlantic States, and believing as we do that if your honorable bodies will increase the mail service between St. Joseph, in the State of Missouri, and the city of Placerville, in this State so as to give a tri-weekly mail each way between these places, this laudable end can be accomplished, therefore respectfully and earnestly petition your honorable bodies to take such action in the matter as the exigencies of the case may demand.

"It is a well known fact that for the last nine years the central route to the Pacific, *via* Salt Lake City, has been, and still is, the great thoroughfare of immigration to California. That in addition to its being the best natural road, for the same distance, on the globe, it is also supplied with a continuous meadow of nutritious grasses, upon which countless thousands of animals subsist during the annual hegira.

"Moreover, the counties of El Dorado and Sacramento have appropriated and expended 50,000 dollars in the construction of a good wagon road over the Sierra Nevada, from Placerville to Carson Valley. That work is now completed, and is probably one of the best mountain roads on the continent. Already a magnetic telegraph line is being rapidly constructed along the route to Salt Lake City. Comfortable stations and resting places are being established at proper intervals on the road; and although the present mail contractors have had an extremely limited period in which to prepare for the service, the weekly mails now reach California with surprising regularity.

"For the above reasons, and from a knowledge of what has already been accomplished, we are convinced that in less than two years from the present date the mail can be carried over the route in fifteen days travelling time. We therefore earnestly solicit that you may increase

the speed, so as to run through in twenty-five days, and thereby assist in preparing the way for a more expeditious transit at an early day.

"Believing that your honorable bodies will perceive and appreciate the great national importance of a more speedy and frequent communication between our widely separated possessions, we respectfully urge the foregoing upon your early and favorable consideration; and your petitioners will ever pray, &c."—*Alto California.*

A just tribute.

In closing my report in relation to the last reconnaissance, I cannot forbear bearing this testimony to the zeal which Lieutenant Chapin displayed in continuing in command of the escort of the expedition when the impaired state of his health on the morning of his departure from Camp Floyd evidently made it advisable for him to go on the sick report. Before starting upon the expedition I warned him of his imprudence, but he said he had been detailed by his colonel for the duty, and as he considered it a compliment he could not withdraw, it is a pleasure to me to record, as I do, the efficiency with which, notwithstanding his illness, he conducted his portion of the expedition, and the courtesy which I ever received at his hands.

Indians.

My instructions gave me authority to employ an interpreter for the purpose of communicating through him with the Indians I might meet, and thus obtain from them information respecting themselves and other Indian tribes. We saw but three Indians, (Tuilla Goshoots,) and they escaped us before the guides had an opportunity of conversing with them. I have, therefore, nothing to communicate from anything I saw or was personally cognizant; but Mr. Bean, who has been in this country since 1849, and has frequently passed through the various tribes between this and California, and who was employed at various times by Governor Young in the Indian department, has from time to time given me some facts in relation to the Indians, which it might be of interest to communicate. He has also furnished me with a vocabulary of words in the Ute, and a few in the Sho-sho-ne and I-at languages, which, although not as extensive as I could wish, will be of interest to the ethnologist. It will be found in the appendix, marked "E."

Goshoot and other Indians.

The Goshoots are an offshoot from the Ute Indians, and left their tribe about two generations ago, with their leader or chief, Goship. Their proper name is Gosha-Utes, which has become contracted into Goshoots. They are little esteemed by the original tribe from which they have sprung. They number probably about two hundred, and live principally in the Goshoot mountains. Male and female go naked

in the summer, except a breech-cloth in the case of the former, and a short apron-skirt in that of the latter, are worn as the only covering. In the winter the males wear leggings and a kind of coat made of rabbit skins. The women dress as in summer, except that they wear leggings, and their aprons are made of rabbit skins. Thus dressed, they sit crouching closely together before the fire, and endeavor to keep warm. Their only shelter against snows and the rigor of winter is a kind of wall three or four feet high, made of sage bushes packed together and curved over a little at the top. Sometimes they get into caves or holes in the rocks for protection. They live on grass-seed, flag-root, tuilla (three-corner rush) root, mice, lizards, snakes, grasshoppers, crickets, &c. The grasshoppers and crickets they roast in the summer, and thus preserve them for winter use. On being brought to childbed, Mr. Bean says, no one is allowed to be present with the woman, she being her own midwife. They use the primitive mode of generating fire by rubbing two pieces of wood together.

They, as well as the Utes, frequently bury their dead in springs, by attaching sometimes a stone to them, and sometimes by pushing and keeping them down with a stick. Mr. Bean accounts in this way for the skulls which are found in Skull valley, and which has given it its name. It is somewhat difficult to credit this, but the guide, who bears the character of a reliable man by all who know him, and has never shown me that he is any thing different, says he has actually seen several buried in this way near Provo, where he resides. Those they bury in this mode are not persons of any distinction. The chiefs they bury under a pile of stones. *Wacca*, sometimes called *Walker*, a renowned Ute, and chief of all the tribes called Utes, Pawans, Pieds, and Goshoots, died early in 1855, and was buried on a high mountain twelve miles southeast from Fillmore. Mr. Bean informs me that four Pied prisoners (three children and one squaw) were buried with him. Three of the prisoners were first killed and then thrown into the grave; the other was thrown in alive. Ten horses were also killed and thrown into the pile; also ten blankets and ten buckskins.

His people lamented over him some twenty days, all the while crying and singing Mr. Bean was sent by the superintendent, Governor Young, to comfort them and give them provisions. He represents that it was with the greatest difficulty they got the horses up the mountain. The successor of Walker is his brother *Arrapene*, whose Indian name is Sempoch; he lives in San Pete valley, near Manti. Mr. Bean informs me he recovered a ring belonging to Mr. R. H. Kern, the assistant of Captain Gunnison, and who was massacred by the Indians at the same time with that officer and his party. He says it had his name inside of it, and that he gave it to ex-Governor and Superintendent Young. He presumes it has been returned to Mr. Kern's friends. He was at the time interpreter to the Indian agent, Mr. Rose, v ho recovered a portion Captain Gunnison's property, They recovered two ponies, a revolver, and a piece of the odometer, it having been taken apart by the Indians. Some citizens of Fillmore

got the two-wheel odometer carriage, and, he believes, turned it over to Governor Young.

The Snakes (*Shoshonees*) are more united than the Utes, and, according to Mr. Bean, a nation of more principle. He considers them more powerful, though not as numerous, as all the Utes combined. Their chief is *Wasshekick*, and he lives on Green river.

The *Utes* have been guilty of aiding and abetting the stealing of the children of the Pah-utes, although a branch of themselves, and selling them to Mexican traders. This dealing in human flesh has been a traffic which has been carried on from time immemorial with these Indians. The Pah-utes, who are an inferior branch of the Utes proper, and are called Pah-utes from their living mostly on watercourses and subsisting on fish, (pah meaning water,) are very much disorganized and open to the incursions of other tribes.

The Pawants are a branch of the Utes, mixed with the mongrel breeds of California, and speak the Ute language. *Kannosh* is their chief. They occupy the Parran and Beaver valleys, and the valley of the Sevier. It was a portion of this tribe, Mr. Bean says, that killed Captain Gunnison's party. These Indians he represents as a clever people, more to be depended upon than the others, and the only outrage they have been known to commit is that of massacreing Captain Gunnison and party. Kannosh, their chief, Mr. Bean thinks, is the most gentlemanly bearing Indian he has ever met, and an excellent subject for civilization.

Arrapene, the chief of the Utes, is of a vindictive, unstable character, and thinks nothing of shedding blood when enraged. His habits are good in reference to temperance, in eating, and drinking; but he cannot govern his temper. He does not rate as a chief as high as his predecessor, Wacca.

Wacca was very successful in levying tribute from the Mexicans who traded between New Mexico and California. These Mexicans would buy children stolen from the Pah-utes, giving horses and buckskins in exchange, and sell them in New Mexico and California.

The *Pixds* live adjoining the Pawants, to the south of the Beaver mountains, down to the Santa Clara river and upper branches of the Rio Virgen. *Quanarrah* is the chief of the upper Pieds, and Tatsigobbets of the lower Pieds. Their language differs from the Ute, though similar in some respects.

Geology.

I have said but little of the geological aspect of the country over which I have passed in my several reconnaissances, for the reason that I have left this portion of the expedition to my assistant, Mr. Henry Engelmann, upon whom, from education in his native country, Germany, in this branch of physical science, and his previous experience in geological exploration upon the plains with Lieutenant Bryan, Topographical Engineers, I would prefer to depend than upon my own understanding and observation. I therefore refer you to his report, marked "A" in the appendix, which will be found instructive, not

more on account of the speciality with which he goes into the composition of geological formations, than the range which his observations and reading have enabled him to take in the classifying and arranging of the different formations and their several epochs. His report has the merit also of being of a practical and economical character.

Astronomy.

Observations were made by me at proper intervals with a sextant and chronometer, for latitude and time, or longitude along both of the routes reconnoitered; but as the call for my report is a pressing one, I have been obliged, for want of time and any one to assist me in my labors, to leave them to be reported on another occasion. My assistants, Lieutenants J. L. K. Smith and H. S. Putnam, Topographical Engineers, have only within a day or two arrived from Fort Bridger, where they have been surveying the military reserve, and therefore have been so situated as to be incapable of rendering any assistance in the mode needed. I must, however, express my acknowledgments to Captain Thomas H. Neill, 5th infantry, who has courteously relieved me of the labor of taking a *tracing* of my map.

Meteorology.

Barometric and other meteorological observations have been taken all along the route reconnoitered, but the apology for the non-introduction of a profile of the routes in this report is that given above, in respect to the astronomical observations, and it must be presented in another report.

The thermometric observations, however, require no computation, and will therefore be found in appendix "D."

Itinerary.

For an itinerary of both the outward route from Camp Floyd to Short-cut pass, and the return route, which is the nearest and best, with all necessary remarks in relation to wood, water, and grass, see appendix "C."

Respectfully submitted.

J. H. SIMPSON,
Captain Corps of Topographical Engineers.

Brevet Major FITZ JOHN PORTER,
Assistant Adjutant General U. S. Army.

APPENDIX "A."

Preliminary report on the geology of the country between Fort Bridger and Camp Floyd, Utah Territory, and southwest of the latter place, along Captain J. H. Simpson's routes, 1858; by H. Engelmann, geologist of the party.

CAMP FLOYD, UTAH TERRITORY,
December 25, 1858.

SIR: The limited time allowed for the preparation of the accompanying report, together with the want of books of reference and other advantages enjoyed in a more civilized country, has not permitted me to make it complete. A more thorough study of the collected materials may show the necessity of slight alterations, but I am confident that, in all material points, my statements will be found correct, and wherever some doubt remains I have conscientiously stated it. The paleontological collection has not received yet the proper attention, but in this mountainous region, where plutonic powers have been acting at various, partly at comparatively recent periods, heaving up chains of mountains and dislocating the strata, I have been able easily to trace the limits of the different formations by their lithological character and relative stratification, and I have found my conclusions proved by the examination of the fossils, as far as it has been carried on. By the use of a blow-pipe and a few of the most simple re-agents I have been enabled, at this early time, to communicate some interesting information in regard to the chemical composition of some substances found within the limits of the explorations.

I am, sir, very respectfully, your obedient servant,
H. ENGELMANN.

Captain J. H. SIMPSON,
Chief of Topographical Engineer Department,
Department of Utah.

REPORT.

The country, the description of which is the object of this report, is highly interesting in various respects. Although it extends only from the western rim of the Green River basin, over the Washitah mountains, to the eastern part of the Great Basin, it comprehends marine tertiary deposits; strata of the cretaceous, particularly remarkable for the coal they contain; igneous rocks of different periods; rocks of the carboniferous formation, and extensive quarternary deposits.

It bears striking evidence of the most powerful eruptions of the fluid interior of the globe, but its surface presents no less strong proofs of the vast changes produced by the gradual action of nature,

without any great effort, such as we daily observe it, and to which we are likely to attribute only a very inconsiderable effect, although geology teaches us that all the stratified rocks, many thousand feet in thickness, have been formed by that very same slow process.

The formation of the Green River basin, of marine tertiary age.

This formation is largely developed near Fort Bridger. It extends along the road from the South Pass to the dividing ridge between Weber and Bear rivers. The strata have not been tilted directly, but I found them, wherever they have come under my observation, nearly horizontal, or conformable to the general configuration of the country, with a slight dip off the mountains which limit the basin, as well on the northeast as southwest side. Hereby they can be readily distinguished from the older formations, which have been subject to more disturbances. They overlie, unconformably, strata of cretaceous age, and must therefore belong either to the later part of the cretaceous or to the tertiary period. That dislocations of this strata took place during the cretaceous period I have found near the Medicine Bon Buttes, where evidently cretaceous strata are overlaid unconformably by other strata of the same formation. I have found only a few fossils, but Professor Hall, who has obtained fossils from this formation by Captain Stansbury, pronounces it tertiary.

As we find the Green River basin on several maps marked as "great coal basin," it may be proper to remark here that the coal bearing strata probably do not belong to this formation, but underlie it, and are of cretaceous age. More will be said of them below.

Near Fort Bridger the formation of this tertiary basin is represented by three series of strata, very different in their lithological character. The strata of the upper series are generally green; some coarse green sandstone; arenaceous shales; sandy argillaceous and purely argillaceous shales, interstratified with some slaty sandstone, and calcareous or sandy slates. The color of the sandstone is occasionally changed into yellow brown, or red, indicating various states of decomposition of the silicate of iron, which, in some cases at least, is the green coloring substance. In some places they are rather an irregularly indurated sand, with harder concretions in a more or less loose material. The shales decompose by exposure, and effloresce with a salt which is destructive to the vegetation and makes the water, in places, brackish. These strata, where capped by some of the harder layers, frequently form prominent bluffs, the soft portions wearing away at the base, till the upper strata are left unsustained, when they break down and form a new vertical face, which is soon again cut up by rains and disintegration, and looks rugged, and frequently bold and picturesque. In consequence of this, combined with the horizontality of their stratification, they make numerous table hills, characteristic to the formation, some of which are prominent landmarks. Part of this series is also exposed in the eastern face of the plateau between Fort Bridger and Muddy creek. Its thickness was estimated at 200 to 300 feet. Fossils are very scarce. Some silicified wood found on the surface may have come out of these strata.

The strata of the second series form the lower portion of the plateau. They are slaty calcareous sandstones, slaty limestones, and some purer limestones, in mostly thin layers, interstratified with a great deal of argillaceous shales. The color of all these strata is generally white. The limestones are partly oolitic and fetid, from the large amount of organic remains which they contain, but specimens of fossils can only be obtained in places where the continued influence of water has softened and decomposed the rock. I only got some gasteropoda, and a few acephala, and remains of fishes. Other strata of the limestone are sub-crystalline and very compact. The rock quarried as building stone near Fort Bridger, and also burnt to lime, is uncrystalline, uneven, and earthy or chalky on the fracture, and rather impure. In several places I noticed fibrous gypsum on the slopes, which seems to fill fissures in these rocks. The thickness of this series, near Fort Bridger, was estimated at, at least, 100 feet.

The third series is composed of light colored, generally white, fine grained sandstones, in thick layers, interstratified with mostly brick-red, areno-argillaceous shales. Its total thickness is over two hundred feet, and may be considerably greater. These strata, in which I found no fossils, might, on a superficial examination, be readily mistaken for some of the underlying cretaceous strata, with a similar lithological character, if their unconformable superposition did not indicate the difference.

The country occupied by this tertiary formation is remarkable for its barrenness; in many places it scarcely affords food to a thin growth of dwarfish sage. This is partly owing to the sterility of the soil, a poor, sandy loam; partly to its shallowness in many places, where horizontal strata of limestone and sandstone extend over considerable distances near the surface, undecomposed for the want of humidity; partly to the amount of salty substances in the earth; partly, and mostly, to the dryness of the climate and the perfect drainage by the sandy strata. Only in the immediate neighborhood of creeks a good soil has been formed. Such is the case in the bottom prairie in which Fort Bridger is situated. In the neighborhood of the mountains, where there is more humidity, the aspect of the country is more favorable, and the soil is also better there, in consequence of a more complete mixture and decomposition of the detritus of those and other rocks. There we generally find a good growth of sage, mixed with a great deal of nutritious mountain grass. The country at large is an unredeemable barren. Some few creek bottoms may be susceptible of cultivation, but the elevation of the country, with its sudden changes of temperature, its late snows and early frosts, put narrow limits to the agriculturist. Only such plants might be grown in a few favored spots as require a very short season for their development, and are generally adapted to much more northern climates; and even those are liable to be destroyed by the swarms of grasshoppers which occasionally infest this region. Cultivation will never be carried further than to

help to sustain a station put up for some other purpose, and relying on supplies from outside in case the crop should fail.

The upper series of this formation forms the upper portion of the higher hills near Fort Bridger, but as the strata rises gradually towards the southwest, the second series, of which the lower hills near Fort Bridger are composed, soon attains the height of the plateau, over which the roads lead westward. It caps the breaks of Muddy creek on Captain Simpson's new road, as well as on the old road. On the latter it was found some miles further on, near the top of high hills; and some strata near the top of the dividing ridge between Echo creek and Yellow creek seem to belong to this series. The third is exposed along Muddy creek; on the new road it forms the dividing ridge towards Sulphur creek, is then interrupted by upheaved strata of the cretaceous period, but was found again on the western bank of Bear river, and on both sides of the dividing ridge towards White Clay creek. On the old road it also forms the divide towards Bear river, is there interrupted by tilted cretaceous strata, which it was found overlying unconformably near the mouth of Sulphur creek. It extends further west, across Bear river to the Needles, near Yellow creek, which again disrupts its continuity, but beyond it forms part of the divide towards Echo creek, and may extend some distance down that creek. On the western bank of Bear river these strata are found far up and down the stream, at least to the mouth of Yellow creek. This tertiary formation extends far to the south, in the Green River basin.

Among the fossils collected by Colonel Frémont on the Uintah river, near longitude 111° and latitude 40°, and described by Prof. Hall, are two—Mya fellinoides and Cerithium tenerum—which are identical with specimens found by me in the second series on Ham's Fork of Green river.

Covering this formation I noticed in many places boulders of silicious rocks, highly altered sandstone, and the like, some of which contained traces of fossils. I may be enabled to trace their origin, which is probably the carboniferous formation.

The cretaceous formation.

I have found the cretaceous formation developed on the eastern slope of the Washita mountains. This discovery, in connexion with those which I made in 1856, while geologist of the exploring expedition under Lieutenant F. T. Bryan, Topographical Engineers, will give a key to incoherent facts stated by various explorers, and enable us to trace the cretaceous formation over a vast area on which it was before not known to exist; it will be an important link for the connexion of the northern and southern portion of this formation.

The cretaceous strata, as developed east of the Washita mountains, are not only interesting to the geologist, they also deserve the attention of the economist, so called, and the public generally, on account of the large quantity of coal which they contain, and which comes to the surface at several points. Little use is made of it now,

BLANK FRAME

occasionally passing trains take some for blacksmithing, but who can tell what benefit may once be derived from the knowledge of these deposits. Now they seem to be valueless, thrown away by nature in a desert, but in this age of progress it is sufficient to know that there is a valuable article, and unexpectedly it will be turned to some use, and be considered a source of national wealth.

The interest of the subject, and the desire to bring useful information before the public, may excuse me if I transgress the limits of this report by dwelling a little longer on this matter, and pointing out the localities where coal has been found between the Missouri and the Great Basin. The regular coal measures of the carboniferous formation are known to exist in the southeast of Nebraska, the east of Kansas and the Indian territory, and the north and northeast of Texas. We take for granted that they extend some distance further west, below the surface, and that the beds of coal found elsewhere, in the middle and lower portions of this formation, may be developed and worked at whatever time the increased demand should warrant extensive and costly mining operations. West of these coal measures in Kansas and Nebraska we find a formation characterized by ferruginous sandstones, probably of cretaceous age, perhaps an equivalent of the coal bearing cretaceous strata of the Wahsatch mountains. In these some small seams of coal have been noticed, which, however, do not seem to be thick enough for practical use. The next coal known further west is lignite, at the eastern base of the Rocky mountains. These deposits have not been explored yet, and it is doubtful if they are of cretaceous or tertiary age; but the coal has been proved by the testimony of several explorers and travellers. It has been found between the North and South Forks of Platte river. Captain Abert, Topographical Engineers, in 1845, also observed strata which he regarded as an indubitable proof of the existence of coal northeast of Fort Union, near the headwaters of the Canadian, about longitude 104½°, latitude 36¼°. And I find the existence of coal mentioned near the sources of Red river, within the limits of the cretaceous deposits. In the same longitude further north, near the Upper Missouri and Yellowstone rivers, an extensive tertiary lignite formation is found, surrounded by cretaceous strata. Vague intelligence of it had been received as early as 1806 by Captain Clarke. It has since been visited by several explorers, and a thorough examination has been made lately by Dr. Hayden, geologist of the expedition under Lieut. Warren, Topographical Engineers. Cretaceous or tertiary lignite deposits are known to cover large areas still further north, in the British possessions. West of the Black Hills cretaceous strata have been found on the North Platte river, in the neighborhood of the Red Buttes, and coal on Deer creek. I had an opportunity last summer to examine that country, and will give more information about it in my general report. This coal seems, also, to be cretaceous, and seems to form the continuation of the coal-bearing strata which I found in 1856 along the southern rim of the Laramie plains, extending west along the Upper North Platte river. Colonel Frémont had first made known that coal existed in the latter place.

The strata of coal which Captain Stansbury, Topographical Engineers, noticed in 1850 in various places, from Green river, near the mouth of Bitter creek, to Bridger's Pass, are undoubtedly a continuation of the same strata, and therefore cretaceous. He also observed coal on Sulphur creek, west of Fort Bridger, of so good quality that he considered it a stone coal of the carboniferous formation; and Colonel Frémont, in 1843, had found the same coal some miles northeast from there, on Muddy creek. Captain Simpson, while opening his new road, found similar coal on White Clay creek. The fossils which I found in the coal bearing strata on Sulphur and White Clay creeks prove that they are of cretaceous age; and I have traced this formation along Weber river from Echo creek to Kamas prairie, and along its eastern affluents in that district. These strata are all tilted to a considerable degree, partly vertical, and are limited to the west by a range of mountains composed of igneous rocks of a more recent origin. The lithological character of these coal bearing strata seems to indicate that they have been formed not far from a shore; and the different development of the cretaceous strata on Green river and North Platte would, therefore, not necessarily indicate a different age. My explorations did not extend further, but I am confident these strata will be found stretching around the Uintah mountains, and many miles north and south. In the coal bearing strata on Sulphur creek I found many fossils, one of which is identical with Professor Hall's "Turbo, paludinæ formis," from Muddy creek.

Captain Gunnison, Topographical Engineers, noticed coal in the southern continuation of the Green River basin, near the junction of the Grand and Blue rivers, at the foot of the Elm mountains. From the description of the general character of the country I conclude that the same formation is developed there as further north in the basin; the more so as the igneous rocks of the Elk mountains are very similar to those which have heaved up the strata near Weber river; moreover, near by on Grand river fragments of rocks were found containing fossils, which indicate the cretaceous formations. The same remarks may be applied to the outcrop of fine coal noticed by Captain Gunnison at the eastern slope of the Wahsatch mountains, near the headwaters of Servier river.

Not far from this latter place, in the upper valley of San Pete creek, an affluent of Servier river, taking its origin also on the eastern slope of the Wahsatch range, good coal is found and wrought to a limited extent for the use of blacksmiths. I have not had an opportunity to examine the locality, but I have got specimens of the coal now used at the blacksmiths' shops at Camp Floyd. It is a very good coal, like that from White Clay creek, and seemingly of the same age; not of the carboniferous formation, but a superior bituminous coal of the cretaceous age.—(See below.)

Further south the cretaceous formation is largely developed along the Canadian, Red river, &c., and has been found to extend west across the mountains into the valley of the Rio Grande and Rio Puerco. I refer to the reports of Captain Whipple, Captain Marcy, and others, and to the geologists Mr. Blake and Geo. Shumard. In

that whole extent of the cretaceous formation no indications of coal have been found, as far as I know, with the exceptions of the two points mentioned above, northeast of Fort Union, and near the head waters of Red river, but Captain J. H. Simpson, Topographical Engineers, in 1849, noticed coal in various places near longitude 108½°, latitude 36°, from the Puerco west to the Sierra Turecha. He states that part of the outcrops were rotten and inferior, while others showed a fine bituminous coal. Considering the vicinity of this to the extensive deposits of cretaceous age; considering, also, that after I have shown that the coal known in the Wahsatch mountains is none of the carboniferous formation—the only doubtful place being that in San Pete valley—no coal of that age is supposed to exist west of the coal fields of Iowa, Missouri, Arkansas, Texas, and adjoining tracts of country, we may presume that the strata in question are also of tertiary or more likely of cretaceous age, and further explorations will probably show them forming the continuation of the Green river strata. We know that the intervening mountain chains have, partly at least, been formed during or at the close of the cretaceous period. This obstruction to the continuity of those strata did, therefore, not exist at the time of their formation.

I have to point to another fact. Among the fossils found by me in the coal bearing strata of Sulphur creek are one or two which seem to be identical with those obtained by Colonel Frémont on Snake river, near long. 115°, lat. 43°. This seems to indicate a continuation of these strata to the north, and perhaps a connexion of the same with the cretaceous formation on the upper Missouri. I will, in the following, give a description of the character of this formation at the various points where I found it. The third series of the tertiary strata occupies the western bank of Bear river near the roads. Below the mouth of Sulphur creek they cross the stream and assume an inconsiderable dip to the west, which can best be noticed from the ridge north of Sulphur creek. They are suddenly cut off and the cretaceous strata then forms the hills, striking NE., SW., and dipping with a high angle to SE. Half a mile above the mouth of Sulphur creek, on its right bank, and also on Bear river above Sulphur creek, I observed light colored shaly slates and gray argillaceous shales; also limestones and some sandstones. The limestone was coarse textured, light yellowish, and quite made up of fossils; another was dark gray, very brittle, and fetid from the amount of organic matter it contained. There I obtained a large number of fossils, different Gasteropoda and several species of Acephala. Following up Sulphur creek I found these strata succeeded and overlaid by sand rocks of white color, interstratified with red and gray slaty sandstones and arenaceous and argillaceous shales, and tilted nearly vertical. Some contain coarse grit and conglomerated portions, and most prominent there is, a little below the crossing of the old road over Sulphur creek, a bed of reddish, silicious conglomerate, forming a rugged crest over the hills, which can easily be traced several miles. Between this and the crossing I found specimens of Inoceramus (probably I. Cripsii) in a sandstone. Above the crossing I noticed some prominent strata of

white sandstone, rather fine grained and soft, with the same strike from NE. to SW., and a dip of a few degrees from the vertical to the SE. This rock contains beautiful specimens of Ostrea, still retaining their enamel, and, by their large number, making the rock in places fetid. Immediately overlying this sandstone is a stratum of bituminous coal, the same which Captain Stansbury mentions in his report, saying: "Specimens of it, although much weathered, burned in a camp fire with a clear, bright flame. It is bright black, but where cut with a knife appears dark brown, and where weathered appears dark brown. It is a superior brown coal." The exposure was not good, and, there being no tools at hand for digging, I could only partially succeed in denuding the strata. The first bed is several feet thick, and there is at least one more within a few feet of it, separated only by some gray argillaceous shales. It would be easy to get millions of bushels of this valuable material with no other instruments than the pickaxe and shovel in an open quarry. Sandstone and shales continue up Sulphur creek, but the strike and dip change. At the forks of Sulphur creek, about four miles above the crossing, I found many more specimens of Ostrea in some strata of sandstone, striking S.SW. to N.NE., and dipping to NW.N., forming a range of hills trending to S.SW. This strata is similar to the coal bearing rock, only more impure light brownish. It may be the same stratum brought up here again. In consequence of the reversed dip I was prevented from examining more closely. At both localities I noticed small springs of weak sulphureous water (sulphureted hydrogen) in the bed of the creek. North of the creek these rocks form considerable mountains for some distance, while the divide to Muddy creek is capped by the tertiary formation. From the crossing of Sulphur creek the strata, forming a ridge in the line of their strike, extend southwest to East Bear river, striking it about 1½ miles below the new road. Near there the coal must crop out again. They also extend in the opposite direction when the range changes more to S., and finally to N.NW., S.SE., striking Bear river near the mouth of Yellow creek. By another irregularity of the stratification they crop out again east from there on a fork of Muddy creek, where Colonel Frémont found coal. One mile S.SW. of the crossing of Sulphur creek, near the elongation of the bed of coal, is the spring of petroleum mentioned by Captain Stansbury. Several small and shallow depressions in the ground are filled with water and some oil and tar. When exposed to the air the green oil seems soon to be changed to tar of dark brown color and aromatic taste, which is occasionally made use of by the Mormons and other emigrants for greasing wagons and as a liniment for bruises, &c. This tar, more hardened and somewhat mixed with soil, is found on the bottom and sides of the spring. The affluent is very small, seldom more than two or three gallons, and I could scarcely succeed to fill one bottle, with the help of a teaspoon, because some people had taken it off a day or two previous. Next I found the cretaceous strata upheaved at the needles on Yellow creek, nine miles west of Bear river. White and gray sandstones, partly fine grained, hard, silicious, partly coarse gritstone, and some conglomeratic are interstratified with mostly reddish, shaly strata, arenaceous shales, and shaly sandstones, and tilted nearly vertical. Most prominent there is a heavy mass of light colored conglomerate, formed of rounded, silicious pebbles of the size of hen's and pigeon's eggs, with only few larger ones, thickly disseminated with gravel in a mortar-like matrix. It forms the ragged crest of the hill from which it has received its name. This ridge trends towards the head of White Clay creek. I did not notice any fossils in that locality. Similar rocks were observed on White Clay creek near the new road. At the upper forks they were tilted vertical and even more than 90 degrees, and there are are large masses of conglomerate. Not all the conglomerates of this district are conformable to the cretaceous strata. Some of them have been deposited after the upheaving of the strata had taken place as a local formation. So those on Porter's creek, (south fork of White Clay creek,) which form remarkable turreted bluffs. Their matrix is also different. It is more purely sandy than that of the others. The dip of the strata on White Clay creek is variable. They are not everywhere exposed, some of the slopes being covered up. Some miles below the upper forks high mountains on the south side of the creek exhibit exposures of yellowish conglomeratic sandstones and of dull reddish sandstone, with a strong dip to W.SW., and conformably overlaid by nearly horizontal strata, consisting of a few layers of sandstone and light colored shales, capped by conglomerates. Further down I found alternations of impure whitish sandstones and light colored argillaceous shales, dipping strongly to W.SW., and containing likewise some conglomeratic portions. At the mouth of Porter's creek I again noticed horizontal conglomerates near the tilted cretaceous strata. Higher upon that creek the conglomerates are very prominent, as stated above, and only few other rocks exposed besides. Below the mouth of this fork Captain Simpson found coal, accompanied by heavy strata of white, rather fine grained sandstone, in which I noticed some Ostrea. The strata are very much broken and disturbed, and covered by heavy masses of rock fallen from above, preventing me from obtaining a section, but the strata are altogether similar to if not the same as those on Sulphur creek. The coal is black, bituminous, and much like a stone coal. It contains a little sulphuret of iron and gypsum, and where cut with a knife looks brown. The weathered pieces on the surface are brown and like those from Sulphur creek. It burns with a bright flame and black smoke. I have not examined the locality where the San Pete coal comes from, but the specimens from both places are much like each other, only the San Pete is more bituminous, probably because the specimens are fresher, having been dug out further from the outcrop. It also contains gypsum, but I did not notice any pyrites in it. The blacksmiths inform me that it contains much dirt, (ashes,) but gives an excellent heat, though not as good by far as the best stone coals. These different coals are "superior bituminous brown coals," of a more recent formation than the common stone coals.

Further down the creek I observed white sandstones interstratified

with red arenaceous slate and red shales; at the lower end of the cañon the red color predominates, but thence down I noticed again white sandstone interstratified with gray shales like above, the coal. The general dip there is towards W. or NW., and towards the mouth of the creek these strata are capped by some prominent white sandstones, with conglomeratic portions. Thence to the mouth of Echo creek similar strata continue, all conformable. I also noticed several beds of pure conglomerate, as in other portions of this formation.

Near the mouth of Echo creek purple conglomerates are largely developed, and nearly horizontal; they form, for some miles, high, vertical, turreted bluffs on the north side of the cañon, while the south side generally presents steep but covered slopes, with only few exposures of rocks, which dip strongly to W.NW. I was doubtful whether the purple conglomerates were conformable—in some places they seem to be, in others not; but I rather think they are a later local deposit. The valley is evidently one of evasion and not one of eruption, with anticlinal strata, as has been stated. Some miles further up the cretaceous sandstones, white, yellowish, and dull red, (mostly,) with some conglomeratic portions, form both sides of the valley, with a moderate dip to W.NW. The divide is capped by the tertiary formation.

On Weber river above the mouth of White Clay creek, the same formation was observed; and specimens of Ostrea were found in several places, in white sandstones. The stratification is irregular, and in some places reversed by the influence of the igneous rocks which form the divide west of the river and at the mouth of Silver creek, and at Kamas prairie come to the water's edge. Mostly the dip is very strong to NW., but I found it also to W., N., and E. In consequence of the dip we get to, relatively, lower strata while approaching Kamas prairie. The western spur of the Uintah mountains is formed of granitic rocks, and on their northern slope, in the cañon of east fork of Weber river, I found altered sandstones, white, and brick-red or gray; and also some strata of gray altered limestone, with some fossils, dipping mostly 60 or 70 degrees to W. NW., but variable. I am not prepared to state whether these rocks are not older, and if they are really conformable to those of the cretaceous period. I did not notice any coal on Weber river, but by a more detailed examination it may be found there.

The rocks of this formation are not particularly fit to make good soil by their disintegration, but the detritus of the neighboring igneous rocks exercises an improving influence, and the soil is supplied with sufficient moisture from the snow-clad peaks. The vegetation, therefore, is better. Portions of the valley of Weber river may be successfully cultivated, but others may be found too high and too cold. They will however afford abundance of hay, while the hills are excellent ranges for cattle in summer.

The divide between Weber river and Silver creek, and between the latter and Timpanogos creek, is formed of igneous rocks; but on the Timpanogos, near Round Prairie, we come to the—

Carboniferous formation.

The extensive developement of this formation in the vicinity of Salt Lake has been made known by Captain Stansbury and Professor Hall. Where it has come under my observation it consists, as it does there, of sandstones, partly highly altered to compact quartz rocks, which seem to form the highest as well as the lowest portion of this series of strata; of a great deal of limestone, mostly dark gray, finely crystalline or subcrystalline, and frequently threaded with numerous veins of calcerous spar or dolomite; of dark bluish gray argillaceous, silicious, and calcareous slates; some argillaceous shales, &c. Nearly all these rocks are more or less altered. In the mountain ranges further west I found these rocks in the immediate vicinity of the tilting igneous rocks, sometimes vitrified and seemingly semi-fused; also whole strata broken and crushed into small fragments, and again cemented in a pudding-stone, or else metamorphosed; but I did not notice there the mica schists, and other metamorphic rocks, which Captain Stansbury found on the Salt Lake.

The carboniferous strata extends west as far as I have been, (to Pass Short-cut,) to the exclusion of any other stratified rocks of older than quaternary age; and, from the imperfect notes we have, it would appear that they are found much further to the west and north. In many places they contain numerous fossils, especially Croductus, Terebratula, Spirifer; also, joints of Crinoidea, Zoophyta, and Bryozoa. Although I have frequently seen dislocations of strata by plutonic agency, I have never observed such a variety of contortions within so limited a space as the strata present in the Timpanogos cañon. Here horizontal, then bent with a sharp angle, or forming vaults, or folded up, so as to break altogether the continuity of the overlaying strata; then rising at once vertically from the bottom of the valley, many hundred feet, to the top of the highest mountains, where they appear horizontal again, as if they never had been subject to any violent actions from underneath. The cañon, forming a deep chasm in these disrupted strata, which reach to the region of nearly perpetual snow, is full of bold gushing springs, some of which form cascades of several hundred feet in height; the cañons near by are also well watered.

I have been informed that some small pieces of coal have been picked up near the head of an eastern affluent of the Timpanogos, in Round Prairie, which, accordingly, has been called Coal creek. Considering the general configuration of the country I can scarcely doubt that this is cretaceous coal. About a mile above the Timpanogos bridge bluish-black shales were noticed, containing crystals of gypsum and efflorescences of a salt which proved to be a mixture of a sulphate of lime and sulphate of magnesia, (perhaps with sulphate of alumina?) Captain Simpson found there a piece which is a mixture of such shale with particles of a brittle anthracite. Although I examined the locality again I could not find a sign of a stratum of coal. In a ravine north of the mouth of the cañon I noticed similar carbonaceous shales, as also near Big Spring, east of Battle creek.

The carbonaceous substance is only disseminated in small particles through the shale, but in some places it may be more frequent, and concentrated in pockets, or even seams or strata. These shales deserve to be followed up and examined in various places by removing the weathered outcrops.

The Timpanogos cañon opens into the great basin, in which, as stated above, the strata of the carboniferous formation, in connexion with igneous rocks, form the mountain ranges. These ranges are all more or less parallel to the Wahsatch mountains, running a little west of north and east of south, quite independent of the dip of the strata, which is very irregular, to east, west, north, and south, and altogether depends upon the single protrusions of igneous rocks within these single ranges. This goes to show that in one of the geological revolutions this whole district was rent by numerous parallel fissures, through which the fluid interior burst up, tilting and scorifying or altering the strata with which it came in contact.

Quaternary deposits out of the Wahsatch mountains.

As far as my observations extend no strata of any period later than the carboniferous were observed in the basins west of Wahsatch mountains above the surface of the valleys, nor do the notes of other explorers indicate the existence of any. Besides the carboniferous and igneous rocks we only find some benches of sand or sandy loam, partly somewhat indurated, exposed in the ravines. How old or recent they may be we can judge only from accessory circumstances. Certainly they do not bear in their lithological character evidences of any great age.

What has, for a series of years, been known as the Great Basin, is the country between the Wahsatch mountains in the east, the Sierra Nevada in the west, the divide of the waters of the Columbia in the north, and of those of the Colorado in the south. It has been called Great Basin because no rivers flow out of it; all those which are formed also end within its limits. In fact, however, this country is a system of smaller basins, independent of each other; it is composed, as far as known, of single wide valleys, many miles long, shut in by mountain ranges, either on all sides or having a communication open between them—in other words, forming basins by themselves or being tributary to other valleys and forming only branches of a basin. Within them each river, each creek, each rivulet or spring, sinks sooner or later; many springs not even reach the surface, except during the wet season. The bottom of the single valleys is mostly an unbroken level or shallow depression from one end to the other; in some instances it is broken, and a lower plain formed near the central portion of the valley. Along the surrounding heights, and round the island mountains which intersect wide valleys, generally elevated "benches" are formed by the accumulation of detritus. They frequently are distinct water marks of considerable width and equal height. Captain Stansbury mentions a place at the northern end of Salt Lake where he counted thirteen such successive benches,

the highest 200 feet above the valley; and in regard to Frémont's island, which is 800 to 900 feet high, he says that the water marks reach to near the summit. I never have seen distinctly more than two or three; most likely because I have not been in the lowest portion of the country.

In the wet season many of these valleys form extensive mud flats which cannot be crossed safely, and some of which are salt; when dry these are covered with a solid crust of common salt. Captain Stansbury remarks, in relation to the desert west of Salt Lake: "These plains are but little elevated above the present level of the lake, and have, beyond question, at one time formed a part of it; an elevation of but a few feet above the present level of the lake would float this entire flat to a great distance, thus forming a vast inland sea." If an elevation of a few feet would have such an effect, what would not be the consequence of an elevation of the water of several hundred feet to the highest water marks on Frémont's island? These valleys have evidently once been covered with water, forming an immense inland sea or seas. This no competent observer will doubt; the only open question is, whether this was during the tertiary or quaternary period.

Changes by subterraneous actions may have taken place since, but the country generally has not been subject to extensive revolutions, or else we would not find everywhere the perfect level and evidences of undisturbed sedimentary agencies. The tertiary strata on Green river and further east have been disturbed. I hold, therefore, that within the last geological period, at the beginning of the present era, vast inland seas existed here, probably covering the whole basin, and that the bottom of the valleys, no matter how high above the present level of Salt Lake, has been formed by the deposits of these waters, which since have gradually subsided. How this could take place I will show in a subsequent chapter.

The quality of the soil is variable in different localities, but in general it is a sandy loam, very light, and, therefore, well susceptible of irrigation, and all too dry without it. In a few favored spots, where it contains a larger per centage of the fertilizing feldspathic detritus from the igneous rocks, and has been more decomposed by the continued influence of humidity, it is exceedingly well adapted to wheat, vegetables, and root crops; but the large average is poor, even in the cultivated portions, and with the same amount of labor much larger quantities of grain than are raised here can be raised in almost any soil in the States, all the statements to the contrary notwithstanding.

In many places the soil is shallow, and underlaid with sand; in others with a clay, called saleratus clay, which, under the influence of the irrigation, and loosened by the plough, undergoes a decomposition by which salts are formed, or salts existing before are brought in contact with the upper soil and the roots of the plants which are killed by them. Fields on such spots may produce well the first season, less the second, and in the third they are perhaps worthless. Many fields have had to be abandoned on that account. It must be

remembered, moreover, that only a very limited area is so situated that it can ever be irrigated. At Camp Floyd the upper soil is a finely sanded loam, the subsoil very rough and still more sandy, and exceedingly hard when dry; lower down it changes to nearly pure very fine sand, with only a few particles of clay. This, when dry, does not appear sandy, but forms very compact pieces, which readily absorb water, and thereby become plastic, though little coherent; a little more water makes them dissolve into fluid sand. In such material, from a depth of 40 feet, obtained by digging a well, General A. S. Johnston found a number of minute shells, embracing three or four species of Gasteropoda and Acephala, probably belonging to now living locustrine species.

Near Camp Floyd, on the creek, saleratus clay is found in large quantities. It is a gray clay, in which salts from white crystallizations and nodules, or the whole of which is whitish and impregnated with the salts. I found that the portion soluble in water contains some chloride of sodium, (common salt;) some sulphate of calcia, (gypsum;) some organic substance, and a great deal of sulphate of magnesia. With my limited means I was unable to ascertain whether it also contains sulphate of alumina. Mixed with four parts of fine sand it makes a superior material for plastering; and dissolved in water it makes good whitewash, after the rougher portions have settled down. The same clay, as well as the common soil and subsoil thereabout, makes good "*adobes*," (unburnt bricks.)

Efflorescences of salt, which I collected at Willow Springs, in Skull valley, were nearly pure salt.

In a country of the configuration and situation of the basin we cannot expect to find many springs. The quantity of condensed atmospheric moisture is naturally small on most of the lower chains of mountains, the extent of which, besides, is not large enough to retain the water necessary for feeding many springs, while the valley formation, with its immense horizontal deposits of highly absorbent sand, is still less likely to form springs. The few springs are generally found either in the lowest portion of the valleys or on the slope of the larger mountain chains, and they frequently sink within a few feet from the point where they issue. The quality of the water is, in many instances, bad. The water of the mountains is frequently highly calcerous or impregnated with salts from decomposing shales, while the water of the valleys frequently contains salts of various descriptions from beds of saleratus clay, and other sources. Springs of really good pure water are therefore scarce; but Captain Stansbury justly remarks, that the quality of nearly all the springs is dependent, in a great degree, upon the season of the year. In the spring and early part of summer, in consequence of the large supply by the melting snow, the water is frequently sweet and palatable, while in the dry season the water of the same springs is sometimes totally unfit for use. Many mountain springs deposit calcareous tufa; also the water of Pleasant Spring, on the eastern rim of the desert, which tastes, however, well, has deposited carbonate of lime, especially on the reeds growing it.

Hot and mineral springs.

Besides the brackish springs, there are numerous warm and hot and mineral springs in the limits of the basin and the surrounding mountains, several of which have long ago attracted the attention of travellers, and have been described by Dr. Wislizenus, Colonel Frémont, Captain Stansbury, Captain Beckwith, and others, to which I refer. I only mention the Beer and Steamboat Springs, on Bear river; the numerous hot springs at the western foot of the Wahsatch mountains; the hot sulphur springs at the eastern base of the Humboldt mountains; the boiling springs near Mud lake and in the Honey Lake valley, &c. The water of most of them contains carbonate of lime, sulphate of lime, sulphate of magnesia, some little chloride of sodium, &c. Some are strongly impregnated with sulphuretted hydrogen or free carbonic acid. In the Warm Spring and Hot Spring near Salt Lake City, common salt is the main mineral constituent; and several of the springs deposit considerable quantities of calcareous tufa. In some places pure cold springs issue near the boiling hot salt springs from orifices which have evidently been formed by the deposits of hot springs. In order to explain this, I must point to the origin of the hot springs. In the region of which we speak, several geological revolutions and violent eruptions of igneous masses have taken place at various periods, by which the rocks have been rent and tilted and crushed in a remarkable manner. Many of the fissures, as we find it in all such cases, have been closed imperfectly, and by them the surface waters gain a ready access to the unfathomable depths. By boring deep we obtain warm water, while such fissures undoubtedly extend to a much greater depth than we can ever attempt to reach by artificial means—therefore the water is hot. It may be only heated, or also impregnated with mineral substances found at that depth. This hot water rises again to the surface in consequence of its less specific gravity, compared with that of the cold water, prompted by the forming steam. On its way up it passes through strata of limestone, and dissolves some of it; perhaps, with the aid of free carbonic acid, it comes to sulphurates, which may be imbedded in metamorphic slates, and effects their decomposition, by which is formed sulphuretted hydrogen, sulphuric acid, and, finally, sulphate of lime, of magnesia, &c.

By this process more heat is created, while some of it is lost in the sides of the channels, and by the mixture of hot water with cold water from branch channels. The great quantity of common salt in some of the springs near Salt Lake may either come from the depth, or the hot water may come in contact with water from the lake by branch channels, and carry it up in the main channel. I cannot decide how these causes may be combined in each case, but this seems to be the general process. If some interruption is caused in these subterranean channels by the caving in of some opening, or perhaps by the deposits of the spring itself in the upper portion of the channel where the water, less hot and under less pressure, cannot keep

in solution all the dissolved substances; or if the water finds a more convenient outlet, then the spring will discontinue, or the water of branch channels, less mixed and finally unmixed with hot mineral water, will continue to run in the old channel above the obstruction, and finally form a fresh cold spring in the place of the hot mineral spring.

Two different mineral springs have come under my observation—the little Copperas Springs of Stansbury 2½ miles west of Muddy creek, on the old Fort Bridger road, and the Warm Springs in Round Prairie, Timpanogos valley. The latter are highly interesting, because they exhibit various stages of the formation and destruction of such springs. I may, therefore, be allowed to give a detailed description of these springs. Nearly the whole portion of Round Prairie on the northwest side of the river is formed of horizontal strata of calcareous tufa, in some places 15 to 20 feet high from the creek, and covering an area of about 4 square miles. On this common plateau four smaller ones have been formed on the points where the springs have chiefly concentrated their action, and on these the numerous springs are raised, or rather have raised their openings, while a few form basins in the plateaus. Most of the springs have the shape of conical tumuli of various height with a circular or oval opening on top, and an oven-shaped cavity inside, wider at the base than near the rim. Their number is very great, if we count all the small ones, and the diameter of the openings varies from a few inches to about thirty feet. Most of them are now dry and filled up to some extent with soil, while others contain more or less water, which is warmer or colder proportional to the quantity of the affluent. The more the deposits of the springs have choked the supplying channels, the less water can flow out during a certain time, and the more heat it will lose on the way and on the surface, while the larger and less obstructed affluent will lose less heat in proportion. The temperature of the water varies between 80 and 109½ degrees Fahrenheit. Most of the springs have no visible affluent nor outlet, but the temperature of the water and rising bubbles of gas indicate an affluent, and the exit must take place through crevices in the rock, and makes the ground all around marshy. One of the most beautiful forms a basin 30 feet long, 12 feet wide, and 18 feet deep, in which the water reaches to one foot and a half to the rim. The northern group of springs is distinguished by the high conic shape with comparatively narrow base. On the western plateau is the highest spring; its cone is about 60 feet high, 100 feet wide on top, and 200 feet at the base; its total elevation above the Timpanogos must be about 120 to 150 feet. The opening on top of this spring is only 12 or 15 feet wide, partly covered with calcareous scum, deposited over fucoid plants which float on the water, and on top of which grass was found growing. This shows how some of the spring openings have been closed up. The top of the spring sounds hollow; the water was found 10 feet deep and 107° Fahrenheit warm; it flows freely over the rim of the cone, and disappears at the base in the pumice-like tufa which it has deposited, and the swampy ground around. The warmest spring,

of 109½° Fahrenheit, is one of the most southern, and forms an eliptical large mound which evidently has had different openings at different times; now all, except one, closed with tufa or filled with scum, and overgrown with a luxuriant vegetation in consequence of the humidity and warmth. The present outlet is four feet wide, and nearly filled up with calcareous scum. It will be closed, probably, in a short time. The water runs freely over the rim, but disappears before reaching the base of the elevation. Some gas bubbles up in all those springs; it has no smell, and seems to be carbonic acid; but after the water had been kept some time in a bottle a distinct smell of sulphureted hydrogen was perceptible on opening the same. The water contains in solution a large amount of solid substances, chiefly carbonate of lime, carbonate of magnesia, sulphate of magnesia, also some carbonate of soda, and a little chloride of sodium. I could not detect anything else with the blow-pipe. The tufa, as well the compact granular kind, which forms horizontal layers, as the pumice-like vesicular, which is deposited by the water running over the rim of the springs, and on the plants which grow in the water, is mainly carbonate of lime and carbonate of magnesia. As a curiosity, I mention that the warmth of the springs attracts innumerable rattlesnakes. Their main resort is between the large slabs of tufa at a dry and shattered spring cone.

A great deal of tufa has been deposited also at Big Spring, northeast of Battle creek. The water of that spring tastes somewhat like that of the Warm Springs, but is not altogether unfit for drinking.

The igneous rocks.

The vast changes which have taken place in configuration of the surface of the earth, at certain places and periods exhibiting themselves in the most violent disruptions and dislocations of the solid crust, while at others working only limited alterations, and thereby either sweeping off at once all animal and vegetable life, or not less certainly, but more quietly and gradually replacing it by one more in harmony with the new state of things. These changes, I say, have frequently been accompanied by outburst of fluid igneous masses from the interior of the globe, which have formed the igneous rocks. They have taken place not only at the close of the great geological periods, but also, although more limited in their extent, during those periods; and even during the comparative quiet of the present era, they occasionally manifest themselves. The igneous rocks differ in their mineralogical character, but can be classified in groups of analogous composition; and all those formed within certain, mostly extensive, periods and limits, originating from the same hearth, bear evidence of it in their composition. They are similar to each other, or at least belong to the same group. It is evident, therefore, that the history of the igneous rocks of a region and of their relation to the stratified rocks of the different formations, forms as essential a part of the geology of a country as the history of the extinct animal life, both together only make a whole. The country under consideration is peculiarly interesting in

regard to the igneous rocks, and I therefore propose to discuss them to a greater extent than it has generally been done in reports of this kind. If more attention is paid to this subject, we will be enabled to give a complete account of the phases through which this continent has passed. This will be easier than in most other countries because we seldom find anywhere else lines so broadly and distinctly marked.

The igneous rock of the examined district belong to different groups, distinct in their mineralogical composition; they are porphyritic, granitic, dioritic, and some perhaps even more recent, trachytic. The first igneous rocks, after leaving the South Pass, were found near Weber river, forming the ridge west of that stream towards Snyder's creek, Silver creek, and the Timpanogos, also on Silver creek along the new road, and down Timpanogos river to Round Prairie. I have a series of specimens from these localities. They differ in their appearance, but a careful examination shows that they are all *porphyritic diorites.*

The dioritic rocks are composed of oligoclase or labradore, with blackish green hornblende, and frequently quartz and dark colored mica. One of the most prominent European mineralogists, who has paid particular attention to the classification of the igneous rocks, Professor Gustavus Rose, remarks: "That one might frequently be tempted to group the American diorites together with the andesite," which derives its name from the Andes mountains, where it is largely developed; it is composed of oligoclase or andesine, hornblende, and brown mica in a highly quartzose matrix, and belongs to the trachytic rocks, which are, generally, of more recent origin than the diorites, because, he says, "the age and general development of the American diorites seem not much to differ from that of the trachytes, while in other countries the diorites are much older and stand nearer to the granitic rocks." I find this remark confirmed, and have even been doubtful whether the rocks in question were not andesites. Only by a careful examination and comparison of the mineralogical character of the rocks, and by testing the relative fusibility of the composing materials with the blow-pipe, I have been led to decide to the contrary. I will give a description of the single specimens:

1. From the summit between Silver creek and Timpanogos. This rock may be regarded as the most normal of these porphyritic diorites. It has a dark gray granular, highly quartzose matrix, which, under the microscope, is dissolved into minute crystals. It contains many small crystals of white labradore, also dark brown mica, and less distinct, but very numerous throughout the matrix, slender columns of dark green hornblende.

2. From the immediate neighborhood of No. 1. It is much less crystalline, more sub-crystalline and uneven on the fracture. The matrix is grayish green, (or rather a mixture of bright green, dark brown, and white, the colors of the single mineral,) with many minute crystals of greenish white labradore and reddish brown columnar mica. The small crystals of the latter may, on a superficial examination, be readily mistaken for hypersthene. No other minerals are crystallized out.

3. From the same locality; stands between 1 and 2.

4. From the high conic mountain at the northern end of Round Prairie. The weathered surface is reddish brown. The gray matrix is granular and composed nearly altogether of microscopic crystals; it is thickly studded with mostly small crystals of white labradore, laminar and columnar crystals of dark brown mica, and some quartz, which is more frequent in the matrix. No hornblende is crystallized, at least not large enough to be recognized.

5. From near 4. It is the same rock more completely crystallized; it contains little matrix, and besides the labradore and quartz, and the lamellar hexagonal columns of brown mica, slender columns of greenish black hornblende can well be distinguished.

6. From the same place. It has again much more dark matrix. The crystals of labradore are less numerous but larger; the mica is dark green, the matrix quartzose, and hornblende could not be distinguished.

7. From the divide between Weber river and Silver creek. It is a compact, granular dark gray rock, more light-colored near the weathered surface. The white labradore and the hornblende are imperfectly crystallized. Small spots of oxide of iron indicate that more hornblende, or probably mica, has decayed. Other pieces are a little better crystallized.

8. From near 7. It contains only little whitish matrix, and is mostly labradore in tabular crystals, in its appearance much like some vitreous feldspar or sanidine, together with many columnar crystals of dark green hornblende, mostly thin, and a few laminae of brown mica. This specimen has quite the appearance of a trachytic rock, but still I must consider it a diorite.

9. From Weber river below Silver creek. It has only very little gray matrix between the coarse crystals of labradore, the bright hexagonal laminae of brown mica, and the grains of quartz. This rock is nearly granitic.

From the above we see that the minerals taking part in the composition of this group of rocks are: labradore, dark brown mica, quartz, and dark green hornblende. The latter was found only in well crystallized specimens, and the want of one or the other of these constituents in some of the rocks must be considered as local. It seems, however, that the more the mica prevails and is well crystallized, the more does the hornblende disappear and quartz come in. We also find a new proof for the rule: that from one specimen, perhaps picked up indiscriminately, it is impossible to draw any correct conclusions on the general composition of the igneous rocks of a district, by which we might be enabled to recognize a contemporaneous formation at a distant point.

Along the valley of the Weber river, from Kamas Prairie to Echo creek, stratified rocks were found, with the exception of one place below Silver creek. The igneous rocks make their apearance only towards the crest of the ridge. In many places they form conglomeratic masses on top of the stratified rocks; so it is on Weber river near the lower end of Kamas prairie, and below Silver creek, and on the ridge between those two places; also on the Timpanogos, above

Round Prairie. The pieces of dioritic rock are imbedded in a similar matrix, and the deposits seem to be formed from the loose pieces of rock and the finer particles, or ashes, after the eruptions had taken place. In some places they may be the result of an overflow of the igneous matter.

On the west side of Kamas Prairie I found much of the rock, 10, which looks like a regular lava, forming also dykes. It is a dull gray finely vesicular rock, with a great tendency to crystallization, containing many indistinct crystals of a blackish green augitic mineral (not olivine) and some laminae of brown mica. I am not certain if this rock is of much later origin than the others, or formed at approximately the same time.

The next igneous rock is a granitic rock, forming high white bare pinnacles on the north side of the mouth of Dry Creek cañon, northeast of Utah lake. Similar heights were noticed, from the distance, northwest of Round Prairie, and low knobs of the same, scarcely sticking out of the ground, west of the Jordan towards Cedar valley. A similar rock, of which, however, I have no specimens for a careful comparison, was observed on the summit of the western spur of the Uintah mountains, between the head of Porter's creek and the east fork of Weber river. The rock from Dry creek, 11, is a crystalline mixture of milk white oligoclase, quartz, and dark green mica. This is not the normal composition of the granites, and comes nearer to that of the *diorites;* it indicates that this rock dates from a period not very far distant from that of the porphyritic diorites. From them it is distinguished, however, by its complete crystallization, by the nature of its feldspathic compound, and by the color of its mica. Green mica was found only in one of those, No. 6, which is a tumbling rock from the neighborhood of No. 11, perhaps even from the line of contact between the different dioritic rocks.

Among the igneous rocks west of Camp Floyd, the oldest one is the *porphyritic* rock which forms the mountains at Pleasant Spring, on the eastern rim of the desert. No. 12. It has only little matrix, in which light pink and white are mixed. Most prominent are the crystals of rather dark colored quartz, and the numerous but smaller crystals of light green highly pellucid feldspar, (orthoclase.) I also noticed many small scales of dark green mica. In other portions of the rock the pink prevails, and in others a light greenish yellow without any red; but in all of them the crystals of quartz are most prominent.

13. From Pleasant Spring is the same rock, differently developed. Most prominent are numerous laminae of brown mica, but I could also distinguish small crystals of white orthoclase and quartz disseminated in a bright red feldspathic matrix, which is softened and somewhat rotten by the influence of the spring. The color has faded a great deal. It contains in some places large green spots, thus forming a transition to the next.

14. Was found near 13, at a little lower level. It has a bright green feldspathic matrix with many particles of quartz, white orthoclase, and dark green mica, and encloses numerous small fragments of altered silicious rock. At first I thought it was a secondary deposit; but after

BLANK FRAME

a careful examination, and finding similar green spots in 13, I regard it as a much decomposed porphyritic rock, which, while fluid, came in contact with sedimentary rocks, and inclosed particles of them.

The other igneous rocks of that region are of more recent origin; 15 was obtained a short distance south of Pleasant Spring, at the foot of the mountain, where it forms a horizontal dyke. It consists of partly large, partly small, angular pieces, closely joined together and cemented by a little calcareous spar, or the like. It has been fluid, and must have split into those fragments while cooling. The rock seems to belong to the *dioritic* group, and may be coeval with those from Silver creek. It is most like No. 1, a compact gray matrix with an uneven fracture, containing numerous small crystals of reddish white labradore, (?) and minute scales of dark brown mica; many yellowish spots indicate that a great deal of mica, or perhaps hornblende, has been destroyed. I noticed, besides, some uncrystalline bright green particles. Where less crystalline, it is uneven and brown, gray and green, on the fracture.

16 forms a similar outcrop several miles north of 15. It is much more uniform; a light bluish gray compact matrix with a conchoidal and slightly splintery fracture, and only few signs of feldspathic crystals. It forms the transition between 15 and pieces like 17, which occur in the same outcrop, although specimen 17 itself was found as tumbling rock between the desert and Skull valley. It looks basaltic; has a grayish black very compact matrix with a conchoidal fracture, and exhibits numerous minute dark green particles of a vitreous mineral, too small to be determined. This rock might properly be called melaphyre, which rock belongs to the dioritic group, and frequently becomes amygdaloidal or vesicular, like 18 and 19.

18 is another specimen of the same outcrop. It is a vesicular dark gray rock, not unlike some lava; most of the cavities are filled with white crystals of some zeolithe. The color of the surface is brown. 19 is a similar irregularly vesicular rock, found scattered east from there in large quantities. It is dull blackish gray; the cellules are empty, or have a yellowish coating.

The difference between these specimens, Nos. 15 to 19, is great; but we must consider that igneous rocks which do not form mountains by themselves, but only fill fissures in other rocks, have frequently dissolved portions of the adjoining solid masses, and thereby been changed to some degree. The different mode and time of cooling exercises a still greater influence on their general appearance.

Seventeen to twenty miles southwest of Pleasant Spring, south of the route, I noticed igneous hills. The rock is most like No. 16, but not quite the same; of light bluish gray color, in places containing crystals of quartz, while in others it does not show any sign of crystallization, and is very uniform. It rings clear under the hammer, and numerous cavities, some of them large, are worn out by the atmospheric agencies, making the rock vesicular. It belongs to the same period as the others. On the slope of one of those hills I found a quartz rock, with crystals of quartz in the purely white quartzose matrix, which gave it the appearance of a porphyry; but weighing all

the circumstances, I must consider that rock as a highly altered semi-fused sandstone. The same igneous rock continues north across the gap south of Pass Short-cut, and there caps the mountains, the lower portion of which is made up of tilted carboniferous rocks. These strata, heated from above and below, are much altered; some have turned brick-red. The overflow of igneous masses does not extend north of the pass.

Similar igneous rocks are largely developed in other parts of the country. Captain Stansbury mentions basaltic hills (compare No. 17) north of Salt lake, and porous trap and porphyry; and from Dr. Schiel's notes to Captain Beckwith's report, it appears that porphyritic diorites are common between Sangre de Christo pass and the Wahsatch mountains, and extend westward over the great basin; but such distinctions are generally made without system, and are, therefore, not available for a systematic classification of the rocks.

I did not find any obsidian, which seems to be common further north.

Minerals.

In a district where the carboniferous formation and porphyritic rocks are developed we might expect to find some metallic minerals, although the devonian and silurian strata are generally more metalliferous. No such minerals have, however, been found in this district, as far as I know, with the exception of the magnetic iron ore, which Captain Stansbury noticed near the north shore of Salt lake, and some other iron ore and iron pyrites in the alum slates. Of other mineral substances we find mentioned in the reports: coal, alum slate, magnesian alum, common salt, sulphate of soda, sulphate of magnesia, and gypsum. Dolomite occurs in large crystallized masses in the altered lime stones. It has been reported frequently that salt exists as rock salt in the southern part of the Wahsatch mountains. By experience I have become very cautious in regard to reports of mineral substances; and in one place where salt is said to be found in red clay, other reliable witnesses have only seen crystallized gypsum. I hope to have an opportunity to visit the southern part of the Wahsatch range, which in this and various other respects promises to be a highly interesting field for a geologist.

Rumors locate lead and silver mines near the southern line of the territory.

General review of the geology of the district.

The oldest stratified fossiliferous rocks of which we know in this district belong to the carboniferous formation, and even part of the underlying metamorphic states may be altered strata of the same. During a part at least of the carboniferous period this country, therefore, formed the bed of an ocean. With the numerous fossils of marine mollusca we only find a few plants. We cannot tell how far these waters extended; but as we find more carboniferous rocks

near Fort Laramie, and the same formation so largely developed in eastern Kansas and the Missouri and Mississippi valley, it is most likely that all these strata have been deposited in the same ocean, no matter how they have been disrupted afterwards, and partly been swept away. I am not prepared at this time to point out the equivalent of the strata here among the sub-divisions of the more eastern deposits. Changes took place, and this country became dry land. In other portions of this ocean strata have been formed which are evidently of later origin than any observed here. We cannot know whether their equivalents have ever been formed here and have since been destroyed, or if this portion of the ocean became dry at an earlier period.

The porphyry of Pleasant Spring bears in its composition evidences of great age. Such porphyries are generally assigned to the later portion of the paleozoic period, and as the carboniferous strata are tilted by it I suppose that its eruption was in connexion with the changes alluded to.

The normal granites, composed mainly of orthoclase, oligoclase, quartz, and mica, and the syenites belonging to the same group and made up of orthoclase and grayish black hornblende, with or without oligoclase, mica, and quartz, are generally, if not always, older than the porphyry. The granite of the Wahsatch mountains, No. 11 of the foregoing, is no normal granite; it lacks orthoclase. In the normal syenites the hornblende disappears and quartz becomes more frequent, when the mica begins to predominate in the composition. With the porphyritic diorites described above, Nos. 1 to 9, the same rule seems to prevail; and if we apply it to No. 11 we find that it must be considered as a diorite, not as a granite. It belongs to the same large group with the porphyritic diorites, but is distinguished from them by its complete crystalization by the different nature of its feldspathic constituent, which is oligoclase, while in the others it is labradore, by the color of its mica and the total absence of hornblende. The difference is considerable, and we therefore may justly presume that its eruption took place at a different time, although within the same large period as that of the porphyritic diorites, and much later than that of the porphyry of Pleasant Spring.

Many of the mountain ranges of this continent which have been described as granite are most likely formed of such abnormal diorite. I have myself, in my report upon the route explored by Lieutenant F. T. Bryan, Topographical Engineers, in 1856, described the rocks of the Black Hills as granites and syenites; the granites composed of light red feldspar, quartz and black mica, the syenites of red feldspar and black hornblende, partly with quartz. Not fully appreciating the importance of such nice distinctions, I have not stated if the feldspathic mineral is feldspar proper; that is, orthoclase or oligoclase; nor if the hornblende is greenish, or grayish black. A new examination of those specimens will probably show that these rocks are diorites, composed normally of oligoclase and greenish black hornblende, with occasionally quartz; and that where the hornblende disappears it is replaced by black mica and quartz, as in No. 11.

Cretaceous strata are strongly tilted on the eastern slope of the Black Hills, near Cache la Poudre creek, which goes to show that these mountains have been raised during or at the close of the cretaceous period. The granites might have been formed previously, and heaved up together with the cretaceous strata; but all the probabilities are to the contrary, and the very composition of the rocks, if dioritic, would speak for their late origin.

The country continued dry land probably during the whole of the triassic and jurassic periods. It may have undergone vast changes, but as no marine deposits were formed we have no records of that time. Terrestrial deposits are naturally always subordinate, and generally so loose that the next great revolution easily destroys what has been built up during the preceding time of quiet. The forces acting during those two periods did not help to accumulate strata, but they certainly worked great destruction among the paleozoic strata deposited before in this district, which must have furnished the material for terrestrial formations and marine deposits beyond our limits.

Other convulsions rent the surface of the globe, producing the changes which opened the cretaceous period. The waves rolled again over this country, and the cretaceous strata were deposited which now occupy the eastern slope of the Wahsatch mountains. As they contain many conglomeratic portions, it would seem that the ocean was shallow there, and the dry land not far off; because pebbles are rounded by the action of the waves near the shore, and not likely to be carried far thence by water of any considerable depth. The coal beds point to the same conclusion. I therefore suppose that the eastern portion of the great basin was elevated above the waters and formed the western terminus of the cretaceous sea in this neighborhood. No cretaceous strata are found now in that region, and if such should have been formed there, contrary to my supposition, they have since been swept away without leaving a trace. Perhaps the Wahsatch mountains existed already; certainly not in their present shape, but one portion of the dioritic rocks may have erupted at the beginning of the cretaceous period, and with the paleozoic strata on their slope formed a barrier to the waters.

The close of the cretaceous period, or probably that of the main sub-divisions of that period, is marked by the eruption of the various dioritic porphyries and diorites; a few of them may be older. During that epoch, I suppose, most of the mountain ranges were formed which now occupy the centre of the continent from the Black Hills to the Wahsatch range, because we find the cretaceous strata tilted on the slope of many of those mountains, while the tertiary rocks overlie them unconformably and much less disturbed. During the (earlier part of the) cretaceous age probably one ocean covered nearly the whole area from the great basin to the Missouri river, extending far towards north and south; and only when these mountain ranges were formed the different basins were marked out.

Although the "backbone" of the continent existed, the continent itself cannot have had its present configuration. At the beginning

of the tertiary period an ocean washed the base of the mountains, now elevated several thousand feet above the sea. We have an evidence of it in the marine tertiary deposits of the Green River country, and the estuary and fresh water formations northeast, east, and southeast of the Black Hills indicate vast inland seas. The latter date from the middle of the tertiary period, according to Dr. Hayden and Professor Leidy.

I avail myself of this opportunity to correct a statement made in my report of 1856. I have described the country east of the Black Hills on Pole creek, near the forks of Platte river, and on the Republican Fork, as covered with quaternary deposits. Last summer I had an opportunity to see the same formation much more perfectly developed on the lower North Platte river, and I have come to the conclusion that the greatest portion of it is an equivalent of the deposits in the Bad Lands on White river, described as miocene tertiary. I found no fossils, except a few fragments of bones. The plainly marked fresh water character of these strata had involved me in that error.

The present era came, and with it the last great revolution of the earth. The forces seem to have acted very equally over an immense surface, and with enormous power; they lifted up the whole centre of the continent several thousand feet, without anywhere, in the district which I have examined, actually bursting the surface and directly and violently disturbing the tertiary strata. These were brought out of their horizontal position, but only raised under small angles. I compare the whole action with the forming of a large bubble. The waters running off to all sides naturally carried away a large portion of the mostly loose tertiary strata and gradual disintegration, and creeks and rivers have since done an incredible amount of destruction among them. In the present Green River country the surface was also raised; but as the pressure subsided again, the surface between the mountains seems to have given way more than the surrounding ranges. In that way the strata must have attained the moderate dip towards the centre of the basin.

The Great Basin—I speak directly only of the eastern portion which I have seen and know of, although the remarks, probably, can be applied to the whole—seems to have been elevated above the cretaceous ocean. The rocks, then, are porphyry, metamorphic slates, and paleozoic strata. The convulsions followed, connected with the origin of the dioritic mountains. The Wahsatch range was formed over a great fissure, running nearly from north to south, and numerous fissures parallel to this one were caused by those shocks all over the basin. In many instances the igneous rocks (Nos. 15 to 19 of the foregoing) passed up through these fissures; by others only heavy faults were caused. Some doubt remains in regard to the time when the fissures were formed; their parallelism to the Wahsatch range speaks decidedly in favor of the period which I have mentioned, and so the mineralogical composition of the rocks seems to do; but, as the latter is not very plain, I cannot positively say that these eruptions did not take

place later, perhaps in connexion with the last great changes at the close of the tertiary period.

The position of the tertiary Green river formation to the Great Basin is anomalous; it is such, on the dividing ridges, that it would seem the basin must have been filled with the same ocean in which those strata were deposited; yet we do not find any traces of like deposits in the basin, and it is evident that the valleys cannot have been formed in that ocean. After handling the question in every possible way, I have come to the conclusion that the present difference of level did not exist at that time. The eastern portion of the basin was dry land, while the Green river country was a sea; and the elevating forces spoken of must have raised the country east of the Wahsatch range more than that west of it. These changes of levels threw the water of the Green river sea in the basin, which must have had nearly its present configuration; and to the sea or seas thus formed the valleys owe their present character. Their remains are found in the Great Salt lake, Utah lake, and others. In order to show how these waters could subside, since the beginning of the present era, we only need to examine into the natural course of events. By applying the physical laws, we find that it could not be otherwise.

We have a vast inland sea, elevated 4,000 to 5,000 feet above the ocean, surrounded by mountain ranges as many thousand feet higher; beyond which, to the north, east, and southeast, mountains and elevated plains extend for many hundred miles; while on the west and southwest side the ocean is nearer, but separated from it by a gigantic range of mountains, the summits of which tower high above the clouds. The country all around will then be well supplied with moisture; soil will be formed and covered with plants best adapted to its properties and location. At such an elevation above the ocean the air is thin; the evaporation fast. Part of the vapors will be condensed again in the same district, and on the neighboring mountains, but the remainder will be carried beyond and lost irreparably, feeding rivers which run away to the far distant oceans. The climate of the country to the north, east, and southeast, is too dry, even if we make allowance for a better state of things at that time, and the ocean too distant to make an adequate return; while to the west and southwest the high mountains turn off the clouds, and effectually prevent the passage to the basin of more than a very limited amount of moisture; moreover, as their eastern base is much higher than the western, they will more favor the egress than the ingress of clouds. The loss will be small at first, and scarcely felt; but taking place continually, through hundreds of years, the effects of it will gradually begin to show themselves. The depths of the waters will diminish inch by inch, foot by foot; the shallowest spots become dry; but still the country around will be sufficiently supplied with moisture, and capable of sustaining vigorously vegetable and animal life. Such seems to have been the condition while human beings lived on this continent, at a time of which we have no records. Traditions point to the country round this sea as the home of powerful tribes, which afterwards, as the country became more and more inhospitable, migrated

to the south. The remains of ancient towns in the northern part of New Mexico, much superior to the pueblos of the Indians which now inhabit that country, and of the origin of which, and of the time when they were inhabited, the present generation has no knowledge, seem to indicate a more prosperous condition of the country in former times. I refer to the pueblos on the Rio Chaco, visited and described by Captain J. H. Simpson, Topographical Engineers, in 1849,* and to Old Zunia, which, however, seems to be of later origin than the others. It is also an established fact, that extensive forests, the remains of which are still found, have existed in some of the central portions of the continent where now no tree relieves the monotony of the barren waste. Volcanic eruptions may have been the immediate cause of the desolation of single spots, but we must look to agencies affecting more equally the whole country in order to explain the changed state of the present time.

The quantity of evaporated water decreases in the same measure as the shallowest places become dry, and therefore the surface of the water smaller. The quantity of condensed moisture and the humidity of the surrounding country decrease proportionally; the air becomes more dry, and the evaporation, instead of actually decreasing proportional to surface of the sea, will rapidly increase, and the shore-lines become more and more contracted. The springs, creeks, and rivers will be reduced or discontinue altogether, the surrounding country become barren and depopulated. Thus the present condition of the basin and surrounding country was produced.

In the spring the snow melts in the mountains, and also the little that is generally in the valleys, and has not disappeared by evaporation. The springs give an abundance of water, which also comes to light in some washes, dry at all other times, the surplus of water of the branch valleys collects in the main valleys; in flat places it spreads out and converts them into impassable mires. In the absorbent sand of the valleys the water soon sinks, and the increasing heat of summer dries the surface. During the other seasons the affluent is small, and the subterranean reservoirs, formed of sand which has been saturated with water in the spring, are emptied by evaporation and by supplying the creeks with which they connect. The creeks and rivers form either lakes, the water of which disappears by evaporation, and the surplus of which, in the wet season, is absorbed by the adjoining sand flats, or they sink in the thirsty sand without even forming lakes. A point must be reached where the quantity of water in the basin is so small that the loss by evaporation is balanced by the quantity of condensed atmospheric moisture. This system of subterranean reservoirs, by diminishing the evaporation, must be regarded as exercising a very favorable influence on the condition of this district; without them the water would all evaporate in the first part of the summer, and many springs would be dry in the fall. The country would be still more desolate than it is now. In many of the valleys the balance may have been attained, in others the quantity

* Senate Document No. 64, session 31st Congress, 1850.

of water may still be diminishing. This is said to be the case in the Salt Lake valley.

Some persons explain this decrease of water in the Salt lake by subterranean outlets, but that cannot be, because the country many miles around is considerably higher than the level of the lake, and even suppose it was so in this one case, we certainly could not account, by a similar reason, for the sinking of all the creeks and rivers nearer to the centre of the Great Basin. The water of Salt lake is a concentrated brine, notwithstanding the large, continual affluent of fresh water by the Jordan, Bear river, Weber river, and others. If there was a subterranean outlet, the salt water would be carried off, and the lake would become a fresh water lake. This shows most conclusively that the whole large affluent is consumed by evaporation. Captain Stansbury, Topographical Engineers, was naturally struck with the appearance of the country in the vicinity of the lake, and expressed his opinion that it was once overflowed, but he attributed the receding of the lake to partial elevations of the country around it. I cannot concur in that explanation. Even suppose that changes of level had taken place by subterranean agencies, this does not at all explain the remarkable features of the country, nor what has become of the water, the quantity of which has been, beyond any doubt, much larger in former times. The changes which have taken place are all the natural consequence of the geographical situation of this country, and we are not compelled to look for extraordinary means to accomplish them. I consider the present condition of this region as one of the greatest evidences of the enormous effects produced by the gradual and unostensible agency of nature.

Another question presents itself. Have the waters which once covered the country been fresh or salt? I am not prepared to discuss this question thoroughly, but I am inclined to suppose that the water has been salt or brackish. The numerous salty substances in the soils and clays point to it. That in many of the valleys no salt is found now does not prove the contrary; they may have lost it. The new supply of water has naturally always been fresh; it has dissolved the salts and carried them off to the lower valleys. Utah lake has lost its salt by the rivers of fresh water which empty into it, and the Jordan which runs out of it; while the Great Salt lake, without outlet, has become a concentrated brine. There are, however, salty springs, and it is possible that all the salt derives its origin from that source.

On Wells.

It may be proper, in connexion with the foregoing, to discuss the question, if or how water can be obtained at suitable points of the valleys or basins? My remarks, in the following, can be applied directly only to the valleys traversed by me with Captain Simpson, but most likely they will be correct, also, in regard to a considerable district beyond.

If roads should be located over that country, they will necessarily have to strike the foot of the main mountain ranges at convenient

distances, in order to get to grass; and their supply of water will have to be procured in the same places. In some instances running streams will afford both. In order to obtain water at all seasons at such points on the slopes, or at intervening points in the valleys, where it might be desirable to establish watering stations, where, however, grass for camping is not to be found, it may be necessary to resort to artificial means. Artesian wells are out of the question. The configuration of the country and the disruption of the strata are such that no result can be calculated upon, and, in many instances, igneous rocks would be struck with the borer. If, accidentally, water should be obtained, it might be salt, or sulphurous, or hot. From the digging of wells I would expect more. I do not pretend to say that water would be obtained everywhere by digging deep enough; by no means; but I suppose that in many instances the distances between water might be shortened by wells, dug in such localities as would appear most favorable for the purpose, or by improving small and insufficient springs.

a. Water may be obtained in such places where small and insufficient springs come to the surface, but sink within a short distance—such as Pleasant Spring. They can be recognized from the distance by a growth of rushes, willows, &c., on their margin, and only require to be followed up to their sources, cleaned out, and provided with some tanks, large enough to hold water for one or two days for a large train. If such springs cannot be relied upon during the whole year, their sources ought to be followed up to the very rock, and, eventually, large subterraneous tanks should be constructed.

b. Similar springs may exist without ever coming to light, in consequence of the gravelly and sandy nature of the surface deposits. We may expect to find them in indentations of the mountains where the vegetation is fresher than elsewhere; where there are, perhaps, green bunches of greasewood, while it is dry all around. I would, likewise, dig down through the gravel to the solid rock in places where heavy washes come out of high and wide mountains, a.. I am confident that water would be found in them in many instances. Such wells might be made accessible to stock, and if the quantity of water should be small, it would, generally, be easy to find a suitable narrow place where a dam might be constructed across the gully at a comparatively small expense. The reservoir thus formed should be covered to keep the water cold and lessen the evaporation. In such a way water might probably be obtained at a point on the west side of General Johnston's pass.

c. Water might be obtained in the valleys, at some favorable places in the washes, by digging to a moderate depth. During the flood time the water collects in rivulets, which run from the branch valleys to the main valleys, and form "washes," in the gravelly bottom of which the water sinks, and flows underground, as soon as the highest flood is over; at last it may discontinue running altogether. Some of the washes may have been formed while there was more water in the valleys, in former times, and it may never be found in them running at present. In many instances the digging in washes would not be

more advantageous than in any other place—only a few feet would be gained in depth—but there are places where the valleys contract, where, perhaps, near the mouth of a branch valley, a spur of hills, or only some strata of underground rocks, run across the opening and make it still narrower, forming a dam behind which the water will collect, and through the openings of which or over which the water must run, if any should run from the branch valley to the main valley. Suppose such a dam be twenty-five feet below the surface, and a wash in that place fifteen feet deep, then the signs of humidity will probably show themselves at the bottom of the wash, but not on the surface above; and by the appearance of the wash we are enabled to judge which may be the most favorable spot for locating a well. If it should be necessary to dig any wells in valleys, such places should be tried first. The water obtained in that way would probably be brackish and unfit for drinking, in case the respective valley contains salts. I have noticed two places of that kind—one several miles west of General Johnston's pass, where a heavy wash enters the gap, towards the desert, and the other in the wash at the mouth of the branch valley and spur of mountains half-way between Pleasant Spring and Pass Short-cut. In such instances the permanent wells should be located to the side of the washes, out of the flood range.

d. Where none of the enumerated facilities should present themselves, it might be necessary to dig wells of great depth. The result, then, would be very uncertain; their depth would render them less serviceable, and the water would, in many cases, be inferior. I have spoken of the reservoirs of water formed of the absorbent sand at the bottom of the valleys, and with deep wells we would try to strike that water. In order to be unfailing, they must be located so that they strike the lower portion of these reservoirs. The dip of the strata is very irregular, and they are so much disrupted that we cannot exactly know the configuration of the bottom of the valleys below the lake deposits, much less give a rule in regard to it. It must, therefore, be left altogether to the judgment of the superintendent to select the preferable place in every instance. These experiments will always be uncertain, and, in order to save time and labor, I would recommend, in all these cases, to examine the depth to the water with an earth-borer, in several places, before locating the well permanently.

In all cases the walls of the wells should be secured with timber or masonry; special care must be taken to secure the lower part, as high up as the water may rise in the wet season, because the fine sand at the bottom is likely to wash in the wells and cause them to cave in. Wherever feasible, they should be made accessible to stock; and where it cannot be done, proper arrangements for watering the same must be made.

To enter into the details of the execution of the work would carry me beyond the limits of a geographical report. I, therefore, conclude with the remark that experiments of this kind should be made during the dry season, the second part of summer, fall, and first part of winter; because in the wet season water can be found

in many places where later in the year there is not a drop. Only in the dry season the experiments would be decisive.

Respectfully submitted.

H. ENGELMANN, *Geologist.*

Captain J. H. SIMPSON,
Chief of Topographical Engineer Department,
Department of Utah.

APPENDIX B.

Itinerary of a wagon route from Camp Floyd to Fort Bridger, explored and opened by Captain J. H. Simpson, Corps Topographical Engineers, under instructions from the headquarters of the department of Utah, in the fall of 1858.

Localities.	Intermediate distances in miles, measured by odometer.	Total fro Camp Floyd.	Wood.	Water.	Grass.
Camp Floyd	.....	.....	.....	.....	.....
Bridge over Jordan	14	.....	.....	.....	.....
Lehi, forage and fuel purchasable	2¼	.....	.....	.....	.....
Am. Fork settlement, (Lake City,) forage and fuel purchasable.	3	.....	.....	.....	.....
Battle creek, (Pleasant Grove,) forage and fuel purchaseable.	3½	.....	.....	.....	.....
Mouth of Timpanogos River cañon, forage and fuel purchasable.	6½	.....	.....	.....	.....
Beautiful Cascade	4½	.....	.....	.....	.....
First camping place for small commands, grass on bench.	¼	.....	.....	.....	.....
First wide place where ox-teams can corral	2	35¾	W.	W.	G.
Good camping places at short intervals all along Timpanogos to within one mile of upper cañon.	18	53¾	W.	W.	G.
End of cañon	2	55¾	W.	W.	G.
Last camp on Timpanogos	1	56¾	W.	W.	G.
Across the divide to Silver creek	6	62¾	Willow and sage.	W.	G.
Parley's Park road	3¾	66½	Willow and sage.	W.	G.
Across divide to Weber river; good camping places all along Weber to mouth of White Clay creek.	6	72½	W.	W.	G.
	12	84½	W.	W.	G.
Good stopping places all along White Clay creek to commencement of lower cañon.	3½	88	W.	W.	G.
End of cañon	¼	88¼	W.	W.	G.
Good camping places all along White Clay creek to commencement of upper cañon.	15	103¾	W.	W.	G.

APPENDIX B—Continued.

Localities.	Intermediate distances in miles, measured by odometer.	Total from Camp Floyd.	Wood.	Water.	Grass.
Last camp on White Clay Creek valley	5½	109	Willow	Water in pools.	G.
Main branch of Bear river	9¾	118¾	W.	W.	G
Middle branch of Bear river, water not constant.	2¾	121½	Willow	.....	G.
East branch of Bear river	¼	121¾	W.	W.	G.
West branch Sulphur creek, small spring about ¾ mile below.	5¼	127	Willow	.....	G.
Middle branch of Sulphur creek	3	130	Willow	.....	G.
East branch of Sulphur creek, junction with Fort Supply road.	½	130½	Sage	W.	G.
First water in ravine going down to Muddy	5½	136¼	Sage	W.	G.
Grass, sage, and willow fuel all the way down the ravine to Muddy, and water at intervals in springs; cedars on the bluffs of Muddy.	5¾	141¾	Sage and willow.	W.	G.
Cañon branch of Black's Fork, grass in vicinity.	7¼	149	W.	W.	G.
Fort Bridger	6	155	W.	W.	G.

APPENDIX C.

Itinerary of a wagon route from Camp Floyd to Short-cut Pass, in the Great Salt Lake Desert, reconnoitred by Captain J. H. Simpson, Topographical Engineers, under instructions from the headquarters of the department of Utah, in the fall of 1858.

Localities.	Intermediate distances in miles, measured by odometer.	Camp to camp.	Total from Camp Floyd.	No. of camp.	Wood.	Water.	Grass.
Camp Floyd	.....	....	....	....	.....	....	....
Camp Floyd pass into Rush valley	2½	....	....	....	W.....	....	G.
Fork of road in Rush valley; take right hand.	2½	....	....	....	.....	....	....
Meadow creek	11¾	17	17	1	Sage...	W.	G.
Johnston's settlement on Clover creek	8¾	....	....	....	.....	....	....
Cross Clover creek	1	....	....	....	.....	....	....
Spring, head of Clover creek; abundance of wood, water, and grass.	3	12½	29¾	2	W.....	W.	G.
Summit of Reynold's pass into Skull valley	1½	....	....	....	.....	....	....
Dry branch; water here only occasionally, and therefore not to be depended upon.	3	....	....	....	.....	W.	G.
West end of pass; get into skull valley; springs on bench of mountain, two miles south.	1	....	....	....	W.....	....	G.
Willow springs; grass here abundant, but not very good; water tolerable; soil alkaline.	5¾	11½	41	3	Willow and sage.	W.	G.
Pass over some sandy ridges, and camp on desert; little grass; should proceed to Pleasant Spring.	13½	13½	54½	4	.....	....	....
Pleasant Spring, (by direct route, four miles,) as we travelled it; good water, abundance of grass, and cedar on the mountain side.	7	7	61½	5	W.....	W.	G.
Short-cut Pass; little grass; no water	19½	19½	81	6	W.....	....	G.

APPENDIX C—Continued.

Return and best route from Short-cut Pass to Camp Floyd.

Localities.	Intermediate distances in miles, measured by odometers.	Camp to camp.	Total from Short-cut Pass.	No. of camp.	Wood.	Water.	Grass.
		Mls	*Mls.*				
Short-cut Pass	----	----	----	----	----	----	----
Pleasant Spring	20	20	20	7	W.	W.	G.
West end of General Johnston's Pass, from Skull into Rush valley; no water.	12	13	32	8	W.	----	G.
Summit of pass	5	----	----	----	W.	----	G.
East end of pass	1¼	----	----	----	W.	----	G.
Meadow creek	6½	12½	44½	9	Sage	W.	G.
Camp Floyd	19¾	19¾	64½	----	----	----	----

APPENDIX D.

TABLE OF TEMPERATURES AND WEATHER.

1.—*Captain Simpson's trip from Fort Bridger to Camp Floyd, September 4 to 12, 1858.*

Left Fort Bridger, September 4. During the day strong breeze from W.SW.

CAMP ON MUDDY CREEK.

September 4.—6 p. m., 61° W.SW., light air, sky cloudless, horizon hazy; 7½ p. m., 37° E., very light air, sky clear, horizon hazy; 9 p. m., 36½° SE., very light air, sky clear.

September 5.—5½ a. m., 34½°, calm, sky nine-tenths covered with light clouds.

It began to rain at 7 a. m.; heavy showers from 12 to 2½ p. m.

All day strong breeze from SW.

CAMP ON THE FORKS OF SULPHUR CREEK.

September 5.—3 p. m., 56° W., light breeze, sky clear, no rain; 6 p. m., 49° W., light breeze, sky covered; showers of rain since 4.

September 6.—5¾ a. m., 34° W., light air, sky covered. During the night, rain; the wind then changed to NE., and it began to snow. In the morning the snow covered the ground 1″ deep. During the morning several short showers of rain or snow.

CAMP ON BEAR RIVER.

September 6.—1¾ p. m., 38¾° N.NE., light air, sky covered, rain and snow; 3 p. m., 34° N., light air; snowing freely from 2 to 4; 6 p. m., 35° SW., light air, sky covered; 8 p. m., 38° S.SE., light air, sky covered thinly.

September 7.—6 a. m., 25° SE., light air, sky clear, some cumulus strat. in W.

CAMP ON WHITE CLAY CREEK.

September 7.—3 p. m., 46½° S., light air, sky half covered with cumulus; a shower of snow and rain just passed; 6 p. m., 39° N.NW., light breeze, sky six-tenths cumuli and cumulo-nimbus; 8 p. m., 36½° N.NW., light air, sky clear.

September 8.—6. a. m., 24° N.NE., very light air, sky clear.

A fine, clear, calm day, at 3 p. m. on the divide, 55½°.

CAMP ON EAST FORK OF WEBER RIVER.

September 8.—6 p. m., 39½°, calm, clear sky; 9 p. m., 27½° E., very light air, sky clear.

September 9.—6 a. m., 21½°, calm and clear, a little white frost; at 3½ p. m., 65° W., strong breeze, sky clear; on the divide, Parley's Park road.

CAMP ON KAMAS PRAIRIE.

September 9.—9½ p. m., 34°, calm, clear sky.

September 10.—5¾ a. m., 22½°, calm and clear, a little white frost; 7 a. m., 35½° calm, sky three-tenths cirro-stratus.

On the divide to Timpanogos river.—10¾ a. m. 36° SW., light breeze, sky clear.

CAMP ON ROUND PRAIRIE.

September 10.—3¾ p. m., 73°, calm and clear, some cirro-stratus on horizon; 9 p. m., 41°, calm and clear.

2.—*Capt. Simpson's exploration from Camp Floyd to Pass Short-cut, October 19 to 20, 1858.*

CAMP ON MEADOW CREEK.

October 19.—4½ p. m., 44⅔° N., light breeze, sky four-tenths cirro-stratus; 6¾ p. m., 25¾°, calm and clear; 8¾ p. m., 19½° S., light air, clear.

October 20.—6½ a. m., 13° S., very light air, a few cumuli.

CAMP ON THE HEAD OF CLOVER CREEK.

October 20.—2 p. m., 56⅔°, calm and clear; 4 p. m., 51°, calm, sky four-fifths cum. strat. and cirro-stratus; 6 p. m., 39¼° NW., very light air, a few light clouds; 9 p. m., 31½°, unchanged.

October 21.—6½ a. m., 30½°, calm and clear.

CAMP IN SKULL VALLEY.

October 21.—3 p. m., 60° S., light breeze, sky nine-tenths lightly covered; 6 p. m., 46° S., light air, sky covered lightly; 9 p. m., 51½° S.SE.., light breeze, sky nine-tenths covered with cum.-nimbus.

October 22.—6¼ a. m., 47½°, S. breeze, occasionally heavy squalls, sky dark.

FIRST CAMP IN THE DESERT.

October 22.—3 p. m., 59½° S., breeze, sky eight-tenths cum. and nimbus, in the morning rain; 6¼ p. m., 48° S., light air, sky eight-tenths cumulo-nimbus; 9 p. m., 41° S., light breeze, covered, in the evening some rain.

October 23.—4¼ a. m., 39°, calm and covered ; in the night rain.

FIRST CAMP ON PLEASANT SPRING. .

October 23.—1 p. m., 49½° SW., very light air, clear, a few white cum. on horizon; 3 p. m., 51½° SW., very light air, clear, SW. horizon slightly covered; 6½ p. m., 40¼° S.SE., light air, sky three-tenths covered with light clouds; 9 p. m., 39¼°, calm, sky eight-tenths white cumuli.

October 24.—6¼ a. m., 40¼° NE., light air, sky covered lightly. All morning SE. breeze.

CAMP NEAR PASS SHORT-CUT.

October 24.—6 p. m., 43¾° N., air, sky four-tenths covered with cumulo-nimbus; 9 p. m., 39¼° N., air, sky dark.

October 25.—5¾ a. m., 32° N.NW., breeze, sky covered, during the night a little rain and snow, in the morning more snow.

Considerable snow during the morning ; all day strong N. wind.

SECOND CAMP ON PLEASANT SPRING.

October 25.—5 p. m., 38° N.NE., breeze, sky three-tenths cumuli; 7 p. m., 32° N.NE., light breeze, one-tenth stratus on horizon; 9 p. m., 32½° N.NE., light breeze, one-tenth cum. stratus on horizon.

October 26.—6½ a. m., 23¼° N.NE., light air, clear.

CAMP SOUTH OF SKULL VALLEY.

October 26.—3½ p. m., 45°, very light air, clear; 6 p. m., 32° E., very light air, clear; 8½ p. m., 31½° E., light air, clear.

October 27.—6½ a. m., 29¾ E., very light air, sky slightly covered.

CAMP ON RUSH VALLEY.

October 27.—3½ p. m., 48° N.NE., light air, sky seven-tenths white cumuli; 6 p. m., 34° N.NE., very light air, sky covered lightly; 9 p. m., 28½° W.SW., very light air, sky covered lightly.

October 28.—6½ a. m., 21½°, calm, one-tenth cumuli of horizon.

APPENDIX E.

English and Utah words.

English.	Utah.	English.	Utah.
1. Man	Tow-ahts	58. Light	Tesh-á
2. Woman	Muin-i-sóge	59. Darkness	To-poon-e-wok
3. Boy	Ipids	60. Morning	Ap-e-chuck
4. Girl	Nansich	61. Evening	Ug-up-ah
5. Infant	Te-wáts	62. Spring	Tam-inr
6. Father	Ino-ants	63. Summer	Tahts
7. Mother	Ree-ads	64. Autumn	Yeo-wun
8. Wife	Pe-wah	65. Winter	Tome
9. Husband	Ko-niung	66. Wind	Nurr
10. Brother, (older)	Páh-vich	67. Thunder	Oo-róo-rump
11. Brother, (younger)	Such-Kige	68. Lightning	Punk-o-in-te
12. Sister, (older)	Pat-ich	69. Rain	Páh-ore
13. Sister, (younger)	Nani-ich	70. Snow	Ne-wáhp
14. Nation—people	Moonch	71. Hail	Tesh-oo-peki
15. Head	Tote-seeb	72. Fire	Kóo-ne
16. Hair	Tso-peeb	73. Water	Pah
17. Face	Ko-bahb	74. Ice	Ten-ge-pah
18. Forehead	Mo-túk-ibe	75. Earth—land	Te-wéep
19. Ear	Nan-kub-ah	76. Sea	Tw-égе-hoó-oh-pat
20. Eye	Poo-eep	77. River	Hov-oh-no-quint
21. Nose	Moop	78. Lake	Páh-ohr
22. Mouth	Luni-bup	79. Valley	Ú-ab
23. Tongue	Ow-goómp	80. Mountain	Kibe
24. Teeth	Too-ump	81. Cañon	Wé-wuds
25. Beard	Munt sóomp	82. Stone	Tunp
26. Neck	Ko-rép	83. Salt	Oh-ah-bah
27. Arm	Pur-ów-a ga-wobi	84. Iron	Pan-a-Kárre
28. Hand	Mope	85. Tree	Pánt-ope
29. Fingers	Mash-i-wah	86. Wood	O-pits
30. Nails, finger	Mat-scet-sump	87. Grass	O-wéep
31. Nails, toe	Tat-scet-sump	88. Willow	Kan-ahb
32. Leg	Pun-no-up	89. Cottonwood	Shoyp
33. Foot	Namp	90. Pine	U-imp
34. Toes	Tat-sóo-ah	91. Flesh—meat	Tik-ny
35. Bone	O-hópe	92. Dog	Sáre-eche
36. Heart	Peé-in	93. Buffalo	Quets-in
37. Blood	Pap	94. Bear	Que-out
38. Town—village	Kau-ne-gah	95. Wolf, large	She-nob-it
39. Chief	Ne-ahb	96. Deer	Teh-a-yah
40. Warrior	Ni-óqua-ße-ah	97. Elk	Par-i-ah
41. Friend	Tik-a-bóo	98. Beaver	Pah-winch
42. House	Kann	99. Otter	Pant-sóok
43. Kettle	Pam-pó-na	100. Fly	Mo-plds
44. Bow	Ahch	101. Eagle	Yuón dich
45. Arrow	Ooo	102. Rattlesnake	Tó-ahb
46. Axe	Que-pán-um	103. Wild goose	O-wan-unk
47. Knife	Witch	104. Feathers	Pe-ah
48. Canoe or boat	O-bi-shok	105. Duck	Tsig-ah
49. Shoes	Pahts	106. Crane	Tch-kore
50. Pipe	Tlonge	107. Fish	Pah-ger
51. Tobacco	Quop	108. Trout—salmon	At-in pah-ger
52. Smoke	Queep	109. Mullet	Oo búg-ger
53. Sun	T'abbe	110. Chub	We-pah-ger
54. Moon	Mát-oche	111. Bird	Wing-gets
55. Star	Poó-e-chiet	112. Name	Ne-ah
56. Day	Tah-á	113. Love	Pé-mits
57. Night	To-wun	114. White	To-shárr

APPENDIX E—Continued.

English.	Utah.	English.	Utah.
115. Red	An-kárr	Which	Hin-yih
116. Black	To-querr	What kind	Hag-arrh
117. Blue	Show-arr	Over	Quañ-ko-up
118. Yellow	Wók-err	This side	E-nunks
119. Green	A-sig-arr	The right side	In-en-to
120. Great	Hoo-ot	The left side	Man-en-to
121. Small	Me-poo-ls	Yonder	Mów-ah
122. Strong	Nár-y-ant	Here	É-bwah
123. Old	Nan-i-pids	Away off	Mee
124. Young	Ie-poods	Close by	In-chock-i-ba
125. Good	Ah'-	Hole	Puk-age
126. Bad	Kooc-ót	Whip	Wásh-e-nump
127. Handsome	Iey	Lariat	Tshapp
128. Ugly	Oó-cope-na	Meeting—gathering	Shu-par-to
129. Alive	No-re-ga	Rusty	Nah-shánts-pe-nok
130. Dead	Ya-qua	Be still	Ah-gáhrr
131. Gun	Tum-bu-yoo	Get out of the way	Ine-to
132. Powder	Quects-ów-ah	Come from a distance	Pee-jee
133. Lead	Ooo	Rabbit	Kam-mo
134. Caps	Wun-ów-ad-jip	Hare	Tshok-um
135. Bread	Tsho-ti-kup	Finger ring	Pau-a-már-ger-nump
136. Flour	Tu-shu-kunt	Foot of mountain	Kaú-ne-gub
What do you call this	An-a-né-ah-inch	Side of mountain	Pi-ah-bah
To trade	Nár-a-wop	Top of mountain	Wig-ki-bah
To hunt	Pe-shów-gah	Sore stinking	Pe-kéep
To look	Poó-in-ka	What for	Ah-kóu-de-ga
To tell	Pe-sheth-i-na	May be or probably	Um-púg-go
To talk	On-pah-ger	Cedar tree	Wahp
To ask	Mi-bwan	Piñon pure	Teh-up
To write	Po-quint-man-ik	Pine nut	To-won
To hear	Nún ki	Fir balsam	Ohmp
To travel	Pah-nt	A spring	Tspe-kin
To go on foot	Namp-pah-nt	All	Mon-ó-nah
To go on horseback	Ko-wi-yo-tspee	Awl	We-uds
To eat	Tik-ub-ah	Mouse	Widget
To drink	E-bee-bah	Cat	Mo-pids
To lay down	Ah-bee	Chicken	Kúhm-pung
To sleep	E-pivee	Cricket	Un-sock
To get up	Quer-i-ka	Grasshopper	Ahr-au-gige
To sit down	Kar-e-wah	Brier	Man-áhb
To stand	Rounñi	To meet	Tói-tia
To run	Pun-ker-o	To cook	Si-eh
To camp	Me-a-bitch	To preach, harangue	Om-pár-ro-ah
To move camp	Me-a-bi-que	To shoot	Ko-que
To go home	Pi-que-ban	To kill	Puk-ie
To guide	Me-ár o-gi	To gamble	Nah-a-witch
Go	Pi-qua	To hit the mark	We-nahr
Come	Pi-eke	To miss the mark	Kar-en-qé
Blanket	Pán-shi-mo	To win	Quoi
Want	Ash-en-ta	To whip	Wit-te-push
Sugar	Pe-á re-kunt	To kindle a fire	Koo-ne-fi-te
Cold	Shoo-pe-ki	To rub	We-tools-pe-nok
Hot	Koo-toó-rits	To grow	Nan-fi
Creek	No-quint	To cut	Tskeb-in
Crooked	No-ko-me	To dig	Ho-ri-eh
I (pron.) or me	Tain-mi	To put down	Rood-zee
You	Nini-weh	To hide away	Áh-gah-wód-zee
He or him	Ing	To steal	Ee-ying-ah
That	Marr	To fasten or tie	Tap-itch

APPENDIX E—Continued.

English.	Utah.	English.	Utah.
To think or remember	Shu-mivi	To sing	Ki-eh
To make	Man-e-kish	To kick	Tang-ie
To give	Mog-ée	To take	Kivee
To load a gun	Tow-ódz	To catch	Tsie
To burn	Koot-sik-ee	One	Sooze
To glean	To-in	Three	Py-oon
To quarrel	Náh-am-bah	Five	Man-ne-gin
To strike	Que-pi	Seven	Nah-ry-kup
Where	Kuk-áh-bah	Nine	Sa-romp-chu-in
What is the matter	Mike	Eleven	Sooze-spia-ke
I said	Mike-ing	Twenty	Wam-shuin
Fight	Ni-o-que	One hundred	Taw-um-skin
Angry	Ni-ah	To catch with lasso	We-tsung-ga-nunk
Nothing	Nah-vash	To drive	Tó-wush-o
Another	Ko-inush	To herd or drive	Po-nee-wo-nee
Looking glass	Nah-voo-nah	To fly	Widge-que-nung
Crow or raven	At-tók-nuts	To understand	Pe-su-ge-wa
Wolf, small	Yodes	All the time	To-shump
Back bone	Ho-app	A few	Nán-e-goos
Ribs	Ow-át-in-bope	To shake hands	Moo-tsie
Money, silver	To-sharr-páu-a-kar-re	To smoke tobacco	Quót-tik-ub-ah
Gold	Waw-pún-a-kar-re	To go slow	Shan-cep-pah-nt
Skin or hide	Pove-ah	To trot	Pove-yah
Handkerchief	Koo-ret-a-spap	To gallop	A-poo-nah
Ramrod	Tskuri-nump	To run	Tw-eze-pem-ker-ro
Flint	Wón-nump	To stop	Ar-rik-in
Dry	Tal-ash-e-quipe	Up above	Pan-rink
Wet or miry	Pah-we-up (or) Sho-go-o-gi	Down below	Pat-san-unk
Wagon	Oo-yem-bung-go	Say	Ah
Canteen	O-chatts	Enough	Oo-na-shúmp
Brass kettle	Wok-er-pam-po-na	Just like	To-an-ower
Middle of a thing	Tol-teo-re-roup-punt	Together	Now-ah
Cane grass	Pah-gahmp	Two	Why-oon
Wire grass	Sve-neep	Four	What-se-vin
Coarse grass	Owow-eh	Six	Na-vah-oon
Yes	Oo-wah	Eight	Wah-whats-so-en
No	Kotch	Ten	Tow-shu-in
To laugh	Kee-ung-kah	Twelve	Wyge-spin-ko
To cry	Yog-ie	Thirty	Tam-shuin

A few sentences in English and Utah.

English.	Utah.
God, or the older brother	Tow-áhts
Devil, or younger brother	She-nob
Friend, what do you call this?	Tik-a-boo-an-a-ne-ab-inch
I do not know	Tami-i-Koch-pe-su-ge-wa
Where are you going?	Tum-huk-ah-ba-pi-qua
I am hunting horses	Tain-Ko-wi-yos-pe-shaw-ger
May be I saw them yesterday	Um-puggo-tam-Kuhw-poo-inka
Where? Do tell me	Huk-ah-bah-oo-ish pe-sheth-i-na
Yonder, the other side of this mountain	Mov-ah-inch-Kibe-quan-ko-up
I am very hungry	Gam-i-tu-ege-teg-u-na-ra
I have plenty. You eat with me	Tain-hov-on-kar-ne-um-now-ah-tik-i
Very well, my friend	Tu-ege-toy-tik-a-bun
When will you come back?	Um-an-oke-pe-nun-Ko-pee-jee
May be in one month	Um-puggo-sooy-mat-och-jay

APPENDIX E—Continued.

English.	Utah.
Where will you camp to-night?	Un-huk-ah-hah-me-a-bick aph-to-wun
Here, close by the spring	E-huah-en-chock-i-bah-tspe-kin
Where is the next water?	Huk-ahbah-ko-mush-pah-kar-re
Yonder, in the middle of the valley	Mov-ah-toi-ter-re-wap-punt-inch-nab
Is there another good road?	Ko-mush-att-poh-Kar-re-ah
Yes, up this cañon	Oo-wah-inch-we-wuds-pau-unk
I am now going	Tam-ap-pe-qua
I say, give me some bread	Oo-ash-ah-tsho-to-pup-mog-ie
I have none, it is all gone	Kats-kar-re-mon-o-na-tu-pik-wa
Who ate it all?	Aug-i-mon-oke-tek-ie
Your father and mother	Um-mo-auts-pe-ods-now-ah
It is snowing now	Ahp-newahp-pi-eke
After, be very cold	Penun-Ko-to-ege-shu-pe-ki

English and Sho-sho-ne or Snake words.

English.	Sho-sho-ne.	English.	Sho-sho-ne.
1. Chief	Tah-givin-up	Now	E-gee-che
2. To trade	Un-re-mo	To-morrow	Po-e-chick
3. Large	Pé-up	Friend	Hanch
4. Small	Té-tich	A very good friend	To-widge-shout-harch.
5. A great deal	Shout	Woman	Mo-ro-quah
6. Deer	Shok-a-re-ah	To see	My-bony
7. To make	Mo-hún	To hear	Mo-nan-ga
8. To hunt	Mah-wake	Yes	Hog-gash-ah
9. To talk	Tig ren	Fire	Cove
10. Good	Chant	To come	Kim
11. Bad	Kosh-nant	By-and-bye	So-bush
12. Horse	Pim-go	It may be	No-hog-gen-ny
13. Antelope	Quarets	Lodge	Kann
14. I or me	Nin-ny	One	Sum me-teach
15. You	M	Two	Whet
16. War chief	Nab ba-tink, Tag-wip-up.	Three	Pight
		Four	What-so-whit
Bread	To-stick-up	Five	Man-ne-git
Husband	Ko-mung	Six	Nar-vight
Wife	Wipe	Seven	Tul-so-wit
To understand	Chum-won-my	Eight	Wash-awib
To eat	Tic up-pa	Nine	Qas-neck-sho
To sleep	Ep-pay	Ten	Sem-a nute
No	Kay	Eleven	Sim-itz-mat-doike
To go	Mear-ro	Twelve	What-mal-doike
What do you call this	Hog-on-ny-na ne-ah	Twenty	What-sim-wer-ruin

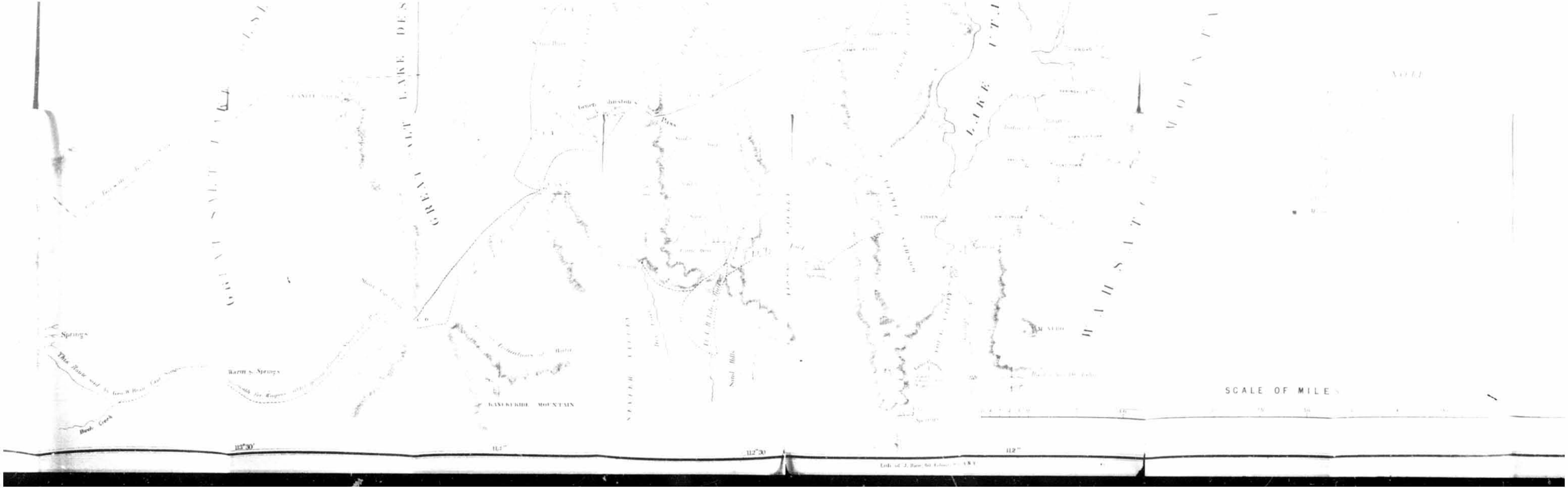
APPENDIX E—Continued.

English.	I-at.	English.	I-at.
One	As-see-to	Six	Ah-seen
Two	A-be-ka	Seven	Ah-been
Three	A-mo-ko	Eight	Ah-mogue
Four	See-po-po	Nine	Pye
Five	Ar-rap-pah	Ten	Har-a-py-e

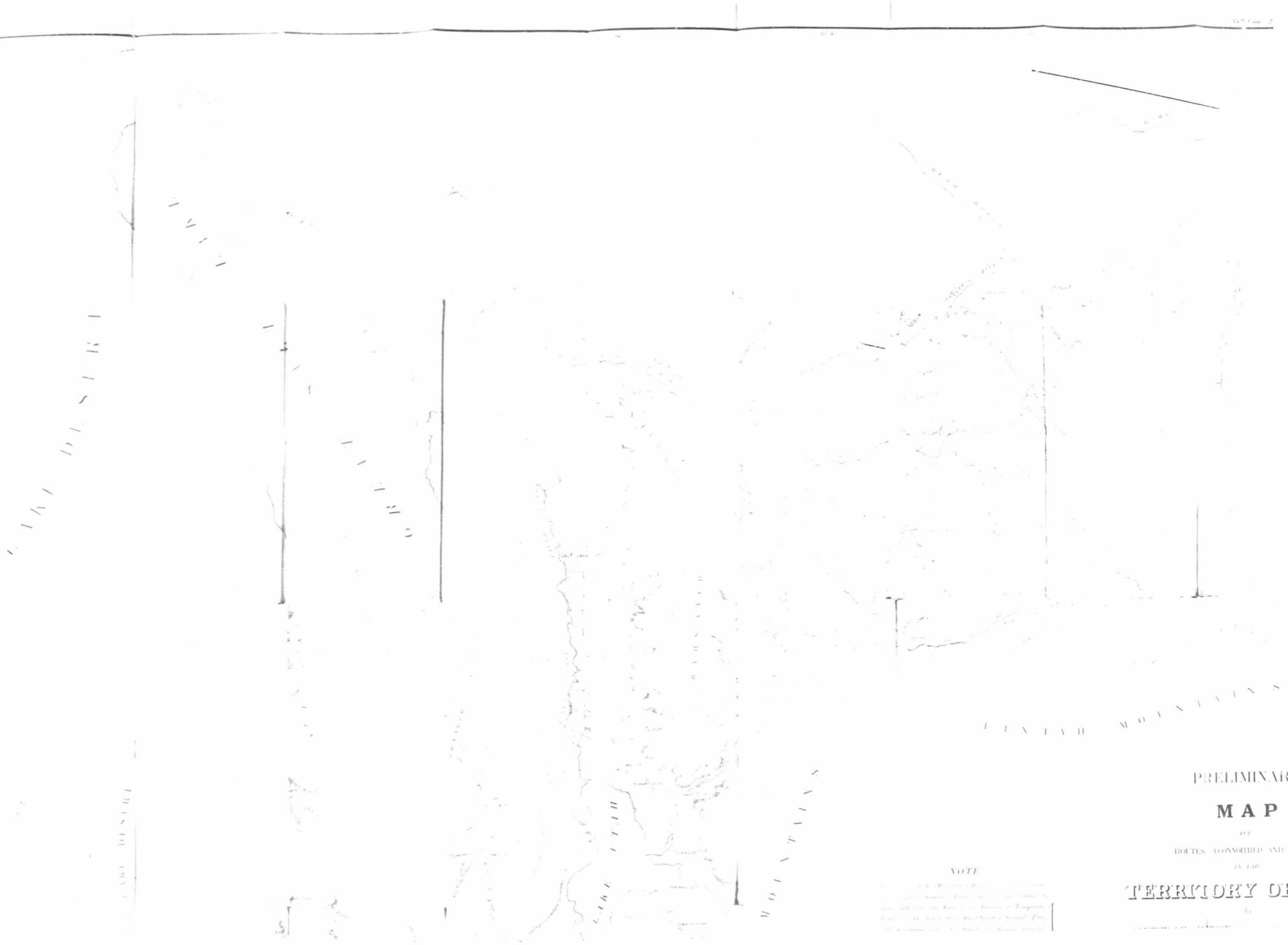
GREAT SALT LAKE DESERT

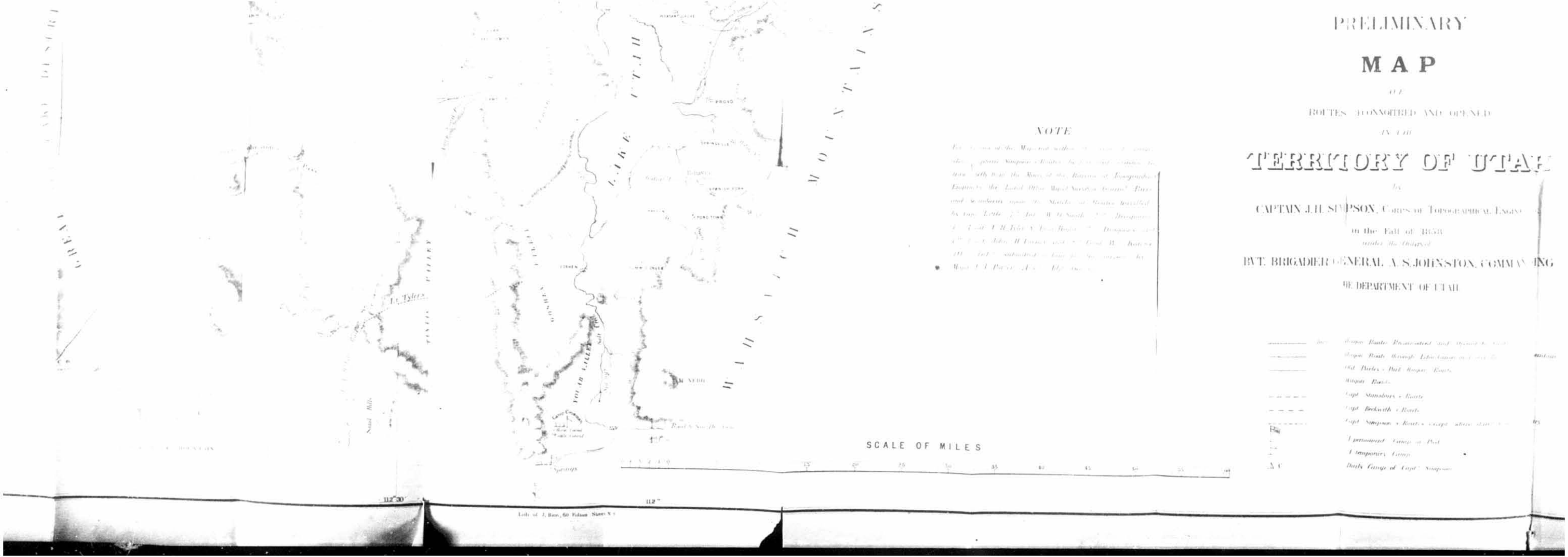
UINTA

UTAH



Springs
Warm Springs
Pass
Bush Creek
Sand Hills
SCALE OF MILES
113°30'
112°30'
112°


PRELIMINAR
MAP
OF
ROUTES EXAMINED AND
IN THE
TERRITORY OF
NOTE


PRELIMINARY
MAP
TERRITORY OF UTAH
CAPTAIN J.H. SIMPSON
in the Fall of 1858
BVT. BRIGADIER GENERAL A. S. JOHNSTON, COMMANDING
DEPARTMENT OF UTAH
NOTE
UTAH LAKE
WAHSATCH MOUNTAINS
PROVO
MT. NEBO
Ft. Tyler
Sand Hills
SCALE OF MILES
112° 30'
112°

PRELIMINARY

MAP

OF

ROUTES RECONNOITRED AND SURV

IN THE

NOTE