ENGINEER DEPARTMENT, U. S. ARMY.

PRELIMINARY REPORT

UPON

A RECONNAISSANCE

THROUGH

SOUTHERN AND SOUTHEASTERN NEVADA,

MADE IN 1869.

BY

FIRST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY,

ASSISTED BY

FIRST LIEUT. D. W. LOCKWOOD, CORPS OF ENGINEERS, U. S. ARMY.

UNDER THE ORDERS OF

BRIG. GEN. E. O. C. ORD,

BVT. MAJ. GEN., U. S. ARMY,

COMMANDING DEPARTMENT OF CALIFORNIA.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1875.

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OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., March 9, 1875.

SIR: Lieut. George M. Wheeler, Corps of Engineers, has submitted a report concerning a reconnaissance made by him in 1869 in parts of Southern and Southeastern Nevada.

The principal features of this report will be embodied in volume I of his forthcoming report of geographical explorations and surveys west of the one hundredth meridian, to be printed under provisions of the act of Congress approved June 23, 1874. In order, however, that the report upon this reconnaissance may be made available at once, I would recommend that one thousand copies be printed at the Government Printing Office for the use of this office, upon the usual requisition.

Very respectfully, your obedient servant,

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

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

Approved.
By order of the Secretary of War,

H. T. CROSBY, *Chief Clerk.*

WAR DEPARTMENT, *March* 11, 1875

UNITED STATES ENGINEER OFFICE,
GEOGRAPHICAL EXPLORATIONS AND SURVEYS WEST OF THE 100TH MERIDIAN,
Washington, D. C., February 18, 1875.

GENERAL: I have the honor to transmit herewith a report concerning an engineer reconnaissance accomplished in 1869, under orders from the headquarters Department of California, and under my charge, in parts of Southern and Southeastern Nevada.

It should be remarked that this report has been prepared at such intervals as press of other duties would allow, and that its principal features will be embodied in volume I of the forthcoming report, in course of publication under provisions of act of Congress approved June 23, 1874.

The map[1] accompanying this report, while answering the purpose for which it was published, is not at present of specific value, and has been replaced by the regular atlas sheets.

Very respectfully, your obedient servant,

GEO. M. WHEELER,
Lieut. of Engineers, in charge.

Brig. Gen. A. A. HUMPHREYS,
Chief of Engineers, United States Army.

[1] Map not to published.

GENERAL ITINERARY.

UNITED STATES ENGINEER OFFICE,
HEADQUARTERS DEPARTMENT OF CALIFORNIA,
San Francisco, Cal., January 21, 1870.

To Brevet Colonel J. P. SHERBURNE,

Assistant Adjutant General, Dep't of Cal., San Francisco, Cal.:

SIR: I have the honor to make the following preliminary report in reference, more particularly, to the military features connected with the reconnaissance through Southern Nevada, lately conducted under my charge, in which I was assisted by Lieut. D. W. Lockwood, Corps of Engineers, United States Army, three professional assistants, and two practiced soldiers, accompanied by an escort of twenty-five men of Company H, Eighth United States Cavalry, from Camp Halleck, Nevada.

The conception of this reconnaissance having originated with the brevet major-general commanding the department, was communicated to the Chief of Engineers, and, meeting with his consent and approval, Special Order No. 91 was published, as follows:

[Special Orders, No. 91.]

HEADQUARTERS DEPARTMENT OF CALIFORNIA,
San Francisco, June 7, 1869.

By authority from headquarters Military Division of the Pacific, Lieut. George M. Wheeler, United States Engineers, will proceed with his civil assistants and three enlisted men to either Camps Halleck or Ruby, Nevada, and having been joined by Lieut. D. W. Lockwood, United States Engineers, now *en route* via Fort Churchill, will there organize a party, to consist of two non commissioned officers and twenty-three enlisted men, (cavalry or infantry mounted,) such drivers, packers, and guides as may be required; equip them with the necessary, full, and complete outfit, as far as the resources of the posts will enable him so to do; after which he will proceed, via the White Pine district, to make a thorough and careful reconnaissance of the district of country to the south and east of White Pine, extending his reconnaissance, if practicable, as far as the head of navigation on the Colorado River, with a view of opening a road thereto from the White Pine or Grant district, of obtaining correct data for a military map of the country, and for the selection of the site or sites for such military post or posts to cover the mining country south and east of White Pine from hostile Indians, as may be required. Such explorations and examinations as may will be made in reference to the physical geography of the country, its resources in wood, water, agricultural or mineral productions.

The character, habits, and numbers of Indian tribes, and their disposition toward settlers and miners, will be subjects for investigations.

Upon his return, he will make a detailed report upon the results of the expedition, accompanied by a map and subreports of assistants.

By command of Brevet Major-General Ord:

JOHN P. SHERBURNE,
Assistant Adjutant General.

Having carefully made the necessary preliminary arrangements, June 12 found us ready to take the field.

It having become necessary to forward transportation from Fort Churchill, Nev., to Camp Ruby, Nev., Lieutenant Lockwood was obliged to leave late in May, as he would have to make from the former point a march of about nine days on the old overland road.

Camp Halleck was reached on the morning of the 15th, and it was found that few necessary arrangements had been completed for fitting out the expedition for so long and difficult a trip. It was necessary, therefore, to remain several days in this vicinity, which proved of no considerable ultimate delay, as the survey of a hay reservation for the post was required.

Careful sets of astronomical and meteorological observations were taken to test our instruments.

and to put them and ourselves in working-order; besides, a line was carefully run to Peko, the nearest telegraph-station at that time, (since then a new location, called Halleck Station, has been made more nearly opposite Camp Halleck and more accessible than Peko,) from which longitude by telegraph was to be determined.

Meanwhile, Lieutenant Lockwood, having reached Ruby with wagons and mules, came at once to Halleck. Finally, on the evening of the 26th of June, everything was ready for departure.

Instructions from the Chief of Engineers were to the effect that, in consequence of the geological survey in charge of Clarence King, it would not be necessary to delay on account of details, until about the latitude of White Pine was reached; but as it was thought best to carefully fix the positions of as many points as possible, and among them Camp Halleck, as well as also to perfect methods, it was considered advisable to go first to Elko, thence to Peko, on the Central Pacific Railroad, as the Humboldt opposite the latter place was at the time unfordable, obtaining in this way longitudinal position for these points as well as Halleck. This duty was completed on the evening of the 3d of July. Leaving Camp Halleck on the morning of the 4th, and following the upper or Gilsen stage-road to White Pine, until the old overland road was met, and following it through Hastings Pass, Camp Ruby was reached on the evening of the 7th of July.

Here, again, the necessities of a few final preparations obliged us to remain four or five days, which interval was employed in making careful sets of observations, and in again telegraphing for longitude. At last, on the morning of the 13th of July, everything was ready for the march; the train consisting of 36 persons, 8 wagons, 18 mules, and 31 horses.

Taking the line of the telegraph-road, Long Valley was traversed, and a camp about three miles eastward of Hamilton, White Pine district, Nevada, was made on the 16th. From this point wagons were sent back to Camp Ruby for barley and further amounts of commissary stores. At and around this point more careful topography was taken. Telegraphing for longitude was also carried on with excellent success, the error of the chronometers obtained, and also their rate up to this time. Thanks are due to Maj. H. M. Robert, Corps of Engineers, who very kindly took in hand the direction of the chronometric signals received at San Francisco. Capt. H. F. Rodgers, United States Coast Survey, also very obligingly lent his assistance; while Mr. Thos. Tennent furnished the chronometers, and the Western Union Telegraph Company (to which especial thanks are due,) furnished the use of its lines and the necessary telegraphic facilities.

WHITE PINE DISTRICT.

This district at this time had been so much written about and so frequently visited that its general features were well understood. The excitement of the fall of 1868 and succeeding winter was so much greater than the size and richness of the place demanded, that the consequent reaction had caused great distress among the working classes, and the streets of Hamilton were thronged with hardy miners and rough mountain-men, without anything to do and without money. Subsequently, upon returning to this vicinity, most of the people had departed, working their way toward Arizona. It cannot be expected that any one district will exhibit more than three or four principal leads, and if these prove to be fissure veins with yielding ores, permanence is considered certain, and the facilities produced by time and capital determine the result. During my stay in White Pine I saw nothing that could be called a fissure vein, although the mother lead, from which the various deposits seemed as but segregations, is pretty certain to exist. The base-metal range has a great mineral showing of low-grade smelting ore, and reduction works were in progress in November, 1869. This camp may be made, to a certain extent, the nucleus of supply to remote interior mining points.

The necessary guides, packers, &c., having been obtained, a march to the eastward was made, and thence the reconnaissance carried to the south, along a meridian somewhat to the east of White Pine; as to the south, so far as the Colorado, the whole of Southern Nevada was virtually unexplored or mapped. Therefore by conducting the topographical search as far to the east as the Utah line, and returning, if possible, on a more westerly line, the greater if not the best parts of Southern Nevada could be examined. Subsequent results show the route to have been well selected.

Camp was broken on the morning of the 31st of July, and a march made toward Steptoe

Valley, the wagons following a wagon-road to the Robinson District for the first day's march of twelve miles. The country is comparatively well watered, and grazing in sufficient abundance. The next day took us directly across Sierra Valley, to a place called Summit Station, in the foot-hills of the Egan range, scantily supplied with bunch-grass, and water coming from a little spring, some two miles to the northward. The road from this point to Mineral City, Robinson District, a distance of fourteen miles, was good and hard, so that in this day's march a camp is made on Murray's Creek, on east slope of Egan range, flowing into Steptoe Valley, which at this point shows a strip of land fit for cultivation. This valley extends to the southward from Murray's Creek, a distance of nearly thirty-five miles, while current report indicates that the same or contiguous valleys reach to the Central Pacific Railroad, with insensible divides, touching the same at a point about thirty miles east of Humboldt Wells, or near Toano. It is reasonable to suppose that such is the case with this and Spring Valley, the next valley to the eastward. If so, the railroad can be tapped with good success, and country roads, nearly due north and south, may be constructed on either line. Murray's Creek lies some six miles below Hercules Gate, a point on Simpson's route 1858–'59. Remaining at this camp for three or four days to take careful observations and topography, a chance was given for a hasty examination of the mines in the

ROBINSON DISTRICT,

which is twenty miles long by six in width, lying on either side of the gorge in the Egan range, through which a natural road leads into Steptoe Valley. This camp presents remarkable natural facilities for the mining and milling of ores. Water and wood are in abundance and in close proximity to the prominent leads. Lumber in immense quantities can be procured along the eastern slope of the mountains, from eight to fourteen miles to the south, while the hills in which the mines lie are covered for the most part with a thick growth of nut-pine and mountain-cedar. Agricultural products can be obtained from ranches in Steptoe Valley. The ores are principally base, showing large proportions of lead and copper. A proportion of these alone would permit of working by the ordinary wet process, while others require roasting and others again must be smelted. The deposits are plenty and have more the appearance of deposits than well-defined veins, occurring in dolomitic limestone, much disturbed. But few developments had been made, and it is not impossible that after reaching a moderate depth permanence of the veins may be secured, and, if so, upon further opening up of the country, it is not unlikely that large amounts of bullion can be profitably produced from this locality.

Leaving camp on the morning of the 6th of August the foot-hills of the western side of Steptoe Valley are followed to a place called Ice Creek, quite seventeen miles. To our left, during the day, several hay-ranches were passed, mostly situated on Steptoe Creek, rising in the Schell Creek range. The crop of grass is abundant; bunch-grass is also good and in large quantity in the hills. To our right fine patches of timber are seen in the distance, often reaching almost to the tops of the highest peaks of the Egan range. Pine and fir furnish all the kinds of lumber found in these hills; there is, however, an unlimited supply, but unfortunately situated with reference to water, as are most all places found at high altitudes in the mountains, and below the latitude of White Pine.

Only small springs are met with, and these do not always contain good water, except where they act as reservoirs for the melting snows. Steptoe Creek sinks in the middle of the valley, as is common with most streams in these semi-desert localities. Nearly opposite camp is the Nevada Mining District, not visited for want of time. In the same range, to the northward, is another small district.

On the morning of the 9th camp is broken, and passing a low divide, Cave Valley, having the same general southern trend, is reached and followed to a locality opposite the Patterson Mining District near a cave of local fame, supposed to be quite extensive and wonderful. This camp is in a very lovely basin, with the sharp, steep peaks of the Schell Creek Mountains to the east, while the Egan range, with broken and rolling hills, lies to the westward. Wagons were sent back to Hamilton to take forage and supplies along the more westerly line for our return; meanwhile parties went out to the north and eastward. A secure and pleasant camp was made; also arrangements to

collect all possible data previous to encountering a more difficult country to the south. The march to this point from Ice Creek was $28\frac{3}{4}$ miles, over a fine mountain-road, with no water available till within two miles of the camp.

TRIP TO PREUSS LAKE AND RETURN.

Upon the latest published map of Nevada consulted, (Holt's map,) a lake of considerable size, called Preuss Lake, is put down as cut by the eastern boundary of the State. It was determined to send a small party to find out this locality and return to the camp at the cave. Accordingly, on the morning of the 14th, with an escort of ten men, a start is made, and passing through the break of the mountains where lies situate the little places known as Montezuma and Springville, belonging to the Patterson District, Duck Lake Valley is reached, and bearing along its northwest side, after a march of fifteen miles, a camp made at Benson's Creek. Here is good grazing, and a tract of arable land. Have passed a lake of small size, filled with innumerable duck, comprising most of the game so far encountered; large game very scarce, only an occasional deer and antelope seen, and these at long distances. As for small game there is but little; along the foot-hills now and then a few sage-hens and jack-rabbits are encountered; higher up, and wherever timber is found, grouse appear in occasional flocks. The next day a low divide is crossed into Spring Valley, which, like its mate, (Steptoe Valley,) continues, it is said, to the railroad direct, with only low divides between almost continuous depressions. A march of over twenty miles leads to a camp opposite Jeff Davis Peak, near the Shoshone Mining District. Camp is made at a small creek with pure and clear water, near ranches that have sprung up in conjunction with the mining camp. Bunch-grass abounds; hay is plenty in the immediate neighborhood, and three or four thousand acres of cultivatable land await the settler.

SHOSHONE DISTRICT.

A few hours are taken for a hasty glance at these mines while the party is moving on. This is done in company with Mr. A. F. White, acting State Geologist of Nevada, who met us in this vicinity, having been our companion at the Cave for a few days. It is not proposed to enter into any detail with regard to mines in this report, as their bearing upon roads and means of communication, whether military or civil, is very slight at present, and as their undeveloped state is so general.

The mines are on the western slope of the Snake range, and exposed in a rough break in the side of the mountains, down which a large wash of sand has accumulated, making a ramp to bring one up nearer to the level of the mines. The leads seem wide and well defined, free, also, in a great measure, from the base metals, and ought to work well by the ordinary wet process. There is certainly a good showing for the extraction of a large amount of ore, most of which is likely to be of low grade. But few miners were at work at the time of our visit. Water in the near vicinity of the mines is scarce; being enough for the necessities of the camp. The creek, near which the camp was made the night before, affords a good site for mills. Fuel abundant; lumber to be obtained some eight or ten miles higher up on the same range. The party had gone into camp; some springs of bad alkaline water. Before night fourteen rattlesnakes had been killed, and it was thought not inappropriate to name this place "Rattlesnake Springs." Further acquaintance with the locality proved that it was well to leave a warning in the name for the future traveler.

From this point, the ascent of the mountain known as "Jeff Davis Peak," and considered the highest point between the Sierra Nevada and Rocky Mountain range is made. The summit reached by the moonlight, and a descent to the line of vegetation, where the rest of the men with the pack animals were in camp, is made therefrom. An early start in the morning brought us to the top at 8.30 a. m., and observations for latitude and longitude were taken, the barometer-observations showing an altitude of at least 13,000 feet. The descent was more rapid, but not easy, and night found us back at camp completely exhausted. The next day a march of twenty-three miles is made to Sacramento District, in a pass of the Snake range.

The road all along Spring Valley had been a rude track, lately made by the prospectors of the region. Pure water is found in this mountain-pass. Some little fuel of scant cedar and nut-pine. Generally speaking, the water so far in our course has been found far better in quality and more

frequent in place and quantity than had been anticipated. There are only a few places that have been at all alkaline or mineral. This advantage will prove a great one as travel is directed to any points along the eastern border of the State.

SACRAMENTO DISTRICT.

This district is situated in Red Cañon Pass of the Snake range, and exposes to view, on the southern side, the mines that had attracted, at our coming, a few miners. The products are both silver and gold, found within a limited compass, and in continuation of the mineral belt to the northward of Shoshone, and which seems to follow several distinct mountain-chains through Nevada. The eastern limit shows slate. No present developments indicate a certainty of large mineral products, yet the average assays have been good, and the ore is easily mined. Chloride of silver appears in a highly crystalized spar, so near approaching quartz in hardness, texture, and appearance that it is hardly possible to distinguish; however, I believe that, so far, no chlorides have been found in a highly siliceous matrix.

The facilities for the benefit of a good mining-camp are favorable. Water sufficient, wood enough for fuel, lumber in limited quantities in the mountains, at not too great distances. Both Spring and Snake Valleys, in the vicinity, are favorable for the production of the various farm-supplies necessary for sustenance. It is not unlikely that one, or two at least, good leads or deposits will be found.

So far, our intercourse with the Indians had been limited, appearances indicating that in many instances they have fled at our approach. The Shoshones and Gosintes, in whose country the route had so far lain, have, in years gone by, suffered greatly at the hands of the United States troops, and our guide and interpreter was known to them personally, and the word having been passed along the lines, they had silently taken their departure prior to our coming. This was indicated in two or three instances by the sight of deserted wick-e-ups, and it appears as a well-attested fact that they have a great terror of the soldiers.

Emerging from the pass, near Sacramento District, Snake Valley is entered, and here are encountered some of the Snake Indians, who are in the habit of occupying the valley in planting and harvesting season, raising scanty crops, which they *cache* for the winter use, and then retire to the mountains. Altogether, we have found some two hundred of these Indians, whose chief, Blackhawk, is a shrewd and calculating Indian, undoubtedly of a character superior to the average. These Indians had never received annuities from any source, and had always, according to their own story, been peaceable and friendly to the whites. Some Mormons had farmed a ranch near them, about the center of the valley, but they had never brought anything from the Mormon side. Further insight into the Indian affairs in Southern Nevada leads me to suppose that but little care has been bestowed upon the manner in which the Indians receive annuities or benefits from Government. To be sure, scarcely anything has been known of the number, character, or habits of many of these Indians, who are quite numerous. Yet, in the case of the Indians on the Muddy, who are living on the line of a mail-road, and have done so for years, up to the time of our arrival no such person as an Indian agent was known to them. I understand that lately a sub-agent has been sent to this particular locality. The most of these Indians, in case they were placed upon a reservation, could support themselves readily, and would be entirely peaceable and easily managed.

The second day's march down Snake Valley leads to Snake Creek, at a point that proves to be within half a mile of the Utah line. It had been my intention not to cross this line, as it not only carried me out of the military division of the Pacific, but also out of any proposed or supposed north and south line of communication to the Colorado. However, a part of this detour-trip was for the purpose of finding Preuss Lake, which it still appeared to be of some satisfaction to attempt.

On the afternoon of the 2d August, a start was made, and next day at 5 p. m. Hawawah Springs, in sight of the lake, was reached. The next day brought us to its shores to receive only a disappointment on finding it both salt and brackish to an extreme degree. A night march to the camp at Hawawah Springs was made, and after three days forced marching the more permanent camp in Cave Valley. Our return was upon a rough desert road, made by the Mormons in 1857,

when they were looking for places of refuge in case that our troops molested the quietude of their mountain villages. Upon reaching the old camp, observations were repeated for time, which gave good results in determining the rate of the chronometers, which were found to have been running with great regularity.

PATTERSON DISTRICT,

Lying in a natural pass of the Schell Creek range, was discovered by parties driving cattle through from Southern Utah to the vicinity of mining camps in and around Austin and Belmont. Nothing was done, however, till the spring of 1869, when a little excitement sprung up. The showing of mineral appears upon the northern side of the pass, the leads having the general northern and southern trend so noticeable in most localities visited during the trip. A slight examination of these mines was made, and the general impressions derived were quite favorable. The leads are found mostly in limestone. The country rock is much disturbed, and in consequence, until some deep developments are made, there appears no absolute certainty of finding a well-defined fissure-vein, although one particular lode, the "Gray Eagle," has the outward appearance of being the mother vein. There is a great absence of the base metals, and the ores will, in almost every instance, work freely. Water is scarce on the western side of the summit of the pass, and nearest to the best mines. Wood for fuel is in sufficiency, and lumber to be found on the eastern slope of the range at a distance of seven or eight miles to the north.

There is a sad lack of capital at this as well as most other of these remote mining locations which want, coupled with remoteness, are serious drawbacks that now hold in abeyance the development of a vast amount of mineral wealth in Southern Nevada.

The animals and men having recuperated, on the morning of the 1st September, camp was broken for a start into a region comparatively unknown, and about which but little information could be gleaned from either Indians or white men. The long marches both by night and day, joined with constant labor, have been considered slight in comparison with the hardships expected from climate and desert in our further progress to the Colorado.

Lieutenant Lockwood was detached at this point, and sent with a small party with orders to conduct his march via Pahranagat Valley, and reach some of the settlements on the Muddy. This proved to be the most direct line to the southward. I was led to believe that by going still farther to the east, a better route in regard to grass and water could be found for the train. Ultimate results showed that this idea was a false one, although either route would have been difficult for a number of wagons heavily laden—the nature of the road, the distances apart of the watering places, and chances for grazing being in advance uncertain.

Passing to the eastern slope of the Schell Creek Mountains, through Patterson, the road leads along the foot-hills to the Ely Mining District, some ten or twelve miles above the head of Meadow Valley, with only one spring of water intervening, and a stretch of forty-five to fifty miles of comparative desert. It was reported that Mormons were living to the east of the next range, named Fortification Range, and by crossing over into the chain of valleys so settled that a good road could be found well supplied with grass and water, upon which, by detouring a little, we could reach the settlement at Meadow Valley. I was greatly desirous of continuing the topography as far as the eastern line of the State, and this would give the opportunity; moreover, we were all very curious to see as much as possible of the Mormons and their settlements. Our experience in taking this route was a sad one, but the extra amount of topographical and other information gained more than repaid. Crossing Duck Lake Valley, we came to the pass in the Fortification Range, and for four or five days labored faithfully to cross. This was called Pioneer Cañon, an appropriate name, as we were all pioneers during its passage. Most of the wagons were upset while going through this cañon, although all possible care was taken, and everybody was at work from sun to sun. The escort behaved remarkably well, showing a great deal of energy and endurance, both of which qualities afterwards, in several instances, were called for, and at all times they did their duty faith-

NOTE.—The locality reached was determined in 1872 to be the southern shore of Sevier Lake the reservoir of the water coming from the Sevier River. Hence Preuss Lake is hypothetical. The valley lying to the eastward of the Hawawah range, in which occurs an alkaline flat evidently overflown by water from Sevier Lake during seasons of great freshet, has been called "Preuss Valley" upon the atlas-sheets to perpetuate the name of this most excellent topographer connected with Frémont's expedition.

fully. On the summit of the Pass, as indeed on every summit sufficiently high, encountered in our travels, as far as the eye could reach in all directions, one sees only chain after chain of mountains in every variety of contour, hiding from view valley after valley, found to exist only after a nearer approach. Descending the grade, a ravine is followed for four or five miles, where a camp is made for the night. The next day's march commenced through dense cedars reaching far into the foot-hills of the northern end of a valley known by the Mormons as Spring Valley, and named Cedar Valley, when it was found that it came within the limits of Nevada. After a march of seventeen or eighteen miles, the first Mormon settlement is reached, a little place called Homer, built in the shape of a fort, and settled with a number of people of the Mormon persuasion. The coming of so large a party, with several wagons and numerous animals, stirred up quite a commotion among these people nestled among the mountains, who are unaccustomed to seeing a strange face except at rare intervals.

These outer settlements have been formed from time to time when the excess of population crowds them farther and farther away from the central point, Salt Lake City. The one above mentioned is among the most remote and inaccessible, situated, however, in a fine mountain valley, containing a limited amount of good land. We made a call upon the Bishop, or acting business man of the colony, and were well received. Some knowledge was gleaned as to their character and habits in that and also at other settlements.

In Spring or Cedar Valley is the source of a creek known, for the greater part of its course, as Meadow Creek, that flows through Eagle, Rose, Dry, and Round Valleys to Meadow Valley, often through tortuous cañons, but traceable in all cases. Following down Meadow Valley, these waters pass through a very difficult cañon, known as Meadow Valley Cañon, and thence through Long Valley, until within about thirty-five miles of the Muddy River, when they sink to rise again within twelve miles of the above river, and flowing for a little distance, are lost again in the sandy wash, and do not re-appear. Without doubt this water must come into the Muddy before the latter reaches the Virgin, showing in reality the Meadow Creek to be the eastern branch, and that quite a section to the northeast of Pahranagat lies in the basin of the Colorado, instead of the Great Interior, or Salt Lake Basin. Where this water comes out, its temperature is quite warm, reaching as high as 76° Fahrenheit; similar waters are found in Pahranagat Valley, that also flow eventually into the Muddy, through a subterranean source or transit for these waters.

The cañon leading directly from Cedar to Eagle Valley was not passable for any except horsemen: consequently a detour, first to the south and east, and then south and west, was made, bringing us to the place after a march of fourteen miles.

This is a little valley entirely surrounded by bluff mesas, and not distant mountain-peaks, and appears as if by magic, as one emerges from the steep walled cañon, thickly studded on either side with cedars leading to it from the east. In the mountains there is an abundance of fire-wood on the mountain-sides, but not always near the places most eligible for settlement. Timber is, however, very scarce. Eagle Valley produces fine crops, which were in full growth at our arrival. The hay-makers were at work, and the extreme picturesqueness of the scene brought great relief to the eye, accustomed to look ahead day after day, with rough mountain-peaks in advance and only the calculations of the imagination to estimate the decrease in distance from them. We have been traveling, as it were, in the dark since leaving our camp in Cave Valley. Our guide had never been over this part of the route up to this point. The Indians and Mormons were both taciturn as regards information. The day's march was continued, and night found us at a little valley some two miles in length, called Rose Valley, full of stock, and completely hemmed in, a little basin in the mountains.

Our marches have been tedious to both men and animals, as the wagons were heavily laden. The roads, at some points, were very rough and winding, making distances seemingly great. It was thought best to let the animals remain for twenty-four hours, as the grazing was good. Only a few Mormon ranchmen in this valley.

The amount of land in the three valleys mentioned will not exceed 2,500 acres, if it were cultivated to its greatest limits, and at least half of this is only fit for grazing and hay.

The soft, saccharine bunch-grass, so valuable for the animals, is still found on the foot hills, and in many cases extends high in altitude.

The topographical parties continue on, winding through Dry Valley; then detouring, first to

the southeast, then southwest, Meadow Valley is reached after a march of eighteen miles over a very good mountain road.

I had remained at the camp in Rose Valley to take observations till 2 p. m., and then rode rapidly forward, joining the camp at a large warm spring, about a mile above Panacca—the Mormon settlement in Meadow Valley.

At all times, when near the Utah boundary, greater care has been taken in the astronomical observations, as it soon became apparent to me that quite a large number of settlements, supposed by the Mormons and every one else to be in Utah, would prove to be in Nevada. The present reconnaissance determines beyond a doubt that seven or eight settlements, varying in size from one hundred to five or six hundred souls, will come within the Nevada line.

The next day the Meadow Valley mines, (Ely Mining District,) were visited, with only a small party and a scarcity of time, as great delay had been experienced in passing Pioneer Cañon, and had still before us one of the hardest marches in the country before reaching the Muddy, which point it was desirable to gain by the 15th, as at that time the rations of Lieutenant Lockwood's party would be exhausted; and on the morning of the 9th September, we are only at the

ELY MINING DISTRICT,

which is situated among the high and broken foot-hills of the Schell Creek range, at the head of Meadow Valley, to the northwest of the settlement, and about twelve miles distant. I was told by Mormons in Panacca that these mines had been known for a long time to them, but that neither their church doctrines nor their habits had encouraged the development of mining enterprise. They were located by a scouting party sent out by General Connor from Camp Douglas, some years ago, but were never worked till afterwards located by prospectors, among whom was Mr. Ely, from whence the name. A San Francisco company have started work upon some of the locations, apparently on quite a large scale, while Mr. Ely and some others were engaged in developments of many of the leads. The slight examination made of these mines left a very favorable impression upon my mind as regards their extent, permanence, and richness. The country in close proximity is very rough, from irregularities of rock structure and erosion, and covered in great part by nut-pine and cedar. No water within six or seven miles, except a small spring, affording but a few gallons daily; but to the westward, and at the distance above mentioned, is a fine spring running at its minimum eight inches of water, and, at certain seasons, as high as from thirty to thirty-five inches. This can easily be brought to the immediate vicinity of the mines. The bulk of the ore is argentiferous galena, intermingled, however, with both lead and silver in other forms. The Pioché is one of the principal mines, and judging from the showing, is a part of the *mother* vein of the district. A shaft has been sunk to a distance of forty-five feet, showing a wide vein of ore with well defined walls, which is undoubtedly a true fissure.

A return by night is made to our camp, which has been changed to a spring three miles below Panacca, which is reached a little after midnight. Every one is in camp, except two men absent after stock. So far only two animals have been lost, but strenuous and continuous exertions have been necessary to keep them from straying away or being stolen. The Indians especially are fond of such games.

We are now in the country of the Pah-utes, but they also keep away from our sight. The old Indian, Adabe, who had accompanied us to Preuss Lake and return, also to Spring Valley, was sent from the latter place after stock, and has not shown himself since. This has caused some little uneasiness, as the character of the Indians following our march to the Muddy is known to be treacherous, and this fellow has been at one time the captain of from two to three hundred of them. Most of the Pah-utes profess to be friendly to the whites, but they will steal and lie, like all true Indians, to a fearful extent. The Mormons stand in considerable awe of them, and treat them very well, giving them a great deal to eat. We learn of the massacre of two men in the cañon below by Indians within twenty days of our arrival, and the place is not looked upon as safe for parties of two or three men. We remained in this camp over one day, as all of the professional members of the expedition were sadly worn out.

All reports were unfavorable with regard to a route leading to the Muddy. The shortest line

would be to follow the waters of Meadow Creek, and the washes below the main cañon should at last bring us to the desired point. The distance on this route would have been about ninety-five miles. A road leads from Panaeca to Hyko, and from thence to settlements on the Muddy, a distance of one hundred and fifty miles. Again, by detouring to Clover Valley, a little to the east, and coming into the same wash below Meadow Cañon, the above point could be reached in about one hundred and ten miles. None of these routes seemed especially pleasing. It was only necessary to select the one productive of the best results. The Mormons said, "Go by the cañon." This would have been the shortest route, but in my own mind I had concluded that the heavy army wagons, with large loads, could never go through a cañon having here and there quicksands, and the whole surface, for the greater part, covered with water. Accordingly, it was considered best to detour by way of Clover Valley. Although this proved a sorry route—almost as good as impracticable—yet we afterwards learned from good authority that it would have been impossible on account of the miry places to have taken the train through the cañon.

On the morning of the 11th September a start was made to continue the route to the southward, but, mistaking the road, one was followed down the valley. We were stopped at the mouth of the cañon, some of the wagons having mired, and finding out that we were on the wrong track for Clover Valley, had nothing left us but to return to the old camp, not a little disappointed. We encountered an old Mormon gathering hay near the head of the cañon, and having had experience with a light wagon through the cañon, told us that, in his opinion, it was impassable for us. This only confirmed preconceived ideas.

The succeeding day we got fairly off, and continued the march for thirty miles, coming in at night to another little mountain valley, having passed over rolling country, principally covered with nut-pine and cedar; road good, but very crooked. The wash from this valley enters Meadow Creek Cañon, and therefore how far to the northeast of this position the dividing line of the great interior basin from that of the Colorado passes, it is somewhat difficult to say. However, it is judged not to be very far distant. Clover Valley is a small Mormon settlement, comprising some seven or eight hundred acres of arable land.

The next day we followed a wash leading to the southeast; which followed higher up to the foothills, develops some fine timber-patches—this at a distance of seven or eight miles from where we left the ravine. There is a small saw-mill at this place that furnishes timber for all the outer Mormon settlements, sending some as far to the south and west as the settlements on the Muddy. This is the only patch of large and fine pine timber for a radius of fifty miles. In fact, such areas are seldom found in the section of the State traversed.

From Clover Valley a rough and tortuous road is followed to a summit, descending from which a large wash joining Meadow Valley Creek below the cañon is entered. No laden wagons had ever passed through this ravine, and upon fairly getting into it, I began to despair of ever bringing the train through. At noon the wagons had just begun to descend; at 6 p. m. they had only succeeded in gaining two miles. Meanwhile every one in the party was hard at work making a road. Some of the advance parties, by accident, found two or three little water-holes some four or five miles distant from the summit, and the animals are driven to this point, but get only a small allowance. A little bunch-grass is found nearly one mile from this place. Appearances indicate that bunch-grass is disappearing, as also everything in the shape of vegetation—a sure sign of a near approach to the Colorado Desert.

The next morning pioneering is again commenced, and continued until nightfall, when the wagons reach the little water-holes mentioned, which, by careful cleaning out, have, by the next morning, gathered nearly enough water for all the animals, that are now every hour getting worse fagged and worn. The surveying party pushed ahead, and late at night succeeded in threading out the labyrinth, which will be called Clover Valley Cañon, and made camp upon Meadow Creek at the point where it comes out from a steep cañon. The whole case was taken into consideration, and the conclusion arrived at that the horses and mules, in their worn condition, with hardly any grass and infrequent supplies of water, would not be able to get through to the settlements on the Muddy without losing many valuable animals. Accordingly, in company with Mr. Wm. M. Ord, a start was made to reach those settlements, hardly knowing the distance, the dangers, or necessities

of the march. This was at 2 p. m. of the 14th of September. We traveled till 4 a. m. the next morning down a sandy wash, with almost perpendicular walls of rock and sand conglomerate on either side, without reaching any water, as Meadow Creek had sunk about three miles below our camp, in a widening out of the wash, called Long Valley.

It was then concluded best to take a little sleep until the day might break. Meanwhile our horses made a hearty meal of the surrounding canes. During the day willows with pods and blossoms were seen along the wash, quite different from any before noticed; also, one wildcat. At night two horned rattlesnakes were met with, which, with their incessant rattling, moved off in a lateral direction at our approach—not pleasant friends to encounter in so dreary a locality. The mountain-quail are noticed in this wash for the first time during the trip; scarcely any other sort of game. Even the jack-rabbits are no longer seen except on rare occasions. Daybreak discovers to us, after saddling up and riding ahead for about one thousand yards, that we have camped within that distance of where the Meadow Creek again appears. A slight breakfast is taken, and we push on, and at 1 p. m. come across some Indian rancherias, but as none of them could converse in English, it yet seemed uncertain how near at hand our destination might be. Still the same dreary sandy wash continues, opening out as the rancherias are passed, and in the foreground, some fifteen or twenty miles distant, apparently, were mountains supposed to be to the westward of the Muddy. At 3 p. m. Mr. Ord's horse had given entirely out, and we had been walking for two or three hours. At this time, by climbing a little sand-mound, a line of vegetation, winding through the desert, was seen in the distance, and apparently a party encamped. I concluded to ride ahead, and much to my joy and relief found Lieutenant Lockwood and his party—a rather sorry meeting, as, having had bad luck also, they were entirely used up. In company with him, a further travel of eighteen miles was made, till Saint Joseph was reached, at which place it was supposed that grain could be purchased. The next morning this business was consummated, and the grain forwarded to the party. The distance traveled from our camp on Meadow Creek had been seventy-eight miles.

It was thought advisable to have all make camp near West Point, a settlement within two or three miles of the point at which the old Los Angeles and Salt Lake road crosses the Muddy. This was done, and Lieutenant Lockwood's party immediately moved to this point. The most was made of the interval, before the other wagons should come up, in physical recuperation of both men and animals. Finally, on the afternoon of 22d September, the parties hauled slowly into camp—a scare-crow, exhausted-looking set—sadly wanting on the part of the animals, then in a semi starving condition, good grain, grass, and water, while the men needed at least a few nights of sound repose.

The Indians and Mormons are frequent visitors to our camp while near West Point. The former come both for curiosity and to see what they can steal; the latter, to vend the productions of their little ranches and gardens.

The Indians in Southern Nevada and below the latitude of Patterson District know but little of white men other than Mormons, and have been taught to look upon them as chief, clearly discriminating between the former and Gentiles. This peculiarity is carried to a remarkable degree of penetration whenever a German happens along, who no sooner comes alone and unprotected than he is pretty sure to lose his horse and other personal effects.

The treaty made by Governor (now Senator) Nye in 1863, in Ruby Valley, extended only as far south as Quinn's Cañon. The Indians on the Muddy, when all counted, number nearly five hundred, while at the rancherias in Long Valley wash there are between seventy and eighty. The numbers of other Indians in close vicinity of Clover Valley, in Meadow Valley, and near Spring Valley, could not be accurately found out, as they kept wholly aloof—a sign always to be feared, as when they do so it only wants the hope of certainty of success for them to attack any party. To what cause this was to have been attributed is somewhat difficult to say. Their communication with more northern Indians is quite slight; and the Utahs speak quite a different language. These Indians could all be easily habituated to live on a reservation, and in that way would become self-supporting. At the rancherias encountered they raise small crops of grain, potatoes, and many melons.

The valley of the Muddy, though very contracted, is fertile, and forms the Dixie of Nevada

State, and so are called the three Mormon settlements—West Point, Saint Joseph, and Saint Thomas—adjacent to the most fertile spots. Of these the entire population amounts to from twelve to fifteen hundred souls. In summer many go to the more northern settlements, to return again in the winter, having always, as a matter of course, a wife or wives in each place. One of these people, privileged with four wives, was the happy father of twenty-two children. All of them at this, his winter resort, were being reared unwashed, unkempt, untaught. All sorts of crops that are familiar to the growth of our Southern States can be raised on these little spots of land, although surrounded by the mountainous desert on every hand. Unfortunately, the areas that can be cultivated are small, otherwise cotton could be raised in great quantities. Small fields of this were ready for picking at our arrival. All the grains do well, but produce not so largely as in Pahranagat Valley. The same in regard to potatoes and most vegetables. Fruits and vines flourish luxuriantly.

The limited waters of the Muddy will not irrigate more than about fifteen hundred acres; so that, in case vast extents of the finest vegetable mold existed, it must now lie desert and arid for the want of irrigation.

The most is made of every particle of information that can be gathered in respect to the nature of the country in immediate vicinity of the Colorado, so that our exhausted forces shall be put to the best use in continuing the examination, that it may be as full and satisfactory as possible. All accounts were alike unfavorable, and our minds were made up for the severest trials of the trip. It was plainly evident that the most that could be done would be to follow the Virgin to its mouth; thence, closely hugging the Colorado, El Dorado Cañon might be reached, and from thence a road runs to Las Vegas Springs. The wagons can go no farther south without having to return, showing how opportune it had been to keep them in vicinity of the old California road. It was determined to send them at once to Las Vegas Ranch, at which point the animals would have a chance to recuperate, and the parties would be in position to re enforce the party going *via* the Colorado This party consisted of, besides myself, Lieutenant Lockwood, Mr. Hamel, one corporal and six men, in addition to a pack-train, consisting of six animals. Previous to our departure on the morning of the 29th, the section in proximity to the valley of the Muddy had been examined. The settlements along the Muddy had also been visited.

The first day's march brought us to the junction of the Muddy with the Virgin. Camp was made beside the stream so long looked forward to with some anticipation, that told us we might find a river. Instead, however, its dignity attains to no more than that of a mill-stream over a sandy flat. The water, continually full of clay and sand particles, is of a reddish, muddy color, fearfully brackish, and scarcely fit for any animal to drink. The thirst occasioned by a long day's travel over a sandy road, in a temperature that would indicate more than 112° Fahrenheit in the shade, made any water palatable.

The next day, after taking observations till 2:30 p. m., we moved down the river some five or six miles, passing and leaving on our right the noted Salt Mountain, containing remarkably pure crystals. This is owned by the Hyko Silver Mining Company, and is a very extensive deposit. Other salt deposits are found near the banks of the Virgin, and to the south, while within one thousand yards of its mouth is a large, deep well of remarkably clear water, but powerfully charged with salty matter. This is situated upon the *mesa*, some five hundred yards from the Colorado, with precipitous banks, looking on the deep waters below. No one knows the depth; our parties could not ascertain this for want of means. Undoubtedly its origin is from the Virgin through underground channels.

We had reached the mouth of the Virgin, and looked upon the banks of the Rio Colorado. Here two Mormon fishermen inhabit a little hut, and catch some few fish from the river. We were at this point some fifty or sixty miles below the foot of the "Grand Cañon," which point it had been my intention to visit, but the worn-out condition of the expedition absolutely forbade my doing so.

From the most reliable information that could be gathered, it appears that the Colorado is approachable on its northern and western sides at but very few points from El Dorado Cañon to far above the foot of the Grand Cañon. A few sandy washes in the near vicinity of El Dorado Cañon lead down to the river. From the head of several of these access can be gained to the interior country. The next one is found at the mouth of Vegas wash, above the Black Cañon, a strip

of low shore that, extending above Callville, is lost in the rough mountains that, breaking across the river at this point, constitute the walls of Virgin or Boulder Cañon. Again, at the mouth of the Virgin, the river may be approached, but not again until the crossing is reached below the foot of the Grand Cañon. This point can be approached from Saint George by following down the Grand wash. The next crossing is at the mouth of Paria Creek. Some twenty miles further is a point known as El Vado de los Padres, that leads into the Navajo country.

These six points are the only available ones in a stretch of three hundred and fifty miles at which the river can be approached by a road, and at the most of these that road cannot be much better than a trail, without large expenditure in the way of building. The precipitous and high mountains make down to the banks of the Colorado in a continuous line, from eight to ten miles below El Dorado Cañon, and up to within five or six miles of the mouth of the Virgin. At the three other crossing points direct communication can be had with the lower country. Between the first-mentioned places, according to information obtained, no parties have ever succeeded in getting down to the river from the lower side.

I am indebted to Mr. Gibbons, representative from Saint Thomas to the territorial legislature of Arizona, and Mr. Ira P. Hatch, an old Indian guide and interpreter in Meadow Valley, for much of the information in regard to the Colorado in the vicinage of the reconnaissance-line.

Lieutenant Ives and party succeeded in following down Diamond Creek until the Colorado was reached. This is probably the only point at which a party can get through on the lower side between the crossing below the Grand Cañon and the confluence of the Little Colorado, except at the Sheavwitz crossing. In case there is to be a railroad leading from any point on the Central Pacific Railroad through Nevada, and connecting with Arizona, the problem is a very simple one. The Colorado must be crossed either at the mouth of the Virgin or at the mouth of the Grand wash.

Knowledge gained from the Indians and from other sources makes it apparent that the passage is not difficult, after having crossed the Colorado at the mouth of the Virgin, to reach the head of the Hualapais Valley, and thence to Prescott, the most notable of any of the points in Northern Arizona.

While standing upon the *mesa* near this place, I could see a wide wash that seemed to follow to the top of the low hills opposite, and from which the Indians said we could easily follow to any of the valleys below. I was very anxious to cross the river at this point, and climbing some peak get a view to the south and eastward, but we were obliged to push rapidly on. Should this prove true, it will not be impossible to connect this point easily with a road to Prescott, which would probably meet the road from Hardyville to the above point near Camp Toll-Gate. A hasty reconnaissance through this stretch of country will be necessary in order to fully settle this point.

The route from Toano, on the Central Pacific Railroad, leading through Pahranagat Valley to the mouth of the Virgin, will be the most eligible in case that it is desirable to reach points below the Colorado in this way.

The route that has been traveled considerably during the present season, leads from Elko via White Pine, down Railroad Valley to Quinn Cañon; thence, via Crescent Mill, Indian Spring, Las Vegas, and Hardyville, and thence on the military road to Prescott, passing Camp Toll-Gate. By a reference to the table of distances it is seen that this route is comparatively worthless, and can only be used by small parties.

As regards the navigation of the river, my opinion can only be rendered as a digest of the bulk of authentic intelligence which it was my care to seek as much as possible, at all times, where I supposed it could be found. It is well known that the Esmeralda, an old hulk, did succeed in getting as far up the river as Callville, then a small Mormon landing above the Black Cañon, passing successfully the Roaring Rapids. If this has been done, it seems quite certain that there are fewer obstructions in Virgin or Boulder Cañon. If so, practical navigation may easily reach the mouth of the Virgin. Again, from this point on, it is understood that no insurmountable hinderances occur to ordinary navigation until the Big Cañon is reached; but after ascending this for a distance of about five miles, it becomes impossible to go any further. No present or prospective needs go to show that it will ever become necessary to navigate higher than the Virgin. If they do, such navigation may be carried as far as the Grand Cañon crossing. In order to accomplish

this, strong stern-wheel steamers, of light draught, with heavy power, will need to be used, while all the merchandise will have to be placed on barges.

The local necessities for navigation, even this far, seem, at the present moment, to be very few. Scarcely any mines exist in close proximity to the river, and of those above Mojave the only ones known are at El Dorado Cañon. There is no agricultural land of any moment above the same point, and there are no roads for communication to the interior any higher up, except to the Mormon settlements on the Muddy, and these find, at the present prices, the Central Pacific Railroad having been built, that it is better and cheaper to receive supplies via Salt Lake. Steamers run up now as far as Mojave with Government freight—occasionally as far as El Dorado Cañon, where a small mining enterprise is being carried on.

The proposition stands thus, so far as present means of information, which for all practicable uses are authentic, that in case any developments of the country call for it, the Colorado River can be navigated by steamers as far as the old Indian crossing, about one and one-half miles below the foot of the Grand Cañon; but that beyond it its waters can serve no benefit to the internal communication or the gradual development of its surrounding country except for purposes of irrigation.

The reaching of the mouth of the Virgin has brought us to the extreme southern end of the main line of the reconnaissance. The further continuance had to be controlled by the force at disposal, and the desire to gain all possible information while upon the ground, not alone for the sake of information and the full performance of duty, but connected with it a lingering regard for the misfortunes of another, who possibly might be sent to examine this wild and desolate region, provided this reconnaissance did not complete the required end.

It appears that a renegade band of Navajo Indians have been in the habit of crossing the Colorado at both La Paria and Ute Crossings, making raids upon the Mormon stock near St. George, and retreating by the same route.

Provided the future development of Southern Nevada calls for the establishment of a military post, or posts, there are but few points at which this can be done. The direct lines through, as is shown, are but two in number. Upon one or the other of these such post, or posts, must be established, except further knowledge shows that some one point calls, on account of local, political, or strategic importance, for a post in its immediate vicinity. At Meadow Valley, all that is required for the erection and sustenance of a post can be found. It is quite outside of the north and south lines of travel. On the line from Toano to the mouth of the Virgin, there are really but four eligible points—at Murray's Creek, Cave Camp, Pahranagat Valley, and the Muddy. The finest of these positions, as regards central location and surrounding necessities, is Pahranagat.

Although when we had reached the Colorado a great sense of relief came over us, that our reconnaissance line had been so far extended, yet it was well known by every one of the little party that the greater part of one of the hardest trips was yet before us.

On the morning of the 2d October we leave the mouth of the Virgin to thread our way, hugging the river as closely as possible, intending to follow this programme as far as El Dorado Cañon, should circumstances permit.

The first day out proved a very disastrous and fatiguing one, and the night coming on found us in three parties, each in a sandy wash leading down to the river near Callville—some without water and with rations, others with water and no rations, and others again without either. We succeeded in getting together and reaching Callville by 1 p. m. of the next day, with only the consolation of looking back and seeing that great difficulties had been passed, while, turning to the other hand, as great ones stared us in the face.

CALLVILLE.

This was originally started as a little Mormon landing, from whence stores coming to the river could be shipped to the settlements of Southern Utah. Quite a large store-house and several stone shanties had been erected; all were abandoned at the date of our arrival, adding desolation to sterility. There is no possible reason for regenerating the place, and whenever a stray traveler reaches these solitudes he will only see, as we have seen, the deserted store-houses and surrounding shanties.

Here news from the party at Las Vegas ranch met us, and also the intelligence that some grain had arrived at the mouth of Vegas wash—good news, since that purchased at St. Thomas had

become exhausted, and beyond a little salt grass at the mouth of the Virgin, nothing had been encountered in the way of forage.

The road down the Virgin from the confluence of the Muddy is not passable for heavy wagons in high water, on account of shifting sands. At these times a road upon the sand mesas to the westward will have to be constructed. This will be a rough and sandy road. From the mouth of Las Vegas Wash we have before us the Black Butte, near which Lieutenant Ives came with his boat at his farthest station upon the Colorado, while with the river party. At this point there is a little sand island, around which a small part of the river runs and again returns to the mother stream, collecting much alkaline matter in its passage. Reaching this, Lieutenant Ives judged that they had found the mouth of the Virgin, and looking to the east and north, they saw the dark, high mountains, that seemed to say there lies no passage beyond, concluded that farther than this point no navigation of the Colorado could be effected.

The mountain scenery in this locality, to my idea, was the most wild, picturesque, and pleasing of any that it has ever been my fortune to meet. The walls of the Black Cañon rise steep, dark, and sharp on the south and east, and to the northeast those of Boulder Cañon, while the continuation of ranges leading to the north and northwest makes our station appear similar to that of a depression in a grand basin, from which escape seems difficult in any direction. The walls of Boulder Cañon are nearly perpendicular, from twelve to fifteen hundred feet in height. The scene encountered upon reaching the river by moonlight was one of extreme loneliness and grandeur.

The next morning those so fortunate as to return follow up the wash to meet the train, in camp at Las Vegas, while the hardy party—pioneers of the last few days—have continued on the trail toward El Dorado Cañon. A hard day's march in the burning sun is concluded, and night brings nothing save the certainty that no camp has been reached, and that no one knows where there is any water. We had been directed to some ambiguous place nearly one mile away from the trail, where it was said that it could be found, and finally, a little before midnight, we did find it—Lieutenant Lockwood and myself coming in somewhat later than the pack-train. Never was water more acceptable, though found in so drear a locality, high up among some dark volcanic-looking foot hills, upon which no one would suppose that rain had ever fallen.

During the day the surveying party had gotten lost, and at night we did not know where they were—an affair that caused much uneasiness, as it would have been little better than death if they had followed any route except the one leading to Las Vegas. After reaching El Dorado Cañon, our apprehensions were quieted, and another party started out and came to that point.

Strange as it may seem, there was a slight amount of wild bunch-grass, or "hard-tack," as it is called, near at hand to our dismal camp, which, though very dry, offers some nourishment to the animals, that are allowed to graze till 10 a. m.; after which a brave start is made, and after winding in and out of cañons and sandy washes, the mill at El Dorado Cañon is reached before nightfall. During the day, and while crossing several high divides, the river stretched out before us down below Cottonwood Island, and the mountains that follow down below Fort Mojave and to the east can be plainly seen. The position of the post can also be nearly determined by the aid of a field-glass, although the distance was at least sixty miles.

A day's rest was taken at the mouth of the cañon to see if anything could be heard from the surveying party, and on the succeeding morning we start back and meet another party sent out from the "Vegas," at a little spring in the cañon, not very far from the mines. While at this point, a short time was taken to look at a few of the leads in

El Dorado District.

Before the war these mines had been the scene of some little excitement, which subsequently was broken up, and the camp nearly abandoned. About 1865 a revival was created, and some of the mines have since been worked. In 1866 a company of troops were stationed near the mouth of the cañon. The principal lead is the Techattiecp, which has all the appearance of a true fissure-vein, though not very wide. The surface-showing of ores have always assayed high; those from the interior have rich mineral indications, but at our coming, by the ordinary amalgamation process—the only one used—did not yield a large return. Whether this resulted from mismanagement, or the fact that the process was poor and the mill old, it is difficult to say. The vein-matter shows

galena, sulphide of silver, and copper pyrites. The sulphide of silver and what little chloride is found are all that so far have yielded any return. In case that arrangements were made for roasting, it seems almost certain that this mine could be made productive. The facilities for mining are extremely unfortunate. The mines are in a perfect desert, without wood or water. Everything connected with their working is expensive, and must so continue until competition can be brought to bear upon facilities for transportation.

The other mines in this district are comparatively undeveloped. Their number is legion, as is nearly always the case in mining sections. Every boulder that has a streak of mineral is likely to be located as a ledge, with all its dips and spurs, angles, &c.

From this point we turn our backs to the far-famed Colorado, that should be known as the River of the Desert; winding its way here through steep and sterile cañons, and there through arid and long-extended deserts, acting as an imperfect channel of communication, varying in velocity and volume. In my travels it has been my lot to cross it twice—at Mojave and Fort Yuma—and to examine its character for nearly seventy miles from El Dorado Cañon to the mouth of the Virgin, and when we looked back upon it for the last time no sense was touched, save that of relief.

During the day of October 6th topographical parties have made the best use of the time, and the next day at 2 p. m. all start to join the main camp at Las Vegas.

October 8th finds us all together again, a sorry-looking crowd, although the camp is a pleasant one. Nearly every one wishes to go by the Salt Lake road to Los Angeles—by far the easiest route, as by going to the northward at the time of reaching the latitude of White Pine it was expected to find much frost and snow. The fixed resolution of going back on this line was still persisted in by myself, although it seemed a thing almost impossible, considering the state of the transportation. However, as it was necessary to send to Fort Mojave for supplies, it was thought best to forward a requisition for mules. Four were received, and these, in connection with the six captured from the Mormons, greatly recuperated our worn-out train.

While remaining at this camp a reconnaissance was made toward Potosi Mountain, in vicinity of Salt Lake road; one along the Vegas wash, and another to northwest along the range known as Spring Mountain range. I was in charge of the latter, and had left instructions for the train to meet our small party at Indian Springs. The reconnaissance to the west and south was conducted in charge of Lieutenant Lockwood as far as the old Potosi, now known as the Yellow Pine District. A description of this district appears in the preliminary report of 1871.

The Indians in the vicinity of Las Vegas are the Pah-Utes, and vary in numbers from fifty or sixty to one hundred and fifty or two hundred, according as they see fit to live in the valley, or keep to the mountains. Some of these at times make their wick-e-ups about El Dorado Cañon, and again a few near Cottonwood Island, on the river; while the most of these same Indians are found in the mountains of the Spring Mountain range, and to the northwest from the Vegas, numbering as high as three or four hundred, all told. As some of these Indians could speak Shoshone, it was concluded that our guide would be able to gather from some of them information about getting north from Indian Springs. The result proved quite fortunate in giving us a knowledge of one of the worst forced marches of the trip.

During this detour quite an amount of mineral cropping was discovered by some members of the party. The section was designated as the Timber Mountain District in consequence of its close proximity to a large quantity of very fine pine timber, high up on the mountains. The croppings were galena, chloride of silver, and pyrites, with indications of gold. The ledges, in some instances, were large and well defined. The chances for mining were comparatively good. The development of mines so far remote must depend upon time and increased facilities of inland transportation. If a railroad is built through Southeastern Nevada, a mineral section will be developed not to be equaled on this coast, throwing open chances for legitimate mining operations, where capital, used with judgment, will ultimately prove a profitable investment. The building of the 35th parallel road will improve and render quite accessible some of the mining prospects of this latitude.

Intelligence received from the camp at Las Vegas, upon our arrival at Indian Springs, told of the desertion of two men and the loss of five of our best animals. This further crippling of our

wasted force of animals was so disheartening that it appeared almost impossible to attempt the trip to the north, as all of them were growing weaker each day from the effect of eating the young salt grass at Las Vegas.

Having found some fine bunch-grass about seven miles distant from Indian Spring, orders were sent back for the wagons to come on to this point, and they did so, reaching it on the evening of the 22d October. The animals were sent to the mountains to graze, and all our energies gathered for a severe march. To make this, a division into four parties was effected, as at two of the springs it was known there was not enough water for more than six or eight animals.

On the evening of the 28th October the first party moved out of camp, each one with a feeling of uncertainty as to the success of getting through with the teams. During the next day the second and third parties left, and on the following day the last. The march for seven or eight miles from Indian Spring was across an alkali flat, which became almost impassable in consequence of a rain that had commenced some few hours before the starting of the last party. This party traveled till midnight, when the animals being badly worn out, a halt was made for a few hours. The next day at 1 p. m., Quartz Spring was reached. The march to this point had been across alkali flats, sandy washes, and broken mesas. A more thoroughly horrible road could not be imagined.

Resting for about one hour at Quartz Spring—a little spring some one and one-half miles up a cañon from the sandy wash in which the road runs, and from which eighteen small buckets of water were obtained—it was considered better to ride on to ascertain how good luck the advance parties were having. This was done, and, on the night of the 2d November, Crescent Mill, to the westward of Pahranagat, was reached, from which point the advance party had gone on for seven or eight miles to a place where there was more water and grass. The animals of the second and third parties were driven in during the night to get water, having become too much exhausted to drag in the wagons. The distance from Indian Spring to Crescent Mill is nearly ninety miles, and may be looked upon as a desert for the entire distance, as at the two springs the amount of water obtained was not so great as that taken along in casks and kegs. The grades are mostly ascending. The sandy washes and broken character of the road render it a very disastrous route for anything like heavy-laden teams. Our wagons could never have gone through except for the dividing up and consequent good management, and not even then, except that from twelve to fifteen hundred pounds of surplus materials were thrown away at Indian Spring. Much credit was due to every one connected with the command for the energy and perseverance in this desert trip, which, being the most difficult of the season, was taken after long and protracted hardships during a summer's stay in the mountains.

Finally, on November 4, all the train succeeded in making camp at Schafer's Springs; a weary, dirty-looking set, worse in appearance than emigrants.

Considering that Lieutenant Lockwood had not been able to visit the mines in Pahranagat District during his passage to the south, and as we were very near to them while at Crescent Mill, it was considered advisable to make a hasty visit while the teams were in camp, for the purpose of recuperating. This route was through Logan Springs to Silver Cañon, where are situated most of the buildings belonging to the Hyko Silver Mining Company, engaged in mining on a large scale.

This trip afforded many new hints. This company own nearly all the mines in the district, and leads that stretch over a distance of five miles. The general direction of the most of these is nearly north and south, while many feeders, chimneys, wings, and cross-veins exist that, when developed, run into the mother vein. The Illinois and Indiana were the leads most worked, and those showed well defined walls at a depth of nearly 300 feet. The ore is low grade, but of large amount. Much money has been spent in the enterprise, with, so far, little return. One of the finest ten-stamp mills in the State has been put up at Hyko. Everything connected with the mining of the ore is conducted in the best manner. The expense of hauling the ore to Hyko, a distance of about ten miles, and wood also, brings the price of roasting so high that both together eat up all the profit. An attempt was being made to find water in Silver Cañon, and a depth of ninety-seven feet had been reached.

A hasty trip was made to Hyko and down Pahranagat Valley toward the lake, as it was desirable to learn more with regard to the valley that, by common consent, is considered as the most fertile

in Southern Nevada. The little town of Hyko is at the head of the valley, practically so, since the head has to be taken at the commencement of arable land, determined, in this case, by the appearance of a large spring, the water of which brings the land into a state fit for cultivation. There is quite a strip of fine vegetable mold farther up that can never be made use of for want of irrigation. This is covered with a luxurient growth of sage-brush.

It has been noted that, throughout Nevada, wherever the sage-brush grows thick and to a large size, the soil underneath is susceptible of the highest cultivation. Unfortunately, however, water is lacking in most of these localities, except at some future day artesian wells develop the existence of large basins of water in the valley depressions. The *mesas* from the east side of the Pahranagat range come down so closely upon the valley that it is rendered quite narrow, but what there is of it is extremely fertile. The length is something over thirty miles, and width from three-fourths to one and one-half miles. The land-surveys show that there is from fifteen to eighteen thousand acres of land subject to cultivation. This is an amount not equalled by any other valley encountered in our travels, except Ruby Valley. There are three large springs that rise suddenly out of the ground, showing powerful subterranean force. The amounts of water are sufficient for the irrigation of all that part of the valley necessary to be irrigated. Some parts saturated continually need no irrigation. Adobes can be made for buildings. Wood is not plenty, and must come from the neighboring hills. Bunch-grass is found on the foot-hills at the lower end of the valley. The valley-grass in some parts is salt grass; in others, the "blue-joint" appears. Cattle thrive upon any of it when acclimated. Stopping at several of the ranches, I was much surprised at seeing such luxuriance of vegetation; vegetables were especially large, both in size and production, and excellent in quality.

The approximate area of agricultural land in the valleys traversed by our parties is two hundred and fifty square miles, showing the great scarcity of arable land. It appears certain that lands in Southeastern Nevada fit for agricultural production will, in time, be valuable.

A return to our camp at Schafer's Springs is made, and orders given for the train to move on as far as Quinn Cañon, the next stopping-place. Meanwhile a detour is made for the purpose of obtaining topography of and information in regard to the

TIM-PAH-UTE MINES.

These are situated in the southern end of a short detached range to the northeast from Tim-Pah-Ute Peak, and to the west of the head of Pahranagat Valley. Their surface-showing is very fine, and the ores assay very rich. The slight developments made determined nothing as to the surety of the development of a fissure vein or veins. The opportunities for mining and milling are not convenient, but, on the other hand, very difficult. The nearest water is Tick-a-boo Springs, some eight miles distant.

The Crescent Mill, sixteen miles from the mines, had just completed arrangements, at that time, to mill their ore. The nearest approach from the vicinity of White Pine is *via* Quinn Cañon directly down an alkali valley to the west of the mines, and the distance is approximately one hundred and fifty miles. But a slight amount of capital had been employed up to the time of our arrival. The chances seem very favorable in this district for the future. Considerable sulphide of silver is here found, and very little base metal.

GROOM DISTRICT.

This is situated to the south and west from Tim-Pah-Ute Peak, and is one vast deposit of galena, so far as all accounts can be trusted. It was not visited for want of time and means.

This district was not being worked by any miners in November last, but I understand that since that time parties have gone there to make some developments. The chances for mining are favorable; wood and water are sufficiently plenty, and timber enough for all requirements.

These galena ores are assuming quite a respectable status among mining schemes, and the future will open to them a history unknown to the past. Good results may be looked for, and

what the Indians have called "bullets," and the Mormons "lead," will prove, under the hand of true American industry, to contain large amounts of that power that rules the prosperity of peoples —money.

A hasty return to our camp at Quinn Cañon is made, which we reach on the 9th of November. The animals are resting, and parties are out among the hills gaining information. Here we find barley that had been placed on store in August last, and which proves remarkably acceptable, considering the worn-out condition of the team animals.

The road from Crescent Mill to Quinn Cañon has been more than an average of fair mountain-road. Not so the one from Indian Spring to the first-mentioned place, which was a succession of washes, sand stretches, and alkali flats. The bunch-grass, that is still found in spots, more frequently higher among the hills than the ordinary traveled route, had become so very dry that it seemed almost worthless for the animals when they could get it. The occasion for this has resulted from the extreme dryness of the season. This grass, however, appears to retain its saccharine and nourishing qualities, no matter what the degree of dryness.

From Quinn Cañon Lieutenant Lockwood took a small party to make a detour *via* Reveille and Hot Creek, and thence return and meet us at Monte Christo Mill, opposite White Pine; while the wagons approached the same point by following up Railroad Valley. This is a long, wide, sterile and alkaline valley, stretching far to the south from where we debouched into it opposite Quinn Cañon. The land that is fit for ranching is extremely small in amount, the greater part of which is in the vicinity of Duck Water, on the western side, while our line of travel was nearer to the eastern side. To the west of the valley extends the Pancake range, that merges about opposite White Pine into the Diamond range, that follows farther on to the railroad, making a natural trend of valleys, with almost insensible divides, from Peko, on the Central Pacific Railroad, to far below the Reveille District. This avenue, as a natural route for a railway, cannot be surpassed; but where the railroad would go, in case of its being built, after leaving Railroad Valley, is a subject worthy of close investigation.

Rapid marching was made, and Monte Christo Mill reached on the evening of the 16th November. We had come to what appeared to us as considerable civilization, when we were within a few hours' travel of the White Pine settlements—having been so long without receiving letters or much of any sort of intelligence. Here letters and friends were found, and newspapers, too. No one who has not tried the mountains for a long and tedious time can tell how acceptable all these are. Lieutenant Lockwood and his party arrived late on the evening of the 18th.

Telegraphing for the rate of the chronometers, conducted in a similar manner as in the preceding season, was consummated during the night of the 19th.

On the succeeding morning the train moved out on the stage-road to Elko. Hasty marching was made to the telegraph station on the old overland road, from which point a surveying party was detached to go through Ruby Valley to Camp Halleck, to get position of the road and ranches along the valley, and as much further topography as possible, while the teams, hugging the western side of the Humboldt range, follow for a while the stage-road, and then a road that detours by Lamoile Creek, reaching Camp Halleck in a severe snow-storm on the evening of the 25th of November.

The next day everything was packed, the property turned over, and, during the succeeding night those of us who were to return to San Francisco reached Halleck Station, where, taking the westward train on the morning of the 27th, San Francisco was reached on the eve of the 28th of November.

RECAPITULATION.

By reference to the accompanying map, the extent of the reconnaissance is easily traced, and its area found to embrace, approximately, 26,500 square miles. Of this no accurate mapping had been made below the latitude (39° 15′) of White Pine. The length of the reconnaissance-line in all its detours is 2,210 miles.

The final map, will be completed upon a scale as large as one inch to eight miles.

The astronomical observations, taken altogether at some fifty stations, have been of such a

character as to determine the latitude to fractional parts of a minute in arc; while at points where the telegraph could be used, more satisfactory results have been attained with regard to longitude; below White Pine these positions are only approximate, depending upon the equability of the rate of the chronometers.

NATURE OF THE RECONNAISSANCE.

The intention has been that the information collected shall be of as great practical value as possible, showing upon the map, besides the general topographical features, all the present existing roads, with tables giving distances between stations, the character of the roads, &c., streams and springs, the spots at which timber exists, the height of noticeable mountain ranges, peaks, &c.

The basis of the reconnaissance has been the actual road traversed, carefully meandered; the distances being taken by odometers that can be depended upon to a variation not exceeding two per cent. The positions of the camps, as thus determined, have been modified from the results of the astronomical work. In many cases, from the tops of prominent peaks that had been carefully located, directions were taken to other prominent peaks, far in the distance; thus accomplishing a trigonometric connection.

Meteorological observations have been taken, so as to be used in connection with the obtaining of altitudes, and for such general information as their discussion will develop. At six or seven points these have been taken hourly, and at intervals extending from forty-eight to ninety-six hours.

Aneroid barometers, compared each day with cistern barometers, have been used with good success to give data for determining a rough profile of routes traversed.

The natural trend of the mountain chains and valleys is seen to be north and south, varied here and there by a break in the wave motion of the great force that first created the upheaval—showing at these points lateral divergences, giving more difficult divides from one valley to another, and every variety of hill and ravine contour. This is, perhaps, the most noticeable in the vicinities of the White Pine and Pahranagat ranges.

The valleys traversed were twenty-three in number, as follows: Huntington, Ruby, White Pine, Long, Steptoe, Cave, Desert, Meadow, Spring, Snake, Lake, Pahranagat, Rose, Cedar, Eagle, Dry, Clover, Meadow, Vegas, Coal, Sierra, Railroad, and Alkali.

Eighteen mining districts were visited, that lie within the area embraced by our route, as follows: Cave, White Pine, Robinson, Patterson, Sacramento, Snake, Shoshone, Ely, El Dorado, Yellow Pine, Timber Mountain, Hercules, Tim Pah-Ute, Pahranagat, Reveille, Hot Creek, Morey, and Grant. Slight glances at their character, and a somewhat general description of each, is given in the body of the report. There are really two distinct and somewhat parallel lines: One, leaving the railroad near Toana, bears southward through Steptoe Valley, via Cave and Pahranagat Valleys, and thence along the Muddy and Virgin Rivers to the Colorado; thence by a prospective route till some point on the military road from Mojave to Prescott is reached. The other, leaving the railroad at Elko, passes west of Hamilton, down Railroad Valley, thence, via Crescent Mill, Indian Springs, Las Vegas, and Hardyville, to the same military road.

If any route is ever used as a through line of travel, either as a railroad or as a country road, for any heavy transportation, it must be the one crossing the Colorado at the mouth of the Virgin. The more westerly line is comparatively a desert all the way to Hardyville, after White Pine is reached.

By a reference to the tables, it will appear that the distance from Toano, on the Central Pacific Railroad, to Prescott, Ariz., on the natural route of travel, is five hundred and fifty-eight miles; while from Elko, a point farther south on the railroad, by a more westerly route, it is six hundred and forty one miles, giving an advantage of 15 per cent. to the former in distance alone. The other advantages, such as better roads, camps with better accommodations in regard to wood, water, and grass, and fewer desert marches, are superior to the one above mentioned. Provided the road can be made through from the mouth of the Virgin, loaded wagons can reach Camp Toll-Gate from the Central Pacific Railroad in twenty or twenty one days actual travel; while, on the other route, it would take at least twenty-nine or thirty days, and longer intervals at stopping-

places, for rest, on the route. Government stores freighted on such a line would cost, delivered at Camp Toll-Gate, 12½ cents per pound for the freight, reckoning at the rate of 2½ cents per pound for every hundred miles, which would naturally be about the average contract price. At present the contract price for freight via the mouth of the Colorado to Fort Mojave is 3⅜ cents per pound, and from thence by land to Camp Toll Gate 4⅞ cents, making a total cost of transportation from San Francisco of 8¼ cents per pound.

It is likely that more than two-thirds of the gross weight of commissary and quartermaster stores that go into Arizona are purchased in San Francisco. In addition, then, to the 12½ cents per pound, necessary to pay freight to Camp Toll-Gate, would have to be added the cost of freighting to some point on the Central Pacific Railroad from San Francisco, or an addition of 2½ cents, making 15 cents per pound total cost. From this it clearly appears that supplies cannot be forwarded on any such line to posts in Northern Arizona, provided they are purchased in San Francisco.

The saving in cost of purchase in Chicago, and subsequent shipping to some point on the Central Pacific Railroad selected as a depot, are subjects upon which even approximate estimates cannot be made, since the data are not at my disposal. There could be a saving made, after the route is opened, by stopping recruits for Northern Arizona at some point on the railroad, and having them march overland. This would come from the saving in transportation from said point on the Central Pacific Railroad to San Francisco, and thence to Wilmington, Cal., via steamer—an amount for each recruit of about $56, coin. We will suppose that there are four hundred recruits per year to be distributed; this would result in a saving of $20,000.

AGRICULTURAL LANDS.

These are so few in number and limited in amount, that, although the Ruby Valley meridian has been carried to the south as far as the California boundary, still there have been very few places at which sectionizing has yet been called for. Pahranagat Valley has been sectionized by these parties, and, upon our return to the vicinity of White Pine, they were at work surveying on White River to the east of the mountains in which the Grant district is situated.

There is a strip lying contiguous to our easterly line that will call for surveys in the future. These lands will be principally in Steptoe, Spring, Desert, Cedar, Eagle, Rose, Meadow, and Clover Valleys, also those upon the Muddy.

MINERAL-BELTS.

Through the section traversed there seem to be four distinct and well-defined mineral-belts, following a general northerly and southerly course along prominent mountain-ranges. The most westerly of these commences on the north with the Diamond range, in which Mineral Hill and Pinto Districts are found. In continuation of this range the Eureka District is encountered—a place of note. Specimens of ore seen at Hamilton were very fine, and the bulk of legitimate reports seem favorable.

Going to the south, Morey and Hot Creek are reached, being in the Hot Creek range. Reveille District is also due south, but in different mountains. Then comes a desert, unexplored strip, unknown to white men, and but little inhabited by Indians. The old Amargosa mines lie in this same southern trend; also several districts in Inyon County, California.

The next belt commences with the mines in the Humboldt range—the only ones of any interest being in the Cave District facing on to Ruby Valley. Along in order come White Pine, Grant, Pahranagat, Tim-Pah-ute, Groom, Timber Mountain, and Yellow Pine, also the Clark District, to the south of Yellow Pine and in California.

The third belt commences at Egan Cañon, and following the range of that name, contains the Hercules and Robinson Districts. Going due south the ranges are not so well defined, and nothing is met with until El Dorado District is reached. It is believed that there are mineral-showings in the Egan range to the northward of Egan Cañon, and before the railroad is reached.

The fourth belt is found mainly in the Schell Creek range. The first known are those in Nevada District; then comes the Patterson, from whence the mountains bear a little to the east of

south, and the Ely mines are in a break off from this range. To the south, and following this trend, no gold or silver mines are known between the above point and the Colorado. Copper shows itself at one or two points.

Those mines, including the Sacramento, Snake, Shoshone, and Silver Park Districts, that commence in the Snake range, and follow down along the Fortification Hills, seem to be a short, detached belt, not so far extended as the others. Above the Nevada, and on the Schell Creek range, some mineral-districts have been found, but few developments are yet known.

It is more than probable that if the general view of the topography north of the railroad is discussed, these same belts, or a part of them, will be found to extend far to the northward, following the general structure and trend of the noticeable chains of mountains; while below the Colorado, as soon as better topography is obtained, no doubt their existence and continuation can be traced.

A number of prospectors have at one time and another run over these mountains, only the more energetic of them striking into the rougher parts, where lies the exposure of the mineral. For a long time to come new discoveries will be made, all tending to give a more definite character and continuity of direction to the mineral belts described.

INDIANS.

The various tribes that were encountered are as follows: Shoshones, Gosiutes, Snakes, Pahvants, Utes, and Pah-Utes. For their numbers and general information acquired, I am indebted to the guide and interpreter.

The Shoshones are quite numerous, extending over a large section of country to the south of the Humboldt as far east as the meridian of mountains to east of Ruby Valley, and as far south as 37 degrees 30 minutes of latitude. Small parties of them were seen at Halleck, Elko, Ruby Valley, and White Pine.

The Gosiutes are farther to the eastward and northeast, and extend as far south as the 38th parallel.

Again, to the east are the Snakes, closely analogous in disposition, and occupying a narrow longitudinal slip.

The Pahvants are found only after the Utah line is passed, and most of them are to the east and southeast of Preuss Lake—our farthest station in that direction.

The Indians between Snake and Meadow Valleys are an intermingling of Snakes, or Utes proper, and Pah-Utes, possessing no peculiarities of either, except the treachery of both to a heightened degree.

On our return trip, the Shoshones were met again in the vicinity of Tim-Pah-Ute Mountains.

The number of Indians actually seen or accounted for, after leaving White Pine, was a little less than 2,500. The bulk of these were not included in the treaty made by Governor Nye in 1863 in Ruby Valley, and have never received any presents. I believe that the greater share of them could be, to a certain extent, domesticated upon *one* reservation, if properly controlled. In their present state, speaking of those below the 38th degree of latitude, the springing up of an intelligent and warlike chief would band them together, and for a time, if there was no military interference, the lives and properties of the settlers would be in danger.

ELEVATIONS AND PROFILE LINE.

The highest ranges of mountains encountered were the Humboldt and Spring Mountain ranges —some of the peaks of the former approaching 13,000, while one of the latter nearly reaches 12,000 feet. Very few of the other noticeable ranges have peaks that show an elevation beyond 8,500 feet; yet the marked force of the upheaval is as plainly seen, while the accumulation of power at particular points is wanting. The foot-hills on either side show a marked difference, those of the western slope having greater horizontal extension, lesser grades, more grass, wood, and timber. This is due to the tilting of the strata, that, inclining to the westward, present the upturned edges of the rock to the denuding force. The eastern slopes, on the other hand, are sharp and abrupt, showing sandy washes and rough cañons, generally devoid of foliage and vegetation.

The *valley* elevation of the Humboldt near Elko is about 5,100 feet. This increases going

southward, until the divide of the water-sheds between the Humboldt or a part of the great interior basin from that of the Colorado is reached. In the direct line south, this is in vicinity of White Pine. From this point the decrease of elevation is quite gradual until about latitude 38 degrees is reached. From this point on to 36 degrees 30 minutes, the fall is more abrupt, while, reaching El Dorado Cañon on the Colorado, we have passed from an elevation of over 6,000 feet to a little less than 900 feet. This fall of itself would necessitate no remarkable grades; these, where found, are near the break of the general mountain trends, appearing as steep divides between contiguous valleys.

NAVIGATION OF THE COLORADO.

The body of the report presents the idea that this stream may be navigated, to good practical success, as far as the foot of the Grand Cañon. The future, for a long number of years, will hardly call for anything of the sort higher than the mouth of the Virgin.

It is possible that, in case Mormon settlements are pushed into Northern Arizona, the route will be by following the grand wash leading from the vicinity of Saint George to the above-named crossing, or at the mouth of Paria Creek, and that, for supplying points to the southward, shipments may come via the river.

MEANS OF COMMUNICATION.

On the easterly line of the reconnaissance the roads were more than a fair average of mountain roads, until the Valley of the Virgin was reached—superior, in many respects, to the variety of roads found in Southern California and Arizona. The approach to the desert on either hand brings with it sandy roads, washes, alkali flats, and sloughs.

On this line a railroad can be successfully run to the Colorado River. On the more westerly line such a railroad, if intended to be a through communication to the 35th parallel road, in event of the latter being built, must join the same at some point west of the Colorado River. On this line the road is generally good till White Pine is reached. The same holds good while traversing Railroad Valley. Upon leaving this valley, the route follows a good road, principally upon the mesa, till its arrival at Crescent Mill; then comes some of the worst of desert travel.

The divide necessary to be crossed by a railroad in going from Elko via White Pine and Railroad Valley, in order to reach a valley necessary to continue on and come out by Indian Spring and Vegas Valley, will be a very serious one. It will be necessary to cross a continuation of the White Pine range at a point just below Grant District, or immediately below Quinn Cañon, either of which shows sharp profiles.

In conclusion, I wish to express my thanks to all the members of the expedition for the able and satisfactory manner in which they have assisted in the performance of the duties entrusted to my charge.

DESCRIPTION OF THE RECONNAISSANCE.

The commencement having been in the early part of June and the termination in the latter part of November, nearly six months were occupied in preliminary and actual field labor, which proved a propitious season, considering the varied changes of temperature in some of the more northerly sections near to, and north of, the latitude of White Pine. In this vicinity the winters are very severe, especially in localities having a high altitude, while the summers are delightful, except at some few places at which fogs and winds prevail.

The melting of the snows in spring furnishes water in abundance for the wants of vegetation, and the bunch-grass, so common among the hills, is in its best condition. Our return-trip brought us again to this region prior to the harsh snows and severe temperatures of the coming winter; while the time at which the immediate desert of the Colorado was reached (in October) was too late for the glaring and continuous heat of the midsummer days.

The greater actual accuracy of prominent points of the survey is in the area north of White Pine, since the four positions at which longitude by telegraph was obtained form the ground-work, while the lines that act as bases, going toward the Colorado, are nearly north and south, giving fewer chances for a great error in longitude, where alone errors of any considerable magnitude arise.

The use of the little field theodolite, constructed especially for reconnaissance-work, has proven to be such a great improvement that very little change between the positions, as obtained from the results of the astronomical work and the meanders, was necessary to be made. The portability of the instrument and the accuracy of its readings recommend it at once as an almost indispensable article for exploring parties, and to their use the accuracy of the present reconnaissance has been greatly due.

The daily march varied from ten to thirty miles; the survey parties, in extreme cases, have been managed independently of the main party, falling back upon it for supplies.

The traveled roads or trails, carefully meandered and measured by odometers, form the base line for the triangulated points, the stations never exceeding two or two and a half miles apart, and such distances only occurring in valleys where the road was nearly straight.

The magnetic bearings were corrected by finding the variation of the needle at every camp.

The heights of the prominent peaks have generally been determined by using angles of elevation taken from points on the base-line, the elevations of which have been determined from barometric work. This has been modified at points where peaks could be ascended, and here barometric readings have been used, and advantage of such occasions has been taken to triangulate to distant peaks that, at times, could be distinctly defined against the horizon at a distance of one hundred and fifty miles. Stone monuments have been erected at these stations as reference-points for the future.

The necessities of the march and the desire to traverse as large an area as possible have caused in some cases a deficiency of topographical detail, while, on the other hand, the general features as regards positions of prominent points, and practical information, are of a sufficiently accurate nature to answer all present wants.

PERSONNEL.

First Lieut. George M. Wheeler, Corps of Engineers, in charge; First Lieut. D. W. Lockwood, Corps of Engineers, executive officer and astronomical assistant; P. W. Hamel, principal

topographer; Carl Raskopff, assistant topographer; C. E. Fellerer, assistant; Wm. M. Ord, assistant, with the necessary number of guides, packers, laborers, &c., and an escort of two non-commissioned officers and twenty-three enlisted men of Company H, Eighth United States Cavalry.

LONGITUDE BY TELEGRAPH.

While sextants and chronometers are the most accurate instruments that can be readily transported by parties moving rapidly in the field, and latitude can be determined sufficiently accurate for ordinary practical purposes by their use, the question of longitude is exceedingly uncertain, since so very strange are some of the inaccuracies of rate in the chronometers that, no matter how many are used, the results must be accepted with caution. Being well aware of these facts, arrangements were made, while preparing for the season's work, to take advantage of the telegraph, to find out at any moment the local errors of the chronometers upon San Francisco time. It was deemed possible to accomplish this at four points, viz, Elko, Peko, Ruby, and Hamilton. With the two latter places the lines of the Western Union Telegraph Company connect, and through the kindness of the managers at San Francisco, Messrs. Mumford, Ladd, and Younntz, permission was granted for the use of their lines, and a letter of instructions to their agents in Ruby Valley and Hamilton was furnished; besides, they very kindly arranged, through Mr. Vandenberg, at Sacramento, the superintendent of the lines of the Central Pacific Railroad, to connect, so that a complete circuit should exist between San Francisco and points on the Central Pacific Railroad, near Camp Halleck. Prof. George Davidson, United States Coast Survey, whose kindness in this matter is worthy of many thanks, offered to take charge of the signals at San Francisco, but he was obliged to start on his trip to the North to observe during the solar eclipse. Prior to our reaching Camp Halleck, Maj. H. M. Robert, Corps of Engineers, having been spoken to upon this matter, his co operation was at once enlisted, and, out of the five times that telegraphing was done, he was at the key during four of them; the other, being the one at Elko, was superintended through the kindness of Capt. H. J. Rogers, United States Coast Survey.

The scheme for attaining accuracy in the recording of the signals was furnished by Professor Davidson, of the Coast Survey, a copy of which is herewith given.

PROGRAMME FOR DETERMINATION OF DIFFERENCE OF LONGITUDE BY TELEGRAPH BETWEEN SAN FRANCISCO, CAL., AND STATIONS IN NEVADA—PROPOSED BY PROF. GEORGE DAVIDSON, UNITED STATES COAST SURVEY.

Lieutenant Wheeler to telegraph to San Francisco immediately upon his arrival at any station, and say when he will be ready to receive signals.

To receive them he will have his chronometer ready at the telegraph-office. When Professor Davidson or Major Robert is ready, he will send message to Elko, or the station, to that effect, and, after preliminaries, for a few minutes will carry out the following programme: Professor Davidson or Major Robert: Rattle, rattle, rattle; interval of fifteen seconds; then transmit *one* signal of which Lieutenant Wheeler must note the time by his chronometer; a second signal fifteen seconds later, and so on, one signal every fifteen seconds for three minutes, then three rattles to close.

Then Lieutenant Wheeler will send to Professor Davidson or Major Robert a similar set of signals at given times, of fifteen seconds apart, for three minutes by his chronometer. Professor Davidson or Major Robert will then send San Francisco time of his first and last signal, also the error of his chronometer on San Francisco time.

Lieutenant Wheeler will send his chronometer time of first and last signals and the error of his chronometer, if obtained; if not known, then he will transmit it by rail as soon as ascertained.

When Lieutenant Wheeler returns from his trip this programme can be repeated previous to his return to San Francisco.

The above scheme has been carried out, and the following tables show the details of the results:

Signals for longitude by telegraph between Peko, Nev., and San Francisco, Cal., June 30, 1869—9.30 to 10.20 p. m.

Date.	Station.	Time of transmittal by Major Robert's chronometer.	Time of receipt, by Lieutenant Wheeler's chronometer.	Difference.	Remarks.
1869.		*h. m. s.*	*h. m. s.*	*s.*	
June 30	Peko, Nev.	10 32 0.0	10 31 36.2	23.8	Through repeaters at Wadsworth, Nev.
			10 31 36.3	23.7	Estimated delay through one set of repeaters.
			32 06.4	23.6	0.04.
			32 21.3	23.7	Operator at Peko, Mr. Wood; operator at San Francisco, Major Robert, U. S. Engineers; and unknown.
			32 36.2	23.8	
			32 51.2	23.8	
			33 06.1	23.9	Major Robert's time-shot of San Francisco mean time at time of observation = 24.5.
			33 21.2	23.8	
			33 36.3	23.7	23.8 + 24.5 = 48.3 chronometer 12.4 slow on San Francisco mean time.
			33 51.1	23.9	
			34 06.1	23.9	
			34 21.2	23.8	
			10 34 36.2	23.8	
		10 35 0.0	Mean.	23.8	

Date.	Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
1869.			*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*s.*	*h. m. s.*
June 30	San Francisco	San Francisco	10 33 30.00	+0 0 21.50	10 33 51.50			
		Peko, Nev.	10 33 6.20	+0 28 25.59	11 1 31.79	0 27 40.29	0.04	0 27 37.27
Longitude of San Francisco								7 49 0.24
Correction of chronometer for midnight of June 30, +28m 25.49; rate, 25.40 gaining per day								
Final difference of longitude for Peko, Nev.								7 42 0.96
Or								115 30 14.40

Signals for longitude by telegraph between Elko, Nev., and San Francisco, Cal., July 1, 1869.

Date.	Station.	Time of transmittal, by Major Robert's chronometer.	Time of receival, by Lieutenant Wheeler's chronometer.	Difference.	Remarks.
1869.		*h. m. s.*	*h. m. s.*	*s.*	
July 1	Elko, Nev	9 57 00 0	9 56 37 1	22 9	Through repeater at Wadsworth, Nev.
			52 1	22.9	Operators at San Francisco, Captain Rodgers, United States Coast Survey, and Mr. Ladd, Secretary Western Union Telegraph Company; at Elko, Messrs. Irwin and Stewart.
			57 7 1	22.85	
			22.15	22.9	
			37.1	22.9	
			52.1	22.9	22ᵐ.95+25ˢ.3 = 48ˢ.25, chronometer 12ˢ.3 slow on San Francisco mean time.
			57 7.1	22.9	
			22.2	22.9	Rate during interval, +0ˢ.05; not entirely to be depended upon, as the signals at Peko were neither as perfect nor as satisfactory as at Elko.
			37.1	22.9	
			52.1	22.9	
		10 0 0	59 37.1	22.9	
			Mean.	22.9	

	Signal.	Lieutenant Wheeler.	Captain Rodgers.	
		h. m. s.	*h. m. s.*	*s.*
	First	10 12 15	10 12 38	23 0
	Last	10 15 15	10 15 38	23 0

Date.	Signals sent from—	Recorded at—	Mean of signals sent and received.	Time corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
1869.			*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*		*h. m. s.*
July 1	San Francisco	San Francisco	9 58 30.00	+0 0 25.30	9 58 55.30			
	San Francisco	Elko	9 58 7.10	+0 27 24.01	10 25 31.11	0 26 35.81		
	Elko, Nev	San Francisco	10 14 8.00	+0 0 25.30	10 14 33.30			
	Elko, Nev	Elko	10 13 45.00	+0 27 23.98	10 41 8.98	35.68		0 26 35.75
Longitude of San Francisco								8 9 38.23
Correction of chronometer for midnight of July 2, +27ᵐ 24ˢ.31; rate per day, 2ˢ.50 gaining; therefore the above corrections.								
Final difference of longitude of Elko, Nev								7 13 2.48
Or								115 45′ 37″.20

Signals for longitude by telegraph between Ruby, Nev., and San Francisco, Cal., July 9, 1869.

Date.	Station.	Time of transmittal, by Lieut. Wheeler's chronometer.	Time of receival, by Major Robert's chronometer.	Difference.	Remarks.
1869.		*h. m. s.*	*h. m. s.*	*s.*	
July 9	Ruby, Nev.....	10 28 45	10 29 02.8	017.8	Operator at Ruby, Mr. Anderson.
		10 29 00			Operator at San Francisco, Major Robert and Mr. Sawyer.
		10 29 15			
		10 29 30			Lieutenant Wheeler's chronometer 1283, slow on San Francisco mean time, 10 seconds.
		10 29 45			
		10 30 00			
		10 30 15			
		10 30 30			
		10 30 45			
		10 31 00			
		10 31 15			
		10 31 30			
		10 31 45	10 32 02.8	017.8	
			Mean.	17.9	

Date.	Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double wave time.	Means.
1869.			*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*s.*	*h. m. s.*
July 9	Ruby, Nev...	Ruby, Nev....	10 30 15.00	0 22 22.76	10 52 37.76			
	Ruby, Nev....	San Francisco	10 30 32.80	+0 0 31.20	10 31 4.00	0 27 33.76	0.04	0 27 33.72
Longitude of San Francisco								8 9 38.23
Correction of chronometer for midnight of July 9, $+28^{m}\ 22^{s}.66$; rate, $2^{s}.40$ gaining per day.								
Final difference of longitude for Ruby, Nev								7 42 1.45
Or								115 31 6.75

Signals for longitude by telegraph between Hamilton, Nev., and San Francisco, Cal., November 19, 1869.

Date.	Station.	Time of transmittal, by Major Robert's chronometer.	Time of receival, by Lieutenant Wheeler's chronometer.	Difference.	Remarks.
1869.		*h. m. s.*	*h. m. s.*	*s.*	
Nov. 19	Hamilton	5 12 0	9 15 38.1		Operators at Hamilton, Nev., Messrs. Ingalls and Henderson; at San Francisco, Major Robert and ——.
			53.0		
			16 08.1		Chronometer No. 1283, at 10 p. m., according to Major Robert's signals, $= 6^m\ 20^s.9$; according to Lieutenant Wheeler's signals, $= 6^m\ 20^s.5$; mean error (fast) $= 6^m\ 20^s.7$.
			23.1		
			38.1		
			53.1		
			17 08.1		
			23.0		
			37.9		
			52.9		
			18 08.0		
			23.1		
		5 15 00	9 18 38.1	4 03.38	

	Signals.	Transmitted by Lieutenant Wheeler.	Received by Major Robert.	Difference.
		h. m. s.	*h. m. s.*	*h. m. s.*
	First	9 29 30	5 25 52.3	
	Last	9 32 30	5 28 52.3	4 03 37.7

Date.	Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
1869.			*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*		*h. m. s.*
Nov. 19	San Francisco	San Francisco	9 13 30.00	−0 2 41.54	9 10 48.46			
	San Francisco	Hamilton	9 17 8.05	+0 20 59.55	9 38 7.60	0 27 19.14		
	Hamilton	San Francisco	9 27 22.30	−0 2 41.54	9 24 20.76			
	Hamilton	Hamilton	9 31 0.00	+0 20 59.52	9 51 59.52	18.76		0 27 18.95
Longitude of San Francisco								8 9 38.23
There are made four sets of observations for time by equal altitudes, giving a mean correction for the chronometer of $20^m\ 3^s.19$ slow at $11^h.7$ into noon. This observation was made at Monte Christo Mills on the 18th of November. The chronometer was then carried over to Hamilton for exchange, consequently the difference of longitude between San Francisco and Monte Christo Mills is obtained. The rate of the chronometer was at this time 2s.57 per day, gives the corrections for the chronometer as used above.								
Final difference of longitude for camp near Monte Christo Mills								7 42 19.28
Or								115° 34′ 49″.20

It may be considered as a distinctive feature of the present reconnaissance that, although the instruments for taking astronomical observations have been limited to sextants and chronometers, yet, by the use of the telegraph, results have been attained that compare favorably with those that would be expected from a more extended series of observations with more perfect astronomical instruments, and opportunity afforded for determining with more certainty the rate of the chronometers upon which the lesser or greater accuracy of the approximate longitudes to the southward depend.

SEXTANT ASTRONOMICAL OBSERVATIONS.

Latitude observations were made at most of the camps where the party remained for a single night by means of the sextant; the determination for time depending upon single altitude observations of the stars or equal altitudes of the sun, including several points at which equal altitudes of stars were also obtained. For latitude, either polaris was observed and also a south star, or circum-meridian altitudes of the sun with a south star or stars. The method employed in reduction is given in these tables, special blank forms having been prepared for the use of the expedition.

The accuracy of these observations is proven to be very great, and the results compare not unfavorably with those obtained by the use of the zenith telescope.

For illustration, the following single results for latitude at a given point, determined during different days, are submitted:

Camp 7, (near Camp Ruby.)

OBSERVER, LIEUTENANT WHEELER.

Date.	Latitude N.	Method employed.
	° ′ ″	
July 9–10, 1869	40 03 55.60	Polaris.
July 11, 1869	46.42	Polaris.
July 11, 1869	45.99	Circum-meridian altitudes.
July 12, 1869	42.27	Circum-meridian altitudes.
July 12, 1869	47.01	Polaris.

Mean latitude, 40° 03′ 47″.46 ± 1″.45.

INDIANS.

All the Indians through Southern Nevada may be termed "Mountain Indians," in contradistinction to those that inhabit the valleys or plains, or live along the ocean-shore. The habits, dispositions, and mental characteristics of all the Indians that I have encountered on the Pacific Slope seem to be governed largely by the topography of the country and the principal articles used as food, the latter undoubtedly having the greater effect.

The mountain Indians are more hardy, intelligent, shrewd, and cunning, generally going into the valleys to plant and harvest, returning to their mountain-retreats after gathering their slender crops. They make up the deficit in food from nuts and acorns, rarely eating roots. The well-known Digger Indians of the California valleys formerly subsisted in the main upon roots and plants, and to them pine-nuts and acorns were a great luxury. They were and are a filthy, sluggish-minded, disgusting race. Certain other shore Indians, closely allied in general worthlessness of character to the Diggers, subsist upon fish and any refuse or offal found along the shore, together with sea-weed and various sea-roots and plants. They inhabit the northern coasts of California and Oregon.

The mountain Indians of Nevada and Idaho, as a general rule, have been endowed by nature with more of the civilized instincts than those found below the Colorado River; and, in fact, it is not unlikely that a provisional latitudinal distinction, modified by the form and extent of the drainage basins, may be made general in its application to all tribes west of the Rocky Mountains.

With the development and population of countries like Arizona, the Indian will become impressed with the fact that warlike aggression or resistance will be futile; and the submissive Apache of a few years hence will be found to differ but little from the tame Ute and Pah-Ute of to-day.

Our guide and interpreter, Henry Butterfield, a thorough master of the Shoshone and Gosiute tongues, succeeded in gaining a pretty accurate census of the "wickeups" at which the Indians were found at home. His estimate of those enumerated was very nearly two thousand five hundred; and it is not unsafe to suppose that at least this number are permanent inhabitants of the area surveyed.

THE SHOSHONES.

This tribe has ranged along the Humboldt for years, branching out here and there to the south and east, and at other points to the north and west, but looking to the valley of the Humboldt as their base. They are quite numerous, and consist of as many as 5,000, all told. Their headquarters is near Winnemucca, named after their old chief, still living. But few of these fellows were seen. Their habits and appearance are well known, as they can be noticed at any station along the railroad, from Humboldt Wells to Wadsworth. They extend as far to the south as Tim-pah-ute Mountain, and to the east as Ruby Valley. A party of some two hundred Indians, under the leadership of a chief named Blackhawk, were tilling the land in Snake Valley, and professed to be Snakes or Shoshones; wished to be peaceable, and to receive agricultural implements. The chief, thinking he might effect something of this sort, returned with our party to the camp in Cave Valley, and then went into Hamilton to see the superintendent of Indian affairs.

GOSIUTES.

This is not a numerous tribe, consisting of not more than 400, with headquarters at Deep Creek. They range no farther to the south than 38° latitude, nor to the east than Sevier Lake Desert, confining themselves mainly to the mountains bordering on Spring, Steptoe, Sierra, and Gosiute Valleys. They differ in no material way from the Shoshones, the language being similar, and habits and dispositions the same, always having lived at peace with each other.

Our first guide, Pogo, was a young buck taken from this tribe, who accompanied us as far as Patterson District. He was lazy and good-natured, possessed of more than ordinary Indian intelligence, and perfectly happy while with us, since he was all the time well supplied with provisions.

The Indian names of the different peaks, ranges, and natural objects have been changed when possible to their English signification, since few of the former possess a claim even to euphony.

Big Horse is the name of the chief of the Gosiutes, and he, with quite a band, was at Deep Creek, to the north of the Snake range, and above our line of travel. Freshly deserted Indian camps showed that they had fled at our approach, and we were told by white settlers that they held the soldiers in the greatest awe and reverence.

THE PAHVANTS

are quite a numerous tribe, living entirely in Utah, and to the south and east of the Sevier Lake Desert. Cutting across the Mormon settlements, in a northeasterly direction, we did not come immediately in contact with any of their wick-e-ups, but our guide, Adabe, who went with us from Cave Valley to Preuss Valley and return, sighted the smoke of some of their camps, and paid them a visit on our behalf. They did not seem desirous of a close acquaintance with the soldiers. Their chief, Blackhawk, is a shrewd and warlike old fellow, and when the Mormons will not give him and his band all the meat that they wish, he immediately retires to the hills, declares war, and levies contributions. I am told that in physical structure they are superior to most of the Indians of the great interior basin, approaching the athletic qualities of the Mojaves. It is likely that this statement should be taken with some caution.

Their language is not understood by either the Snakes, Shoshones, or Gosiutes, the latter supposed to be branches of the great Snake tribe.

UTES OR PIEDES.

The Utes, Utahs, or Piedes, as they have sometimes been called, are a roving, treacherous Indian. They are found from Pahranagat Valley to the mouth of the Virgin River as the most westerly line of their country, extending to the north and east along the different lines of Mormon settlements as high up as 38° north latitude, thence stretching out to the eastward as far as the Grand River, and bounded on the south and east by the Colorado proper.

Their number, all told, is variously estimated from three to five thousand; some six or seven hundred were found along our route.

An old fellow by the name of Toshob was chief of these bands on the Muddy; a wily, treacherous, cold-blooded old scamp, who was well known to have been the leader of the Indians that were engaged in the "Mountain Meadow massacre," that horrible murder of helpless emigrants, both male and female, old and young. The details of this dreadful occurrence were gleaned here and there, and, when fully known, for all coming history will stand out as one of the most disgusting pictures of human baseness.

The Utes or Piedes cultivate the soil, are at war with no particular tribe, and, excepting the fact that they are great thieves, and treacherous to a heightened degree, even for an Indian, do not differ greatly from others of these mountain tribes. They have no hesitation to rob, plunder, and murder, provided they are not found out, while their sagacity teaches them the advantages to be gained from the reputation of "good Indians." They have a most wonderful antipathy against Germans, whom they can tell at a glance, and no one of this nationality can get past their habitations without a good chance of losing everything he has in the way of personal effects. I know of no manner in which to explain the above except that this tribe has been for long years at enmity with the Navajoes, who have been in the habit of crossing the Colorado and making inroads upon the Utes and Piedes, taking their stock, squaws, or anything else, and then beating a hasty retreat. It is a legend among these Indians that the Navajoes at one time captured a large German emigrant train, killing all the men and taking the women to their villages, and thereby created a changed race of bad blood, they say; and possibly in their own minds they think that all their troubles with the Navajoes have arisen in consequence. These Utes or Piedes had killed two men in a cañon leading into one that we traversed from Meadow Valley to the Muddy settlements. These were travelers with good horses. The Indians who were supposed to have been concerned had left their wick-e-ups and fled.

PAH-UTES.

The Pah-Utes, or Water-Utes, are a tribe not differing in any marked way from the Utes, and, like them, of strong physical build, a lively, bright, black eye, rather thin front face and more aquiline contour, bespeaking acuter mental characteristics than most of the Indians of the great mountain basin. Their eastern limit is the western one of the Utes or Piedes; the Colorado bounds them on the south, and to the north and west, the Great Death Valley of Southwestern Nevada, that almost extends to and joins Death Valley proper in California. We found their wick-e-up at Las Vegas Ranch, at various points on the Spring Mountain range, and some few at Eldorado Cañon and below, in and about Cottonwood Island. There cannot be more than two thousand in all, the principal chief of whom is Tercherum, an honest, well dispositioned, chunky little man, who seemed to have but little authority outside of his own small number of wick-e-ups.

For the most part they are a wicked, saucy, and independent set. They have seen and mixed with many whites, principally on the old emigrant road; know well the value of money, and have a great desire for clothes and blankets. They make frequent pilgrimages, and always return well laden with spoils, both in wardrobe and funds. They plant but little, living for the greater part on pine-nuts, which are very plentiful, and by hunting, which around these mountains is better than at any point along the route. By a little good management they could be collected together and made a self-supporting people. No presents, so far as I could learn, have been made to any of these Indians to the south of 38° latitude, or Quinn's Cañon, to which point it is understood that the treaty made by Governor, now Senator, Nye, in 1863, extended.

It is hoped that the information at present gained, and which may be acquired by careful attention on the part of the superintendent of Indian affairs for Nevada, will soon give to these Indians the same annuities that others receive throughout the State; and it will have a great effect in quieting not only them, but the apprehension felt by settlers who occupy, in small parties, here and there, ranches, upon which the Indians at any time are apt to levy contributions.

CLIMATE.

The climate of the area in question, embracing such a large stretch in latitude, is necessarily varied. There may be two natural limits assumed, as that between which snow does and does not

appear along the low foot-hills. The dividing line should be taken on a parallel with the head of Pahranagat Valley, although now and then a thin coating of snow has been known around Hyko.

The northern section shows more variation of temperature; the division into the wet and dry seasons is not so marked, and the intense cold noticed at high altitudes is in great contrast to the heat of the summer's day in the valleys. The biennial rains occur, however, and snow frequently appears instead of rain in the winter season.

At altitudes not exceeding 7,000 feet, and there are but few points liable to be inhabited at a much greater elevation, the maximum of temperature in summer will not exceed 100° Fahrenheit, while in winter the mercury rarely falls more than 15° below the zero-point.

Below the line of demarkation mentioned the biennial rains are strongly marked, occurring principally in the months of July and January. After leaving our camp in Cave Valley, September 1, until reaching Indian Spring, October 25, there was not a single day of rain; at this point there were a few showers, followed by clear sky, until White Pine was again reached.

The thermometer in the heat of summer often reaches from 118° to 120° in the shade at midday upon the Colorado. The clear, pure atmosphere, so extremely dry, renders this excess of temperature more endurable than an atmosphere in the Eastern States not exceeding 95° Fahrenheit. The glare of the sun, however, as reflected from the sandy washes and bare rocks, is very trying to the eyesight. Ice at times formed at points as far south as Las Vegas Springs, but only in thin films. It seems unfortunate that up to this time there should have been so few facilities for studying the climatology of the great interior basins of the American Continent, which, of course, can only be done after extensive series of atmospheric observations have been taken over long intervals. It would seem not ill-advised that a system should be adopted by the Government in selecting marked stations at which to commence and continue these series, though it be at considerable cost.

The following-named mining-districts in Nevada were visited. The results of the examinations will be published in Volume I, of the series of Reports, which volume will also contain all the mining information gathered up to the close of the field-season of 1873.

Name.	No. of Atlas-sheet.	By whom examined.	Remarks.
Cave District	49	Lieut. G. M. Wheeler.	
White Pine	49	do	
Robinson	49	do	
Shoshone	58	do	
Snake	49–58	do	
Sacramento	49	do	Also in 1872.
Patterson	58	do	
Ely	58	do	Also in 1871–'72.
Colorado	66	do	
Tim-pah-ute	58	do	Also in 1871.
Yellow Pine	66	do	do
Timber Mountain	66	do	
Hercules	49	do	
Pahranagat Lake	58	do	Also in 1871.
Reveille	58	do	
Hot Creek	58	do	Also in 1871.
Morey	58	do	do
Grant	58	do	

HEIGHT OF MOUNTAIN-RANGES.

*This description must be limited to the most prominent of the ranges which have been examined.

HUMBOLDT RANGE.

Beginning on the north, we find it to be the most remarkable and well-defined range that belongs to this latitude, between the Sierras and the Wahsatch range. It has its northern limit at the Central Pacific Railroad, near Humboldt Wells, and passing nearly due south, breaks away a little below Hastings Pass, where it is traversed by the old overland road, into a succession of low, broken hills and ridges, pretty well covered with cedar and nut-pine, fit for fuel. The highest peaks

attain an elevation of about 12,500 feet, and on their northern slopes snow remains during the entire year. Little lakes, fed by snow-water, are found at great elevations in the natural basins near the summits of the highest peaks, and present a very picturesque appearance. The western slope of these mountains, unlike many farther to the southward, is well furnished with living streams of pure water abounding with mountain-trout. Here and there the cañons have a showing of pine timber of considerable size, while the foot-hills at a variety of places are densely packed with wood for fuel purposes.

EGAN AND SCHELL CREEK RANGES.

These are well defined in height and direction, extending for long distances, passing either side of Steptoe Valley on the north, then Cave Valley, below which the names change; but a succession of ranges, nearly parallel to the route projected for a railroad to the mouth of the Virgin River, may be said to be a continuation of these ranges. The elevation at any of the points measured exceeds in no instance more than 11,200 feet, while 8,000 feet is the average height. Timber is found at several points, while at many others wood for fuel abounds.

SUPERIOR LIMIT IN ALTITUDE OF VEGETATION.

By measurements taken along the flanks of Jeff. Davis (now Wheeler's) Peak, the height given for this limit was 11,500 feet above sea-level. The latitude is 38° 58′, or in round numbers, 39° north latitude.

Some few specimens of the species *Mimulus*, *Moschatos*, were found at a greater elevation clinging to damp places in the rocks, where evidently nothing of the shrub variety could exist.

Observations taken on the top of Hamel's Peak, on the Egan range, show this to have been a little more than 11,200 feet. The top is here quite bare, and the latitude is but little farther north. Unquestionably, had the height been greater, the vegetation would have crept as high as in the former instance, and it is safe to assume that the practical limit of vegetation among the mountains of Nevada for parallel 39° is not far from 11,500 feet above sea-level.

AGRICULTURAL LANDS.

Of the twenty-six valleys visited during the season, ranging in elevation from 2,000 to 7,000 feet, but a few of the number possess much agricultural area now tilled. The entire area covered by the reconnaissance was nearly a blank upon the map at the time of starting for our season's work; was but little known even to the energetic prospector who had penetrated into the interior of the State of Nevada, and agricultural industry itself was but slowly coming into form in any part of that State, principally mineral in its productions. A few hardy pioneers in stock-raising had brought their herds over from Texas, via California, and others dissatisfied, or lacking room in that State, had sought their way into the high mountain valleys, as it had but lately been found that they would sustain stock during the winter period, which results largely from the fact that the tops of the white sage, made nutritive and palatable by frost, emerge above the snow that falls during the winter season, and is usually available in large quantities.

In Ruby Valley many settlers had pre-empted and acquired title to lands proving to be among the most productive of any in the State. Indeed, this valley probably possesses a greater number of arable acres than any other in the State of Nevada. All lands noted require irrigation, except those in the lower part of Pahranagat Valley, an exceptional spot, where a thorough degree of saturation is obtained because of the large flow of water from the thermal springs that break out in different parts of the same. Along the lines of greatest depression in most of the valleys visited, alluvial beds of greater or less extent occur, and the limit to their cultivation, except where alkaline matters are in excess, is only governed by the amount of water-supply for irrigation that may be made available naturally, since ranching has been taken up in a very desultory manner, with few points for a market, and with little enterprise. Usually a ranchero, turning miner upon the first excitement, and only returning to his ranch when all else fails, but few of the elements that nature presents have been taken advantage of, and irrigation, when applied, has been only of the

rudest kind, not following any definite plan. The cereals, corn, potatoes, and many vegetables grow with certainty and yield largely, notably in Ruby, Pahranagat, Spring, Snake, Duck Lake, Cedar, Rose, Eagle, and Meadow Valleys. In Pahranagat Valley the production of potatoes and other vegetables, in size and amount, is prodigous, equaling the richest parts of California. At the time of our reaching White Pine, many ranches had been established in the little valleys of erosion within a radius of twenty-five and thirty miles, and their productions found a ready market in the little mining towns around that camp. Later, most of these ranches were used for stock purposes only, as the little market of White Pine commenced in the latter part of the season of 1869 to grow less and less, until from seven thousand souls in the district in 1869, it was reduced to less than one thousand in 1872, all told.

The mountain grama-grasses, so common in the plateau and other portions of Arizona, were not noted anywhere this year. The mountain bunch-grass that extends from Montana to the Mexican boundary on the south, varying as to altitude in its different geographical distribution, was noted on every mountain side, without exception, throughout the entire season. Usually it was scant between the lower foot-hills of the valleys and along routes much traveled this season, but thousands, and indeed millions, of acres of this lay along our routes, but little of which was available, however, at this time for grazing because of the want of water; for cattle alone, in many cases this can be remedied. This is especially true of Spring, Duck Lake, and Snake Valleys, in which, with success, in my opinion, at many points along the profile of greatest depression, artesian wells could be sunk, bringing sufficient water to the surface for grazing and mining purposes, if not sufficient for irrigation on a small scale. In many of the valleys, as will be noted where they are described, the excess of alkaline materials prevents any cultivation whatever; especially has this been the fact in the valley of the Muddy, where two or three crops have been necessary in order to eliminate from the soil alkaline and saline constituents found in excess, by volatilization and absorption. When this has been done the soils prove to be of the richest. The richness in growth of the artemisia, or ordinary sage, is a sure indication of the value of the soil which sustains it.

In the slight mesas after reaching no more than 25 or 30 feet above the valleys of the little streams covered with a light growth of sage, usually possessing soil partially limestone, with other parts made up from the lava-rocks, are among those soils most certain to be useful for cultivation when water can be applied. It is to be noted that in the entire area surveyed the amount of valley to mountain area bears but a small ratio. This is extremely unfortunate, since but a small fraction of any of the mountain areas, either from want of arability or on account of altitude, will ever be susceptible of cultivation. A hinderance arises from the fact that the larger portion of the detrital valleys are underlaid with a series of permeable beds usually consisting of washed gravels, to which is due the fact that most of the streams, when emerging from the mountains through their cañon beds disappear, principally by percolation. Therefore, should it be possible to raise to the surface underground beds of water that certainly must exist in places, an attempt to distribute them would, in most cases, be futile from this cause. Hence, when irrigation comes, as come it will, the utmost care must be exercised; first, as to profile, at which a point for boring will be selected; second, the proximity of this point to beds likely to be underlaid by impermeable strata. The latter point is not difficult of detection by a study of the formation of surrounding rock-beds, cross-sections of which can usually be obtained.

Our time and means were both too limited to attempt the measuring of profiles bearing upon the subject of water-supply, and no general survey can in fact take cognizance of a matter of this kind unless directed to special parts of valley-areas where earlier examinations have indicated the possibility of obtaining a water-supply from beneath the surface. The land-surveys had penetrated but little into any of the valleys traversed this year, with the exception of Ruby and Pahranagat Valleys. The map delineates new and unknown sections both to the emigrant, settler, and miner, and to the land department, affording them preliminary knowledge most necessary in pushing forward their surveys, which are necessarily done across broken sections full of almost impassable obstacles, to the newer and more unsettled parts of the State or Territory in which they are operating. The stock raised in this section of Nevada is principally confined to cattle and sheep, with a few horses and mules. The former thrive exceedingly well, and since the completion of the railroad find a ready market. It is believed by those having experience, that the quality of beef in the cattle

driven from Texas to this section of the country is improved after a few years, on account of the superior quality of the natural grass. This seems likely to be true of all the immense grazing-fields of Nevada, and other portions of the great western interior, and that their value is slowly becoming known can only be looked to with satisfaction, since numerous herds are now grazing in the valley of the Mississippi and on the plains of Texas, on lands gradually becoming so valuable that they will be required for agricultural purposes. We must soon look to the high mountain-areas for their sustenance and propagation. If these grasses will submit to an increase of large herds, or to cultivation, and retain their perennial power, the question of meat-supply for the millions in the United States for years to come is solved.

PROFILE OF ROADS.

The profiles have been preserved upon manuscript maps.

MURRAY'S CREEK TO MOUTH OF RIO VIRGEN.

This is designated as Profile No. 1, and gives that portion of the railroad-route projected, actually traversed by the survey-parties. The distance is about two hundred and sixty-eight miles, the actual fall in altitude being 5,200 feet; that is, from 6,400 at Camp 15 to 1,200 at Camp 52, being 19 feet to the mile. The divides that are the most marked exist between Cave and Sierra and Coal and Pahranagat Valleys. They are of such a nature as to offer no hinderance to ordinary railroad-grades, while it will be seen that the decrease in elevation is interrupted by no sudden breaks.

The highest point will be 6,700 feet, about 700 feet greater than the altitude of Toano, on Central Pacific Railroad, which is given on their map 5,961 feet above sea-level.

ELKO TO EL DORADO CAÑON.

This is denominated Profile No. 2, and the distances are also given in Table No. 2 of the report.

The divides between the valleys along this route are more noticeable, and in two or three instances present barriers almost impassable, and hence would necessitate an extraordinary expenditure for the construction of a railroad. These are at Quinn's Cañon, where a crossing of the continuation of the White Pine range is effected, between Mud and Quartz Springs, and at the head of El Dorado Cañon.

It is not certain that a road could not be run to the westward of Quinn Cañon, and to the last two points mentioned. In this event, however, it must continue always to the westward of the Colorado, and remain all the time in a very desert section, which cannot of itself afford the materials necessary for stocking and keeping in supply the construction-parties. The distance from Monte Christo to near the divide of the water-shed between the Humboldt and Colorado Basins to El Dorado Cañon is three hundred and four miles, while the difference in altitude is 6,672 feet, showing a fall of 22 feet per mile, which is not only greater than that of the route first mentioned, but, taken in connection with the sterility of the country and the necessity of heavy grades, condemns the project of a railroad near this meridian.

It seems not unlikely, looking well into the future, that the Colorado River, at some point between Camp Mojave and the foot of the Grand Cañon, will be approached by at least two lines of railroad that, leaving the Central Pacific, follow generally north and south lines. The first will doubtless be not far removed from the one projected on Map No. 1, while the second, connecting with the Utah Central at Salt Lake City, following to the south and west through the chain of Mormon settlements, will meet the river near the foot of the Grand Wash. Still another line of road, passing to the eastward of the Sierras through Owen's River Valley, joining the present railroad from Virginia City to Carson, may be broken to the east to the Colorado, or, bearing slightly to the westward, continue on to San Diego. I believe it to be not an over-sanguine idea that all of this will happen; the exact date of completion of each or any of these public improvements being yet indeterminate.

OVERLAND STATION TO CAMP 15, MURRAY CREEK.

This is shown as Profile No. 1 on the second map, and passes via Long Valley, White Pine, and Robinson District.

The distance is approximately one hundred and twenty-two miles. The divides are four in number, viz, Hastings Pass, leading into Ruby Valley, the summit between Ruby and Long Valleys, in and around Hamilton, and at Summit Springs to the west, and among the foot-hills of the Egan range.

It will be seen that this profile is along a line partly of a northerly and southerly direction, with the remainder running nearly east and west, and is distinctive in its nature from most of the main side-lines, which generally have east and west directions.

CAMP RUBY TO CAMP HALLECK.

This constitutes Profile No. 2, and proceeds along Ruby Valley and through Secret Valley Pass, which is a very difficult one, especially in the winter months; however, the railroad may be reached by passing a gentle summit that brings one into Clover, from Ruby Valley, thence to Humboldt Wells. The distance is seventy-five miles.

CAMP 17, "CAVE VALLEY," TO CAMP 26, "PREUSS LAKE."

This is known as Profile No. 3; the line passing through Sacramento District having been taken; the distance is one hundred and sixty-seven miles, and the divides, some of which are pretty difficult, are at Patterson Pass, near the mines of the Patterson District, from Duck Valley to Spring Valley, a very short divide, but steep on the northern side; Red Cañon Pass, through Snake range, in proximity to Sacramento District; Cañon Pass east of Snake Valley, and Cane Pass, crossing the Hawawah range.

CAMP 28, OR CROSS-ROADS NEAR PATTERSON DISTRICT.

Profile No. 4 gives this line, which crosses only the Fortification range of mountains through Palisade Pass, a tortuous and winding divide. The distance is 37.92 miles, showing no marked features of elevation or depression except along the distance mentioned.

CAVE VALLEY TO WEST POINT.

Profile No. 5 gives this route, which extends from Camp 17, "Cave Valley," to Camp 49, "West Point," via Meadow Valley and Mormon settlements. The number of points at which steep divides are noticed are numerous, and the face of the country over quite a large adjacent area is mountainous, with rough and rocky cañons and passes. The steep divides are at Patterson's Pass, also shown on Profile No. 3; Pioneer Pass, between Cedar and Eagle Valleys, Eagle to Rose Valley, Rose to Meadow, and Meadow to Clover Valley, and Clover Valley to Mormon Cañon; of them the worst are through Pioneer Pass, and from Meadow to Clover Valley. The total distance is 196.69 miles.

As it is natural to suppose, so is it readily seen, there is the greatest difference between the profiles of north and south and east and west lines. A hasty glance at the maps fixes this point upon the attention, and at once develops the idea that nature has determined the directions to be followed for the lines of communication to be made use of by the skilled industry that can alone enter and make use of the vast mineral wealth that lies concealed in these rugged mountain interiors.

Within twenty years we ought to see three if not four grand transcontinental lines of railway across the United States, joining the three principal ports of the Pacific with the eastern coast, cutting the broad valleys of the Mississippi and its tributaries; which along areas to the west of the Rocky Mountains must be joined and crossed in time by a net-work of roads that grow with the growth of interests, usually mineral, that are springing up in the various sections; with the agricul-

tural and various concomitant interests dependent thereon, the importance of which will be acknowledged and felt the more the mass of the people can see legitimate opportunities for labor and investment, which will accrue after wise and judicious legislation, that is sure to come from a more careful study and mature deliberation upon the bearing that mineral productions have upon the national wealth, and especially at a time when the country is burdened with a large national debt.

TOWNS AND SETTLEMENTS.

These are few in number, sparse in population, and mostly uninteresting in appearance.

Away from the railroad, the only settlers, excepting now and then a ranch or station, have come together in the vicinity of mining camps, which, being so uncertain in their nature, call for no great permanence in the architecture of the miner's cabin, the mill, or the store.

HAMILTON,

by far the largest place in size, had something like two or three thousand inhabitants in July, while in November 1,200 would have included them all. This was the principal point for the mines in the White Pine District. Here the greater part of the business was done, and the merchants and traders had collected, while the principal number of the mills at this period were in the vicinity. Of course whisky-mills, with faro-banks adjoining, were plenty, while alternately there appeared either a clothing or a grocery store. Such places become overrun with the surplus population, of a rather questionable grade, of all the worn-out mining camps for a radius of hundreds of miles. This place boasted a passably good stone court-house and a fine stone building in which were the offices of Wells, Fargo & Co., and the Bank of California. One notices no such thing as a church.

TREASURE CITY.

Another settlement near the mines on Treasure Hill, consisting of one street, at an altitude of 9,000 feet, winding along the hills, was filled with miners and offices and residences of owners of mining and mill property. In November, the greater share of the inhabitants had removed to either Hamilton or Shermantown, to save fuel for the winter, so that less than five hundred remained, while in July more than one thousand persons resided in this uninviting locality.

SHERMANTOWN,

the site of several mills engaged in reducing the White Pine ores, was a place of at least one thousand five hundred souls upon our first visit. It is situated in a tortuous ravine, between the White Pine range proper and Treasure Hill, quite secluded from the Pogonips of this section, and near water, a thing not to be found upon Treasure Hill.

These three places, numbering between four and five thousand souls, had all sprung up with the development of the White Pine mines, and upon their future depends also that of the places named, which must build up or become abandoned according as the mines can or cannot support a greater or less number of people.

ELKO,

at present a small station on the Central Pacific Railroad, grew first largely into importance from the fact of its being selected as the point of departure for the White Pine mines late in the fall of 1868.

A thriving place; grew rapidly into existence along the banks of the Humboldt, and in the census of 1870 has been found to number 3,417 inhabitants.

The declining prospects of White Pine in the fall and winter of 1869–'70 soon developed the fact that Elko had exceeded the size necessary for a shipping-point; therefore stagnation of business in all its branches followed, in part alleviated by the discovery of Cope District, to the northward and near the Idaho line, through which the stage-line to Silver City and points in Idaho, which had heretofore left the railroad at Winnemucca, was transferred.

The future of the place seems, now that it has been made a county-town, certain.

TOANO.

This place is at the terminus of one of the sections of the Central Pacific Railroad, and beyond this had no importance up to the spring of 1870, when it was used as the point of departure for heavy freighting in the direction of the Meadow Valley mines. It has been taken as the point of departure for a proposed railroad-route to the Colorado River, on the maps of the reconnaissance, since the divides between the valleys leading to the southward have more gradual slopes than upon any line that can be selected between the 114th and 116th meridian of longitude.

It has been spoken of as a new point from which a stage-line can be started to Idaho and Montana.

RUBY STATION.

For a long time a station on the old overland stage-road; and later, a point from which the telegraph-line starts to White Pine. The whole affair consists of one store, a telegraph-house, and two residences, situated three miles from the military camp, since abandoned, of the same name. The settlers of the valley have received their mail through this point until the railroad was completed, since which time it is believed that the station has been discontinued altogether.

MINERAL CITY.

A small mining camp in the gorge leading through the Egan range, in and around which are found the mines constituting the Robinson District. Its population comprised about fifty souls, with some chance of an increase consequent upon the successful development of the mines. Some ten or twelve buildings had been erected, the greater number being stores, a post-office, and restaurants. The chance for building-sites is quite limited, and in case of large results from these mines the population must crowd out to the east in Steptoe Valley, along Murray's Creek.

MONTEZUMA AND SPRINGVILLE.

Small camps that have sprung up in conjunction with the mines of the Patterson District and on either side of the pass through the Schell Creek range at this place. Several decent wooden buildings have been built from lumber obtained from Benson's Creek, some eight or ten miles to the north, and on the eastern slope of the range. Water is found only on the eastern side, about Springville, and, unfortunately, the principal locations, are on the western slope of the divide.

These mines have been but little worked, as apparently any capitalists who may have made examinations are doubtful as to the chances for large and permanent operations. There is certainly a large surface-showing of ore, and if any of the veins prove at all permanent, there ought to be parties ready to take hold of these mines.

HYKO.

A mining town at the head of Pahranagat Valley, and the county-seat of Lincoln County. Its population varies with the local mining excitements of the country, and according to the amount of developments in operation by the Hyko Silver-Mining Company—in August, 1869, some four or five thousand souls altogether, including the company's employés in the mines in and around Great Quartz Mountain.

There is one of the finest ten-stamp mills that I have seen in the State on the *mesa* edge at the western end of the town, most admirably adapted for the milling of ores, since advantage has been taken of the natural declivity of the site for the transferring always from higher to lower level, in the most convenient manner, during the various milling processes.

Formerly there were quite a number of Mormons at this settlement, many of whom have gone to other sections, leaving but a few of their persuasion. A fine spring, of about 600 inches flow, rises at the northeastern end of the town, and is known as Hyko Spring, furnishing water for town use and milling purposes. There is water enough for any number of mills that may ever be required, and room enough for a city of any magnitude in this vicinity; and, without doubt, the whole of Pahranagat Valley will some day be thickly settled, and that, in connection with continued mining operations of magnitude, will make the necessity for quite a large mountain city.

PIOCHE,

the name of the principal mining town in the Ely District, where are found what are known as the Meadow Valley mines, among which the one called the "Pioche" seems to be the mother vein.

The great richness of this district since the summer of 1869 has caused to grow here a town of considerable size. The mill of the Meadow Valley Company is situate in a little valley to the eastward, called Dry Valley, around which has sprung up a small settlement called Lyonsville, after the present president of the company.

LAS VEGAS RANCH.

This is situated on a little oasis in the desert of Vegas Valley, and consists of about three or four hundred acres of arable land that can be irrigated from the Vegas Springs. An area of a radius of fifty miles, having this point as a center, embraces nothing but desert; consequently, this is a haven for all travelers, north and south, through this section of country. The old emigrant-road to Salt Lake, and the one lately traveled from White Pine to Arizona, here cross each other.

EL DORADO CAÑON.

By this, reference is made to the property of the mining company of this district, who have a ten-stamp mill on the river at the mouth of the cañon, and the necessary dwellings and store-houses for their milling operations. This section is a desert and sterile one. Small patches of bunch-grass are found in the mountains; hay in large quantities has to be obtained at Cottonwood Island, some forty-five miles below, and such barley as cannot be obtained at Vegas ranch must come via the river. Wood in small quantities can be obtained from the drift-wood along the river.

All these difficulties have tended to retard the development of these mines, one of which, the Techatticup, having been opened, proves to be a regular fissure-vein.

CALLVILLE.

This was originally started as a little Mormon landing, from whence stores, coming via the river, were to be shipped in among the settlements of Southern Utah. Quite a large store-house and several shanties that had been erected were all abandoned at the date of our arrival, making the place look, if possible, more desolate than nature had intended.

There can be no possible reason in the future for reviving this place, since it cannot be a point of departure or supply for any back country, neither can a crossing to the southward be made; therefore, whenever a stray traveler, by accident, shall reach these solitudes, his inquiry for inhabitants will be answered by echoes from the deserted store-house and its surrounding shanties.

MORMON SETTLEMENTS.

HOMER.

This is one of the later and more outer settlements, of only about two years' standing, consisting of twenty to twenty-five families, and from one hundred to one hundred and twenty-five persons, all told.

This, being a small settlement, had for its ruler a functionary known as a superintendent, who acts as judge and managing-man. The larger settlements have a bishop, while in addition, at county-seats, are found other bishops, higher in church authority, who are associate elders, and have a voice in the high council at Salt Lake City.

The scheme seems to be to manage the minds of the many by having some one in their midst of sufficient intellect to control, while the others are rude, untaught, with but little prospective hope of improvement. I understand, however, that schools are introduced at the more prominent settlements.

The dwellings at Homer all stand upon one wide street, closed at the ends, making a rectangular-shaped fort, so built for protection against the Indians. The amount of land is parceled out to the families in lots from 7½ to 25 acres, the latter amount being considered quite excessive.

The settlers here, having seen so little of the world, had not become contaminated by the ungovernable thirst to gain money from the Gentiles that is found among the many.

A call was made upon the superintendent, a Mr. Shakespeare, a decent, provincial-looking man, who was not unwilling to give information, but who seemed to have but little to give. They were nearly all alike at this place, having the appearance such as one might expect to meet among some of the lower classes in Holland, Norway, some parts of Germany, and Wales. At the time of our coming all the young men were at muster, which is held twice each year, and every available able-bodied man is obliged to attend. Besides the ordinary militia, there is said to exist a secret compact, known as the "Nauvoo Legion."

EAGLE VALLEY.

This is a beautiful little valley, closely encircled by the mountains, and settled nearly three years since. Here, again, the inhabitants build their rude log houses in "fort" shape.

Our day's march carried us to Rose Valley, some three or four miles beyond, and only a short stay was made. This place, larger in size, attains to the dignity of having a bishop, who has in his trust the forty or fifty families constituting the settlement.

They will number at least two hundred souls, and seem a quiet, inoffensive set, but looking, however, upon the soldiers with a jealous eye, and, with a true Mormon proclivity, where it could be done, taking advantage of the desire for the purchase of delicacies on the march in the way of butter, eggs, and vegetables, charging much more than their value. This custom we found in its most absolute perfection among some of the lower settlements, where Gentiles were more frequently in the habit of passing through.

Doctors and lawyers are unknown in these remote settlements; they themselves speak of this as true for all of them—scarcely anybody sick, but few die, and the laws of the church exist for them as the law of the land.

In Rose and Dry Valleys some very poor, miserable families were found ranching; it was their expectation that their members would be increased from the interior. In the latter place a twenty-stamp mill, the property of the Meadow Valley Mining Company, and known as the Lyons mill, has been erected. Ore from the Pioche mines is being crushed there, with fine results.

PANACCA.

The settlement in Meadow Valley is considerably larger than the others mentioned, and was established in 1864 or 1865. They have laid off the town in streets, and some very fair wooden and adobe houses have been built. Among the best of them is a tithing-house, made for the reception of one-tenth of all that is produced, and given as a tithing unto the Lord.

In these outer places that have been settled for a number of years, many trees have been planted, which here had grown to a respectable size. Water running through the streets in open ditches, irrigates them so that they maintain a luxuriant growth. The water here is of the same nature as that found in Pahranagat Valley, the spring at the head of the town being of about the same size as Crystal Spring, in Pahranagat Valley.

These waters are doubtless from the same source, and all find their way into the Colorado after joining forces along the beds of the Muddy and Virgin Rivers. The town will number about four hundred people, some few of whom are Gentiles.

CLOVER VALLEY

contains some eight or ten families and from fifty to seventy-five people. Its waters flow to the southwest and join Meadow Creek, that, farther on, seeks an underground channel to the Muddy. While following down a cañon leading from this valley and coming in below Meadow Valley Cañon, there was considerable pioneering to do; the animals were getting badly worn out, and the grain was exhausted and grass becoming very scarce. It was therefore necessary to push on ahead seventy-five miles to one of the lower settlements, to purchase grain and have it freighted to the train.

WEST POINT,

one of the settlements on the Upper Muddy, consisting of fifty or sixty families, and from two hundred and fifty to three hundred people. A part of these go north during the summers, which are intensely hot in this section.

At the time of our coming, wheat could be purchased at 5 cents per pound; previous to our departure it was valued at 12½ cents, while all the time the relation between supply and demand was the same.

One man at this place was the happy possessor of five wives, two of them being at a northern settlement, and twenty-two children of various descriptions and sizes; these were all being reared unwashed, unkempt, and untaught.

SAINT JOSEPH,

situated midway between West Point and where the Muddy reaches the Virgin, is a much larger place, and numbers some five hundred or six hundred people, when all are at home from the northern country. This place has a post-office regularly established. A nephew of Brigham Young lives here, vested with some of the superior functions of church office.

SAINT THOMAS,

is situated at the confluence of the Muddy with the Virgin; rather a fine-looking place, well laid out, with shade-trees along the streets. Its inhabitants number as high as three hundred or four hundred altogether, but of the same moving character as the two settlements above named. The bishop at this place, and another person, ex-member of the Arizona legislature, received us with pleasant courtesy. Near this place an Indian chief named Toshob has his wick-e-ups. He is known to have been engaged with some of his Indians in the Mountain Meadow massacre, while the leader of the same was reported to be in a small place called Harmony, some seventy-five miles to the northeast, in a state bordering on insanity from remorse for his actions at that time. No one can judge of the revolting character of that affair who has not been near the ground to learn of the details of the cold-blooded murder of men, women, and children.

Thus it will appear that the late reconnaissance has developed the fact that there are seven Mormon settlements, numbering very nearly two thousand inhabitants, that heretofore have been supposed, certainly or uncertainly, to be in Utah, that lie beyond a doubt within the domain of Nevada. So far they have paid taxes in, and conformed to the laws of, Utah. Some action should now be taken clearly defining their status and place the jurisdiction of both the State and Territory upon proper ground.

That part of Arizona to the north and west of the Colorado River that was ceded by act of Congress of 1866 to Nevada, has never been legally accepted by the State, since their constitution prohibits the accession of territory in this direction, thereby rendering the action of the State officials invalid and liable to be protested in case of attempting to execute their statutes.

The Mormons are prospecting for further lands contiguous to their outer settlements, to be used as asylums for their constantly thickening population, and it is but a short time ago that a call was made for one thousand families to go into Northern Arizona.

ODOMETER MEASUREMENTS.

To show how far these may be depended upon in the field over the variety of roads encountered in a mountain region, several rigid tests were made at a number of points, of which the following is a description. The gait has always been kept at a walk.

ELKO.

1. Wheels *two days* traveled since greased; over one measured mile *on level road*, slightly sandy.

No. 1 odometer on near wheel.

First reading....	3,842
Second reading..	4,242
Difference =	400 = number of revolutions.

NOTE.—The Mormon settlers have been withdrawn from the valley of the Muddy, and the West Point, Saint Joseph, and Saint Thomas settlements abandoned. An Indian reservation including all of these localities has since been set aside by the Government.

2. Over one-half measured mile, on *rolling* ground, good road.

No. 1 odometer on near wheel.
First reading.... 4,976
Second reading.. 5,177

Difference = 201 = number of revolutions.
Average, 401 revolutions.

Near wheel, 13′ 2″.208 in circumference; 400.48 revolutions per mile.
Off wheel, 13′ 2″.063 in circumference; 400.85 revolutions per mile.

CAMP RUBY.

Wheels one day's travel since greased, over one measured mile, on good, hard, level road.

No. 1 odometer on near wheel.	No. 2 odometer on off wheel.
First reading.... 6,392	First reading... 7,133
Second reading.. 6,791	Second reading. 7,533
Difference = 399 = number of revolutions.	Difference = 400 = number of revolutions.
No. 2 odometer on near wheel.	No. 1 odometer on off wheel.
First reading.... 6,536	First reading... 6,793
Second reading.. 7,931	Second reading. 7,192
Difference=395 = number of revolutions.	Difference = 399 = number of revolutions.

Average, 398.25.

Wheels eased of friction from wooden axle; freshly greased.

1. One measured mile through sage-brush.

No. 2 odometer on near wheel.	No. 1 odometer on off wheel.
First reading.... 8,140	First reading... 7,362
Second reading.. 8,542	Second reading. 7,763
Difference = 402=number of revolutions.	Difference = 401 = number of revolutions.

Average, 401.5 revolutions.

2. One measured mile, good, hard, level road.

No. 2 odometer on near wheel.	No. 1 odometer on off wheel.
First reading.... 7,766	First reading... 8,546
Second reading.. 8,166	Second reading. 8,947
Difference = 400=number of revolutions.	Difference= 401= number of revolutions.

Average, 400.5 revolutions.

CAMP TWELVE, NEAR HAMILTON.

From Camp Twelve to stake on hill above Hamilton City. Measured distance, 199.87 chains. Wheels not greased for three days.

Road rough, uneven, some parts stony, others sandy; steep grades.

1st. On up-hill grade:

No. 1 odometer: Number of revolutions = 994 = 398.32 revolutions per mile.

No. 2 odometer: Number of revolutions = 996 = 399.12 revolutions per mile.

2d. From stake on hill down to camp:

No. 1 odometer: Number of revolutions = 998 = 399.92 revolutions per mile.

No. 2 odometer: Number of revolutions = 996 = 399.12 revolutions per mile.

The same as above, with freshly-greased wheels.

1st. On up-hill grade:

No. 1 odometer: Number of revolutions = 997 = 399.52 revolutions per mile.

No. 2 odometer: Number of revolutions = 996 = 399.12 revolutions per mile.

2d. On down-hill grade:

No. 1 odometer: Number of revolutions = 995 = 398.72 revolutions per mile.

No. 2 odometer: Number of revolutions = 1,000 = 400.32 revolutions per mile.

Average, 399.27 revolutions per mile.

BETWEEN CAMPS FOURTEEN AND FIFTEEN.

Between mile-posts, measured by chain, on a hard, somewhat rolling and slightly sandy road, principally down grade.

	Revolutions.		Revolutions.
No. 1 to No. 2	402	No. 4 to No. 5	403
No. 2 to No. 3	402	No. 5 to No. 6	401
No. 3 to No. 4	402	No. 6 to No. 7	402

Average, 402 revolutions.

In remarking upon the results from odometer measurements, two distinct statements must be made, 1st, that the vehicle should go always at a walk, since, by increasing the gait, certain irregularities of revolution must necessarily occur that will vitiate the measurement; 2d, that the friction on the axle must be thrown out as being an element not easy to determine, and one not influencing the result in any appreciable degree so long as the axles are kept in anything like decent order. The experiments made near Hamilton show that the results are equable, both in the case of using the axles after a three days' march, or a little more than sixty miles, and when freshly greased, going to show that at least it has not been necessary to take into account the idea of fresh or newly greased wheels.

It will be seen that in the revolution of a wheel by a horizontal pull that the length passed over will exceed the circumference of the wheel on account of the slipping or sliding motion. It can well be understood that this slipping will be greater in case of rapid revolutions: another reason that these measurements should be made at a walk. The allowance to be made for a slip, determined by experiments made on an Arizona trip in 1868, varied from 1.2 to 2.1 per cent., while the rigid tests of this year decrease this even to the making the mean allowance nearly 0 per cent. I refer this to the fact that in the first instance the animals were driven at a trot. Hence the actual number of revolutions to the mile should be less than the number obtained by using the perimeter as the basis; this is found in practice to be the case, and obtains in all our tests except one at both Elko and Ruby, and those between camps 14 and 15. The former were undoubtedly the result of errors of observation; the later arises from the fact that the tire having become worn, the perimeter was shortened. Omitting, then, these three cases, we have the percentage to be allowed for the slip as follows, viz:

Experiments in Ruby Valley on hard rolling road	0.6 per cent.
Experiments in Ruby Valley on level rolling road	0.1 per cent.
Experiments near Hamilton on steep-grade road	0.31
	3)0.98
Average	0.33 per cent.

All other things being equal, the slip of the wheel will vary according to the nature of the road, increasing as the road bed becomes more heavy, and in very heavy sand special allowance has to be made.

The slip of the wheel for up-grade is found to be greater than for down-grade.

For the first part of the season 401 was the number of revolutions used per mile; later it was found that 400 was a preferable number.

So great was the accuracy of these measurements that, taken in connection with the fact that a Casella reconnaissance theodolite was used for the meander of the road traversed, it was unneces-

sary to reduce meander-lines by the ordinary process of dead-reckoning, individual judgment for the percentage to be allowed being sufficient to reduce to the points astronomically determined.

The odometers were attached to a little two-wheeled vehicle constructed for the purpose, which was taken charge of by a soldier whose sole duty was to keep account of the distances measured. There are difficulties connected with the mechanical contrivances of the odometer. 1st. The leather covering, however carefully made, will not keep the dust from working into the interior of the instrument on account of the manner in which the frame holding the circles is introduced. 2d. The circles themselves work loose from each other for the want of two nuts, one with a right-handed screwand the other with a left-handed one, at the back of these plates, for fastening them together.

METEOROLOGICAL OBSERVATIONS.

INSTRUMENTS USED.

During the field-season cistern barometers, Nos. 1378, 1555, and 1566, made by James Green, New York; aneroids, Nos. 22 and 37, furnished by Charles G. Ewing, optician, San Francisco; and hygrometers, Nos. 1631 and 2348, by Green, were used. Thermo-barometers, Nos. 1 and 2, by Green, were carried to the field, but beyond comparing their indications with those of the cisterns at Elko, Camp Ruby, Hamilton, Ice Creek, and Cave Valley, no use was made of them for hypsometrical purposes.

OBSERVATIONS IN THE FIELD.

Hourly observations were taken at Camp Halleck from June 16 to June 29, inclusive, and at Camp Ruby, Hamilton, and West Point, over intervals of from five to eight days, for the purpose of securing tables of horary corrections to be applied to observations for hypsometrical purposes. On the march tri-daily observations were made at all camps of a day or more, and, at camps for one night only, at 7 a. m. and 9 p. m.

The aneroids were used only in connection with the odometer for securing an approximate profile of the route between camps, the altitudes of which latter were deduced from cistern-barometer observations.

These observations have all been reduced and computed, and the results appear on the map of the reconnaissance.

COMPARISONS OF BAROMETERS, ETC.

Before taking the field, the barometers and attached thermometers were carefully compared with Green's standard cistern-barometer, No. 1571, in Colonel Williamson's office in San Francisco, and their relative and absolute errors deduced. These comparisons extended over an interval of nine days from June 2 to June 11, 1869, and included cistern-barometers Nos. 1566, 1378, 1555, and 1282, and aneroids 22 and 37.

At intervals during the season frequent comparisons were made to check changes in the zero of the scales of the various instruments; at Elko, Nev., from June 29 to July 3, fifteen comparisons; at Camp Ruby, from July 9 to July 12, twelve comparisons; at Hamilton, from July 16 to July 21, seventeen comparisons; at Cave Valley, from August 9 to August 12, nine comparisons; at West Point, from September 23 to September 27, fourteen comparisons; at Las Vegas, from October 1 to October 12, sixteen comparisons; at Indian Springs, from October 26 to October 30, thirteen comparisons; and at the close of the field-season the instruments were again compared with standard 1571 at San Francisco. These comparisons in the case of cistern-barometers gave very favorable results, showing but very slight changes in their relative errors from transportation, but the aneroids, being mechanical devices, suffered considerable shiftings of parts and consequent changes in their index errors, other than those due to temperature or from want of compensation. The extreme variation in errors throughout the season being from $+''.010$ to $''.774$ for aneroid 22, and from $-0''.034$ to $-0''.186$ for aneroid 37, but since these changes appear from the comparisons to have been gradual, very good results were derived from the aneroid work.

Comparisons of mercurial cistern-barometer with standard No. 1571, at San Francisco.

Date.	Hour.	BAROMETER UNCORRECTED.					BAROMETER CORRECTED.					ATTACHED THERMOMETER.				
		Standard.	1566.	1378.	1060.	1282.	Standard	1566.	1378.	1060.	1282.	Standard.	1566.	1378.	1060.	1282.
June 2	2 p. m.	30.042	30.036	30.046	30.052	30.041	29.925	29.919	29.918	29.953	29.925	72	71.9	72.5	73	72
June 3	9 a. m.	30.01	30.046	30.052	30.056	30.050	29.942	29.947	29.951	29.954	29.951	65	65.25	66	66.3	65.4
	2 p. m.	30.084	30.090	30.084	30.044	30.084	29.986	29.992	29.984	30.015	29.987	65	64.9	65.4	65.5	64.8
June 4	9 a. m.	30.082	30.08	30.084	30.112	30.079	29.987	29.984	29.987	30.014	29.984	64	64.2	64.5	64.8	64
	2 p. m.	30.064	30.058	30.058	30.084	30.06	29.945	29.941	29.939	29.964	29.938	72.2	72.1	72.8	73.2	72.1
June 5	9 a. m.	30.088	30.082	30.086	30.111	30.090	29.986	29.980	29.983	30.011	29.989	66.6	66.5	66.9	67	66.4
June 7	9 a. m.	30.022	30.024	30.022	30.048	30.019	29.924	29.927	29.924	29.948	29.921	64.9	64.75	65.5	65.6	64.9
	2 p. m.	30.002	29.994	29.998	30.021	29.992	29.895	29.977	29.979	29.994	29.971	72.1	72.25	73.1	73.3	72.2
June 8	9 a. m.	30.025	30.023	30.024	30.058	30.023	29.919	29.915	29.911	29.948	29.915	68.6	68.5	69.25	69.5	68.6
	2 p. m.	30.029	30.031	30.028	30.063	30.024	29.916	29.918	29.912	29.941	29.910	70.6	70.75	71.6	71.5	70.9
June 9	9 a. m.	30.071	30.073	30.071	30.096	30.065	29.978	29.977	29.974	29.998	29.959	64.1	64.2	64.75	64.9	64.2
	2 p. m.	30.076	30.078	30.069	30.096	30.064	29.961	29.965	29.962	29.987	29.954	71.5	71.4	72.4	72.5	71.4
June 10	9 a. m.	30.084	30.082	30.084	30.111	30.08	29.99	29.988	29.989	30.016	29.986	63.6	63.5	64	63.9	63.5
	2 p. m.	30.082	30.075	30.076	30.1	30.076	29.974	29.967	29.966	29.989	29.968	68.7	68.7	69.5	69.9	68.7
June 11	9 a. m.	30.000	29.992	29.993	30.026	29.995	29.907	29.909	29.893	29.932	29.894	62.9	62.8	63.4	63.5	63

Date.	Hour.	ERROR OF BAROMETER.					ERROR OF THERMOMETER.				
		Standard.	1566.	1378.	1060.	1282.	Standard.	1566.	1378.	1060.	1282.
June 2	2 p. m.	.000	+.006	+.007	−.028	−.002	.000	0.1	−0.5	−1.0	−0.0
June 3	9 a. m.		−.005	−.009	−.032	−.009		+0.25	−1.0	−1.3	−0.1
	2 p. m.		−.006	−.002	−.029	−.001		0.1	−0.1	−0.5	0.2
June 4	9 a. m.		.003	+.000	−.027	+.003		−0.2	−0.5	−0.8	−0.0
	2 p. m.		+.006	.008	−.017	.001		+0.1	0.6	−1.0	−0.1
June 5	9 a. m.		.006	+.003	−.025	−.003		0.1	−0.3	−0.4	−0.5
June 7	9 a. m.		.003	+.001	−.024	+.003		0.15	0.6	−0.7	+0.0
	2 p. m.		+.008	+.006	−.019	+.011		+0.15	1.0	−1.2	−0.4
June 8	9 a. m.		.004	+.0.5	−.029	+.001		−0.1	+0.65	−0.9	−0.0
	2 p. m.		−.002	+.004	−.025	+.006		−0.15	+1.0	−0.9	−0.3
June 9	9 a. m.		.004	+.004	−.020	+.008		+0.2	−0.35	−0.5	+0.2
	2 p. m.		.003	+.009	−.017	+.008		+0.1	−0.6	−1.0	+0.1
June 10	9 a. m.		.002	.001	−.026	.004		0.1	−0.4	−0.3	+0.1
	2 p. m.		+.007	+.008	−.025	+.006		0.0	−0.8	−1.2	+0.0
June 11	9 a. m.		.007	+.008	−.025	+.003		+0.1	−0.5	−0.6	−0.1
Sum			.037	+.057	−.365	+.015		+0.4	−8.9	−12.3	0.0
Mean of 15 observations			.0025	+.004	.0245	+.001		+0.027	−0.59	−0.82	0.0

Comparison of thermo barometers with mercurial-cistern barometer on reconnaissance through Southern Nevada in 1868.

CAMP HALLECK, NEV.

Date.	Hour.	Attached thermometer.	Barometer uncorrected.	Barometer reduced to 32° and to standard.	No. 1 Thermo barometer.	No. 1. Thermo barometer.	No. 2. Thermo barometer.	No. 2 Thermo barometer.	No. 1. Difference between thermo barometer and barometer at 32°.	No. 2 Difference between thermo barometer and barometer at 32°.	Altitude by cistern barometer.*	Altitude by thermo barometer.	Remarks.
1868.						*Inches.*		*Inches.*					
June 16	2 p. m.	70.6	24.276	24.187	202.3	24.593	200.5	23.697	406	−490	.....	.....	No. 1566, the cistern barometer has been reduced not only to 32° but also to No. 1571 in office of Colonel Williamson.
June 17	2 p. m.	68.8	24.209	24.211	202.11	24.649	200.51	23.715	445	−497	.....	.....	
June 18	2 p. m.	63.5	24.389	24.315	202.19	25.547	200.8	23.845	922	−470	.....	.....	
June 19	2 p. m.	65.5	24.525	24.445	202.42	24.654	201.3	24.092	207	−355	.....	.....	
June 20	2 p. m.	68.6	24.341	24.256	202.44	24.661	201.0	23.913	208	−544	.....	.....	
June 21	2 p. m.	74.1	24.500	24.443	202.4	24.641	200.94	23.911	211	−519	.....	.....	
June 22	2 p. m.	73.0	24.500	24.406	202.38	24.631	200.94	23.914	+228	−192	.....	.....	
June 23	2 p. m.	70.4	24.461	24.472	202.3	24.593	200.34	23.911	+221	−457	.....	.....	

* Mean of six months barometric readings gives 5,729 feet

Comparison of aneroids Nos. 22 and 37 with standard mercurial cistern-barometer at office of Bvt. Col. R. S. Williamson, Corps of Engineers, San Francisco, California.

Number.	Date.	Hour.	Attached thermometer.	Standard No. 1551 uncorrected.	Reduced to 32°.	Standard No. 1551 at 32°.	Aneroid readings.		Aneroid differences.	
							No. 22.	No. 37.	No. 22.	No. 37.
	1869.									
1	Dec. 6	2 p. m.	64.4	30.072	.096	29.976	29.219	30.166	+.757	−.190
2	Dec. 7	9 a. m.	57.6	30.071	.078	29.993	29.220	30.189	+.773	−.196
3	Dec. 8	9 a. m.	58.2	30.009	.080	29.929	29.221	30.063	+.708	−.134
4	Dec. 8	2 p. m.	65.1	29.977	.098	29.879	29.221	30.061	+.658	−.192
5	Dec. 9	9 a. m.	56.9	30.271	.076	30.195	29.220	30.379	+.975	−.184
6	Dec. 9	2 p. m.	63.5	30.276	.094	30.182	.....	30.371	.....	−.189
7	Dec. 10	9 a. m.	51.5	30.291	.070	30.221	.....	30.100	.....	−.179
8	Dec. 10	2 p. m.	60.8	30.247	.087	30.160	.....	30.341	.....	−.181
9	Dec. 11	9 a. m.	55.0	30.308	.071	30.237	.....	30.422	.....	−.185
10	Dec. 11	2 p. m.	59.7	30.286	.084	30.202	.....	30.384	.....	−.182
11	Dec. 13	9 a. m.	54.6	30.308	.070	30.238	.....	30.424	.....	−.186
12	Dec. 13	2 p. m.	61.1	30.235	.087	30.148	.....	30.340	.....	−.192
13	Dec. 14	9 a. m.	56.7	30.261	.076	30.185	.....	30.371	.....	−.186
14	Dec. 15	9 a. m.	58.0	30.228	.079	30.149	.....	30.339	.....	−.190
15	Dec. 15	9 a. m.	59.0	30.145	.082	30.063	.....	30.260	.....	−.197
16	Dec. 16	2 p. m.	65.2	30.113	.098	30.015	.....	30.217	.....	−.202
17	Dec. 17	9 a. m.	58.5	30.190	.080	30.110	.....	30.300	.....	−.190
	Sums								+3.871	−3.155
	Means								+.774	−0.1856

MINERALS.

Since the different forms in which the elements of landed surface are aggregated determine whether we shall have a region agricultural, mineral, or arid, as may be expected, the greatest diversity occurs, and experience teaches that agricultural and mineral sections are seldom found in immediate juxtaposition.

Southern Nevada undoubtedly possesses all the rights and privileges of a mineral region, and beyond that, as a place for the aggregation of population, it must always have small weight in comparison to other land-areas of equal size. I do not hesitate to say that the section embraced between the 114th and 116th degrees of longitude, limited latitudinally by 36° 30′ on the south, and 39° 30′ on the north, bids fair to develop and supply more of the precious metals than any similar-sized area covered by our survey.

The minerals found are gold, silver, copper, lead, antimony, iron, salt, gypsum, alum, and cobalt; of them all, silver is the most common, and is the principal of the precious metals in all the different mining camps, while, so far as the knowledge is at my disposal, gold is only noticed at the Sacramento, Egan, and Groom Districts, and, except at Egan, only in small quantities.

Silver-ore appears in all its known forms, the more common being the chloride and sulphide. Sulphide is becoming common and rapidly growing into significance as one of the richer classes of ore, and many a black-looking rock, that would have been thrown away by the early prospector, is now found to assay as high as $3,000 or $4,000 per ton. Copper is found native and in the ore in the Potosi and Clarke Districts, and at various points along and near the Colorado River; lead, as sulphurets, always more or less argentiferous, in some places appears in immense deposits and veins; these can all ultimately be worked, and to a good profit; the base bullion averaging from $35 to $200 per ton.

Antimony occurs also with the galena sometimes to so great an extent as to render the freeing of the silver ore a difficult problem.

Gypsum is found in beds at two places noticed by our parties; one not far from the old emigrant-road, and about midway between Las Vegas ranch and the crossing of the Muddy; and at another along Las Vegas Wash. The quality is apparently inferior.

A wide vein or iron ore was discovered crossing the Colorado in the midst of Virgin or Boulder Cañon.

Small beds of alum occur in some of the side cañons leading down to the Colorado in the vicinity of Virgin Cañon.

Salt occurs in deposits as ore in beds and wells. The most remarkable of the deposits is found along the Virgin, some five or six miles below Saint Thomas, in a very pure form, showing remarkable cubical crystallizations. There are two very extensive deposits near the bed of the Rio Virgen, lying between its mouth and the entrance of the Muddy. Near the former point is a large and deep salt well, having its upper surface at a distance of about 60 feet below the mesa bank. A large bed of salt is found in Railroad Valley; this, however, is quite impure, and only of service in the reduction of ores by the roasting process. Other beds occur to the north and east of the route from Cave Valley to Preuss Lake.

But to the silver that is to come from these rough and rugged hills must we look for the future prosperity of Southern Nevada, and the benefit, both local and national, that is to be derived therefrom.

So long as it is known that there is still hope of finding a fresh silver deposit, so long will eager and industrious men seek for it and dig it out, and it now seems probable that for long years to come the annual silver yield of Nevada will be on the increase.

The most valuable districts in the area above mentioned that have already been discovered are Ely, Morey, Timpahute, and Pahranagat. The first promises the largest results; the second has over six thousand tons of ore in sight, of a very rich quality; the third has been very little developed, but has fine surface indications; the fourth and last has been developed considerably, and shows large veins of low-grade ore.

The prospects of the next four years, if they continue favorable, ought to induce capitalists to build a railroad line through this country, which will have a tendency to open up mines of the low-grade ores, that at the present time cannot be worked profitably.

RIVERS, CREEKS, AND SPRINGS.

Of rivers, within the area embraced, there are but four, viz. Colorado, Humboldt, Virgin, and Muddy. The latter, except in a section bordering upon or in the Great American or some other desert, would never, even in name, approach the dignity of a river, and in the final maps will be changed to "creek."

Of creeks, there is an abundance in some localities, in others a remarkable scarcity; varying greatly in their nature and extent, at some places confined to the mountains, losing themselves before reaching the extremity of the foot-hills; at others stretching farther out only to become entirely absorbed after reaching the dry plains.

It is a noticeable fact that the majority of the mountain-ranges show more creeks on their eastern slopes, a fact easily explained from the more frequent tilting of the strata in that direction, and the consequently greater horizontal extension of the foot-hills.

The Colorado and Rio Virgen, in their turn, will receive a succinct description. The Humboldt, better known, needs none. The Muddy so limited in extent, needs only a few words for its source, volume, and course. The present recognized source occurs in a number of springs of tepid water, near the southern end of the cañon called "Arrow Cañon," leading out from Pahranagat Valley; doubtless these again have their source in Pahranagat Lake, which is fed from the different thermal springs that start in the valley of that name, which in turn may be fed from the drainage of Sierra Valley, gaining their high temperature in subterranean transit.

It is not unlikely that similar sources, flowing through other subterranean channels, feed the springs that act as a source to the Muddy, to those of the springs in Pahranagat Valley, yet one naturally asks for the outlet of Pahranagat Lake, that receives streams amounting in all to 3,000 inches of water.

The temperature of the springs, so far mentioned, varies from about 67° to 94° Fahrenheit, the latter obtaining at "Ash Springs" in Pahranagat Valley.

In the itinerary the fact of the waters rising in Spring or Cedar Valley, above the Mormon set-

tlement of Homer, and, finding their way either on the surface or under ground, to a point some four or five miles below West Point; this, then, may be looked upon as the source of what might be termed the Eastern Branch. The main stream has its confluence with the Rio Virgen about 1¼ miles below Saint Thomas, the greater part of the water having been absorbed in the excessive and careless irrigation of the different settlements.

In the summer season the water remains warm for the whole distance. The rapidity of the current and the looseness of the soil of its banks give rise to the muddy appearance; hence the name.

The volume of the flow taken at a point before any of its waters are used for irrigation, will at least reach 5,000 inches; this amount is carried in a narrow and deep channel, the bed of which has quite a declivity; hence the great strength of the current. The course is about south-southeast, and its length from Muddy Springs is about thirty-two or thirty-three miles, flowing for the most part through a narrow valley, surrounded on either hand by a perfect desert of low sand-hills, broken earth, and stony mesa, in the background of which appear the dark and somber mountains that rule the horizon supreme.

A large number of the creeks are formed from the melting of the snows, which, among the higher ranges, feed a continuous stream for all seasons of the year. Others have their source in mountain springs of pure and limpid water. With hardly any exception the character of the water is very pure, except here and there it is rendered stagnant in pools, or alkaline, on account of infiltration from the banks. It is very rare that one finds fish in any of these mountain-streams. A few small trout were found to the eastward of the Snake range. This does not apply, however, to streams flowing from the Humboldt range, that are numerously stocked with an excellent variety of mountain-trout.

It is believed that the waters of the Muddy contain no fish.

The great variety of springs, as regards their chemical constituents and thermal conditions, is truly surprising, as often in the same valley, within a few miles of each other, will be found those of the purest and clearest water, and others having various mineral indications affected by a high temperature. This was noticed especially in Steptoe Valley. The most remarkable of the thermal springs noted is the one at Elko, which, near the summit of a slight sand mesa, comes boiling out of the earth and flows into a reservoir apparently eroded for its reception. The water shows indications of sulphur quite largely, and doubtless comes from a great depth.

From springs of this class to those showing themselves in Pahranagat and Meadow Valleys, there are found all varieties, some having quite high temperature and no mineral, and others impregnated with minerals and but slightly above the ordinary temperature.

The warm spring near the stage-road, and about midway between Elko and Hamilton, is a characteristic specimen of the former sort. A continual mist rises from the surface, even in the heat of the day, and the intermittent thermal action of the waters can be seen at various points of the bottom, the water being very clear. Strange enough, there were large numbers of small-sized fish playing about in these waters, similar in character to the ordinary chub-sucker, but smaller in size. The few hours permitted for our stay at the place did not allow of getting specimens.

The celebrated Vegas Springs are of pure, clear water, very slightly above the surrounding temperature. Their bottoms are a whitish quicksand that continually changes, continued pressure of the water forcing itself to the surface, which now and then in breaking through makes a revolution, similar in appearance to what I had imagined for an intermittent flow of lava from an active volcano. They are not large in area, but the volume of water will reach as high as 1,500 inches. What are called "seep springs" are now and then found, generally through the aid of Indians, at points where one would never dream of their presence, especially when discovered, as they often are, among basaltic foot-hills, completely desiccated and destitute of vegetation. These, however, afford so slight an amount of water that they cannot be depended upon for any exigencies of the march where many animals are in the party, and are simply reservoirs for the natural moisture that is found along the seams of the rocks composing the mountains. Many springs appearing at the base of the foot hills are occasioned by the melting of the snows on the mountains above, that, flowing a little distance, disappear, to show themselves again where the surface of the underlying rock approaches more nearly that of the soil.

The waters arising from the sources so far described, mostly sink in the valleys before reaching any recognized outlet to carry them to the sea.

In the basin draining toward the Colorado, the downfall of its immense water-shed reaches this river largely underneath the soil, except where, finding a home in natural depressions, it remains, giving rise to subterranean basins of water that exist in nearly all the mountain valleys.

At what depth these shall be reached, and at what points they are most accessible, are questions that require great practical local study.

Admitting the practicability of reaching these reservoirs, there can be seen in the future some relief to these many desert places from the sinking of artesian wells, so soon as the development of wealth (followed by population) and industry admit of their introduction.

COLORADO RIVER.

This stream, magnificent so far as length and extent of country drained can make it so, was the southern limit of the area embraced by the reconnaissance.

At the immediate point at which it was reached by our parties, some four hundred or five hundred yards below the mouth of the Rio Virgen, the current is exceedingly rapid, and the width of the river not more than one hundred yards. The water is of a yellowish muddy color, heightened at this vicinity on account of the waters received from the Rio Virgen; the banks are somewhat steep, the river having encroached concavely into a gravelly mesa, the walls of which are from fifteen to twenty feet in height. At this point everything is a scene of wild desolation; rocky and rugged mountains of various colors stand out on either side in the most strange and fantastic contour.

A few miles above this point the river emerges from a slight cañon, carved out as it were from the Virgen range that from this point follows on to the southward, soon breaking away into low foot-hills, and then entirely disappearing.

The Muddy Mountains that, turning to the southwest, cross the Colorado about five or six miles below the Rio Virgen, inclose the western and northwestern horizon. A continuation of low foot-hills entirely limit the southern view, with no far distant peaks, betokening rugged or impassable ranges.

We tried to obtain the services of the two Mormon fishermen, who inhabited a little hut near by, whose time was divided between catching poor fish and watching a pile of ore from the Salt Mines, distant eight or ten miles above, on the Virgin River, to row one or two of us as far as Callville; but their companion not being with them, they did not dare to leave their rendezvous, as both would be needed in order to bring the boat back. This was the occasion of considerable disappointment, as I had hoped to be able to give a personal inspection to the chances for navigation through Virgin or Boulder Cañon.

Mr. Gibbons, while *en route* to join the Arizona assembly, traveled by the river from the mouth of the Virgin to La Paz, passing through the above cañon, as well as the Black Cañon, in a small boat, and he assured me that by far the most formidable hinderances to navigation were to be found in the latter. He had no doubt that a steamer drawing not more than twenty four inches, with a powerful engine, could successfully pass both places, when the river is not swollen by the freshets occasioned by the melting snows. This cause would impede, if not altogether suspend, navigation during the months of April, May, and part of June. The irregularities of the current and the amount of water are not materially changed by the rains that occur in July and January.

Copper ore was found near the head of Virgin Cañon; iron ore, in a cañon leading out to the river immediately at the entrance to the cañon; while alum-beds were encountered in a small cañon leading down to the river, about midway of the Boulder Cañon. It would be impossible to build a road from the mouth of the Virgin to Callville in proximity to the river. The present one from Saint Thomas to the latter-mentioned point, follows the banks and beds of the Rio Virgen for about eight or ten miles, then branches to the southwest over a sand mesa, and follows winding and sandy washes, reaching the Colorado at Callville, a distance of about thirty five miles.

Virgin, or Boulder Cañon, has been formed by erosion, the sand mesas giving evidences that

at one period the river bed was elevated above its present position some four hundred or five hundred feet. The river widens out somewhat from Callville to the head of the Black Cañon, flowing more regularly with less current; its broader expanse and more regular banks assuming a quiet majesty amid its wild surroundings.

The river-bank was approached by our parties at several points along Boulder Cañon, and at none of them was there appearance of any rapids; the channel was much narrower and the course of the river very winding, with the cañon-walls near approached.

Our route from the mouth of the Vegas Wash to El Dorado Cañon took us away from the view of the river, the sharp, black peaks of the Black Cañon range showing us, however, its position and direction.

Following down a series of sandy washes from the summit, that having been reached spreads out upon our horizon the sharp outstanding crests of the Black Mountains, and the valley of the Colorado as far to the south as the Needles, the river-bank is reached some two or three miles from the mouth of El Dorado Cañon, at which point a quartz-mill was in operation.

Here the banks, the width of the river, and the current, are quite similar to what is found in the vicinity of Camp Mojave.

The barge being absent down the river, it was impossible to make a trip up the river as far as Roaring Rapids, as had been intended.

Along the banks of the Colorado, above the head of Cottonwood Valley, as high as our first point of approach, there is hardly an acre of land under cultivation; there is no wood, with the exception of now and then a stunted mesquite-bush; the banks, where they are not the solid walls of precipitous cañons, are broken gravelly masses, subject to continual changes by denudation. Looking for practical results as regards internal communication alone, one is saddened and disappointed while examining this great river, so magnificent in its solitude.

Particularly here was felt the want of some one with the party who could give entire and careful attention to the geology of the many interesting localities where bounteous nature has framed the walls upon which so much is written.

NAVIGATION OF THE COLORADO.

In the report of the Colorado exploring expedition in charge of Lieutenant Ives, Corps of Topographical Engineers, the foot of the Black Cañon was denominated as the practical head of navigation. The results of later years show that steamers can go as far as Callville, and the itinerary report favors the idea that navigation may be carried as far as the foot of the lower main or Grand Cañon of the Colorado. When the local wants of the surroundings of the Colorado between the above limits call for water transportation, American industry and energy will soon develop the means.

It would seem to be, however, a matter of some importance that at least a rude hydrographic survey should be conducted, as far as circumstances will permit, in an upward direction. Judging from information gleaned here and there, this cannot be carried beyond a distance of about fifteen miles above the mouth of the Grand Cañon.

As far as El Dorado Cañon, the navigation of the river is practicable at all seasons of the year with such steamers as are at present in use. The season of the year is an element which has quite an important influence upon the stage of the river in the cañons, as doubtless, during the lowest water, say for the month of December of each year, no matter how light the draught of the steamer, it could not pass the bars formed in vicinity of the rapids; while during the freshets, which occur in the spring of the year, upon the melting of the snows in the mountains, which give a distance of fully fifty feet between high and low water mark, navigation must needs be suspended.

Without a removal of one of the obstructions, the navigation above the foot of the Black Cañon and to the point mentioned, even for nine months in the year, must be carried on at considerable hazard; steamers towing barges and having a higher power, drawing less water than those now employed by the Colorado Navigation Company, dimensions of which are given in a report made by Bvt. Lieut. Col. S. M. Mansfield to the Chief of Engineers in 1867, can be used above the foot of Black Cañon to better advantage.

RIO VIRGEN.

This river, having its source in the central part of Utah, flowing southwest for a long distance, lined here and there with Mormon settlements, was met by our parties at the mouth of the Muddy, some thirty miles above where it enters the Colorado. Its sandy bed, widened by each successive freshet, changeable on account of quicksands, carries its channel now to the one, now to the other side with a tortuous elasticity, and most of the crossings are uncertain because of changes in the banks and beds of quicksand. The volume is not great at this season of the year (October.) Heading toward the Colorado and traveling for five or six miles the famous Salt Mountain is reached, noted for its crystals of very pure rock-salt. This is the property of the Hyko Silver Mining Company, and is used by them in their mining operations in the Pahranagat District.

Some notion had been entertained of freighting the ores from this enormous deposit via the Colorado and water transportation to a market, but will doubtless be abandoned, since the expense of placing the ore at the mouth of the Virgin River would be nearly as great as the cost per pound of salt at any point where there is a large market. Still following the river and coming to within eight miles of its mouth, on the left bank a salt mine is found, not so pure as the crystals found and mentioned above, but running as high as 80 per cent., while the other reaches as high as 90 per cent.

On an extensive mesa, quite near the mouth of the river, is a salt well apparently of great depth, not large in diameter, and having the surface of its water about 10 feet below the level of the mesa. The water, though very clear, is terribly saline, as is also that found segregated in small pools along the river-wash, which "alkalis" animals, as it is termed, so badly that a few draughts prove fatal. This well is probably the recipient of drainage, not alone from these pools and the bed of the river, but possibly from the salt mines themselves. Below this mesa and on the banks of the fast-flowing Colorado a hut was found, inhabited by two Mormon fishermen. They looked upon themselves as the nucleus of a civilization to be established on the banks of the Colorado, and by following the same active industry evinced in many of their semi-desert towns, they may perhaps establish a little settlement here.

TIMBER.

The locations at which timber, of any size, can be found throughout Southern Nevada, are few in number and of simple description.

Along the Humboldt range, from Camp Halleck to White Pine District, no timber of any size or large amount appears. A small mill in Ruby Valley, some ten or twelve miles above old Camp Ruby, was at work sawing out narrow boards from a variety of short-leaved yellow-pine, something between the ordinary scrub and the long-leaved or yellow southern pine; the trunks being of irregular size and very full of knots.

On the western side of the mountains, facing Railroad Valley, from twenty to thirty miles below Hamilton and near the source of Currant Creek, several mills had sawed out, for building-purposes about the White Pine District, large quantities of a similar kind of lumber, but of generally better average quality. In the vicinity of the Robinson District the true yellow-pine is found in large quantities, extending over a considerable area on the eastern slope of the Egan range, interspersed here and there with patches of mountain-fir.

The next we encounter is to the north and east of the Patterson District, and about eight or nine miles distant, near the source of Benson's Creek. A small steam saw-mill was at work at this place, as also at the Robinson District, upon Murray's Creek.

Directly to the north of the Shoshone District, and on the western slope of the Snake range, some of the ravines are thinly studded with pine of good growth, interspersed with fir, also spruce and hemlock. The quantity in this locality is not large, but sufficient in amount for all local purposes connected with the development of the mines in the vicinity.

Going south on the line farthest east, the only timber along the route, prior to reaching the Colorado, was found in ravines to the south and east of Clover Valley. A small mill was steadily employed at this point furnishing lumber for the various Mormon settlements within a radius of fifty to seventy-five miles.

On Lieutenant Lockwood's route between Cave Camp and the headwaters of the Muddy, timber was encountered at three different points: first, about twelve miles below our camp in Cave Valley, to the west and opposite to the Patterson District; second, on the Pahranagat range, in the vicinity of the Great Quartz Mountain; and on the same range, some thirty-five to forty miles northwest from West Point.

The supply is quite large at the first and third points, while 750,000 feet will be the superior limit in the vicinity of the Pahranagat mining-camp. The last situation is upon the eastern slope of the Spring Mountain range, and nearly fifty miles in a northwest direction from Las Vegas. The amount far exceeds that found at any of the other points, and will not be limited by 3,000,000 feet of lumber.

The pines are of very large diameter and of extreme lengths. Spruce and hemlock show themselves to a considerable extent. The only black birch and poplar encountered during the trip were found in this locality in small quantities.

It will be seen that with the exception of two instances the timber-patches of this entire section are on the eastern slopes of the mountain-ridges, as it is natural to expect, from the formation of the foot-hills.

Nut-pine and mountain-cedar abound in frequent localities, and will become of great value as fuel in many places where now only the former afford the pine-nuts as a sustenance to the Indian. These are large enough in many places to act as timbering for the mines.

It becomes painfully evident that in event of the development of the various mining sections, lumber, always scarce, will of necessity command high prices and entail serious hinderance and discomfort. This was noticed to a remarkable degree in the early days of White Pine, when lumber was worth two hundred to three hundred dollars per thousand, allowing the shipment of it by rail from the Sierra Nevada to Elko, on the railroad, thence by freighting to White Pine, with large profits.

GAME.

Southern Nevada cannot be said to be abundant in game in any of its localities. Among large game there the deer and antelope are noted. The latter, once abundant in some of the valleys, have been driven away by the approach of civilization. Small droves of five or six were seen occasionally upon the route, but always at distances out of ordinary rifle-shot. The deer that now remain have been hunted to the mountains and ravines by the Indians, and are as rare as are the summer rains of this climate. They no longer go in herds, but separate, two by two, to seek secure retreats.

Among the small game are found duck, geese, crane, sage-hen, grouse, quail, jack and cotton-tail rabbits. In some sections the duck are very plenty; especially in Ruby Valley, at Duckwater in Railroad Valley; also in Spring, Snake, and Meadow Valleys. They appear in turn at most of the valley locations where there is clear and living water. They were noticed in the greatest numbers among a nest of lakes in the depression of the valley immediately to the eastward of Patterson District, one of their great breeding-grounds.

The principal species are the teal, mallard, and canvas-back; varieties of each were noticed, the former predominating. Geese, more migratory in their habits, were rarely seen, except upon their march for the southward, upon our return, having come from points further north on their way to a winter resort.

Now and then small parties of large sand-hill cranes were encountered, always so shy that no success followed any of the attempts to capture them.

The sage-hen, so well known in Nevada, are found more or less in nearly every one of the valleys, and if not too far advanced in age make a very good dish for the hungry traveler.

Grouse only appear high up among the mountains, where timber is found, and hence at very few points. They are perhaps the most delicate eating of any of the small game and the most difficult of capture.

Quail are not met with until the latitude of about 37° 30′ is reached. From this section to the southward as far as the Colorado occasionally flocks of small size show themselves. The varieties are those known as the ordinary California quail, somewhat smaller than those found in the Eastern States.

Rabbits now and then occur, but they are annually decimated by the Indians, who kill them constantly and persistently.

To the sportsmen duck-shooting offers the most legitimate field for pleasure.

An ordinary traveler passing through the country and depending upon game for his food would probably starve; even the Indians, the most expert and incessant of all hunters, are obliged to gather pine-nuts, to supply in a great measure the necessity for food.

MOUNTAIN-ROADS.

These above latitude 37° are better than the average of Nevada roads, as by skirting the foot-hills and keeping out of the low ground, where the presence of alkali is nearly always noticed, quite a firm bottom is found.

Constant travel, however, after a short time wears the road-bed, giving rise to a great amount of pulverized material which acts as dust in dry seasons, and as mud upon the advent of the rains. This is peculiarly noticed along the stage-roads from Elko to White Pine, where much freighting has been done.

Over a road similar to the one following down Steptoe Valley, a march of twenty miles for a loaded wagon is accomplished with as much ease as one of fifteen miles on a route similar to that along the valley of the Gila, in Arizona, for instance; this same ratio may be said to obtain between the roads in the section above mentioned and those in Southern California and Arizona, generally. Below latitude 37° quite a change is noticed; sandy washes, broken mesas, and alkali spots becoming more frequent.

The grades going to the northward also become heavier, and there exists, until the Colorado is reached, a more rapid decrease in altitude. This latter is a point of no disadvantage, since the greater part of the travel, present and future, is liable to be to the southward. A strip nearly parallel to the river and to the north and westward may be said to be almost impassable for roads, except in a northerly and southerly direction, and this only upon taking advantage of winding washes and steep box-cañons.

The road from Saint Thomas to the mouth of the Virgin, following for a greater part of the distance the partly overflowed bed of the river, would likely be nearly impassable during the season of the floods. At those times a route following the broken and sandy mesas of the right bank must be sought out.

It will hardly be possible to get through a decent track for wagons from the lower end of Meadow Valley to the settlements on the Muddy; if it is ever done, the first labor will be excessive, and the resulting road will be but an indifferent one, if passable at all.

The road from Toano to the mouth of the Virgin is an excellent one until the lower end of Pahranagat Valley is reached; thence to the headwaters of the Muddy some sandy stretches are crossed; from the latter point until the Virgin River is reached, only a few sandy spots are encountered, so that for the whole distance there is not more than forty to forty-five miles of difficult travel.

The route traversed of late from Elko via White Pine, Railroad Valley, and Las Vegas is a difficult and desolate one. Some parties pushing out from the lower country have reached the Colorado at the mouth of the Virgin, and were obliged to follow as near the river as possible until Hardyville was reached before a crossing could be effected. So soon as the connection can be made from the mouth of the Virgin to the military road leading to Prescott, a through route of considerable service in the future will be established.

CAVE IN CAVE VALLEY.

Our anticipations had been greatly aroused by varied reports of a cave near the Patterson Mining District, for the greater part unexplored, and supposed to be of grand magnitude. Accordingly, upon arriving in its vicinity and pitching our tents within some three hundred yards, our next efforts were toward fitting up a party to make a thorough exploration. We were fortunate in securing the services of an old Indian of the Gosiute tribe, named Anzip, who professed a

thorough knowledge of the subterranean windings, and to be conversant also with the various Indian traditions that attribute strange characteristics to the locality.

As we gather round the camp-fire dinner he relates to our interpreter in his native tongue the various wonders of this underground world. The principal tradition runs that far within the cave they come upon a new and grand world where a race of white people live having fair fields and flowers, grassy lawns and cool fountains, with a vast profusion of magnificence; that at one time and another the Indians who have ventured within their confines have been taken and made prisoners, never being allowed to return to their tribes. In all during his remembrance six had been so taken, and the various lodges mourned their loss and were desirous that some strong power like our own should go to demand their return.

The intense excitement of Anzip's imagination depicted so truthfully upon his swarthy features was highly interesting, connected with his earnest and gesticulating manner. When we would seem to doubt his re-asserted tale he was so terribly angry that, being afraid that he would abandon us as guide, we gave tacit consent to his various narrations. Our old guide "Pogo" has told us that within the memory of his mother, now very aged, two squaws had been taken upon entering the cave, and, after an absence of four years, were sent back to the outer world, clad in the finest of buckskin, covered with hieroglyphics of the race who had for that time held them in bondage. They professed to have been well treated and to have lived in a pleasant land. Again two more had disappeared in the same way and were never heard from again.

These and various other stories served to while away the twilight hour of the evening before our visit to the above locality. Our party numbered twenty-three, well supplied with all necessaries, such as candles, ropes, and arrangements for measuring and making a survey. We made an early start, and were out of the light of day between six and seven hours. Our measurings made the cave no longer than 3,000 feet, and for the last 1,000 feet the novelty had greatly worn away, when we found ourselves crawling among the slime of some of the worst imaginable clayey sediment. For 700 or 800 feet from the entrance everything was dry, the walls high, and several compartments were quite interesting; beyond that the humidity and mud commenced, and upon our returning to the outer air our persons were more of a curiosity than the cave itself.

Our guide got along very well for about two thousand feet; then he commenced to get excited and bewildered, constantly threading various labyrinths and returning to the place of departure. This mistake could have happened to any one, only that we had left marks here and there easily to be recognized.

Every channel was closely examined, and all were found to exhaust in the solid wall of the surrounding lime. One deep well was found that apparently extended downward for seventy feet, at which point the lead sinker struck either the bottom or a projecting shoulder.

A plan of the cave, as well as a view of the buttes in which it is situated, will appear in Vol. I of the Survey Reports. The sketch indicates that the subterranean opening extends as far as these buttes, which are situated some three or four miles from the high peaks of the adjacent Schell Creek range.

We came out and returned to our camp, weary, covered with mud and slime, and with every particle of romance eliminated from us, and to wonder that there ever could be a race so imaginative and speculative in everything that is absurd as the Indian.

ROUTE TAKEN BY EMIGRANTS PERISHING IN AND NEAR DEATH VALLEY.

These parties, consisting of as many as forty wagons and one hundred and fifty souls, having crossed the plains and reached Salt Lake, passed to the south and west through some of the Mormon settlements until the vicinity of Meadow Valley was reached. From this point a Mormon, named Bennett, was to guide them through to California. Passing to the westward of Meadow Valley, a spring in the foot-hills of the continuation of the Schell Creek range, now known as Bennett's Spring, was reached; from this point the guide seemed to have no definite knowledge of the route, and, bearing to the north and west, they wandered on a desert track until the sink of Sierra Creek was reached. At this place Bennett entirely deserted them, leaving behind him no information, and the parties themselves at a poor and sterile camp, while he returned to some of the settlements,

where he is still living. Starting out from Sierra Creek, and traveling nearly due west, they wandered over the mountain desert, traveling for the most part well down in the valleys, not realizing that more frequently the water must be sought up among the foot-hills. Suffering soon arose, and the large party broke up into several small ones, wandering here and there until the men, exhausted by thirst and fatigue, and the animals for the want of sustenance and water, the great Death Valley of Southwestern Nevada made for them a grave.

Chance parties of prospectors and explorers have found the bones of the men and animals and remnants of the wagons at desert points as far to the southwest as Death Valley proper, in California. Iron tires taken from the old wheels were found by us at the mines in Meadow Valley and at Las Vegas Ranch.

An old Indian once told our interpreter that he had followed after the parties, wishing to give information in regard to the springs, but that they were much afraid of him and would not let him come within hailing distance, preferring to perish in the rough, wild desert rather than trust themselves in the hands of the treacherous Indians. Their loss is a sad example of the misfortunes of mountain travel, where, with no one to lead, and no prior knowledge of the country, parties may meet with the most intense hardship and suffering, if not, as in the above case, the most wretched of deaths.

OLD SALT LAKE ROAD.

This was crossed by us in the field of our explorations at two points, one a little below West Point, on the Muddy, the other at Las Vegas Ranch.

This road, so much used at one time in the winter season by the Mormons in freighting into Southern Utah, is long, and sandy in the extreme. The stretches between waters from the Cajon Pass to Saint George are long and tedious, and the camps, at which grazing and wood are scarce, numerous. Its former uses no longer obtain, as it is found much cheaper to freight to the most remote and southern settlements in Utah from the Central Pacific Railroad.

Callville was established with the hope that water-facilities might lighten the extravagant prices of all supplies freighted in by land from the California coast, but before the completion of even a landing or a store-house, was abandoned.

ROUTES TRAVERSED BY MORMONS IN 1857.

The Mormons, looking forward to active operations with the troops ordered to their section under General Johnston in 1857, and for secure shelter in case of being driven from their mountain homes, sent out two expeditions to seek for fertile mountain retreats to the westward.

One party, consisting of twenty-six wagons, leaving Beaver City passed west to Hawawah Springs, then across Desert and Lake Valleys, until the pass where the Patterson mines now are was found.

Beyond this point the route was the same as the one followed by our parties from Steptoe Valley, which inviting valley having been found by them, they returned upon nearly the same route.

The other party, leaving the settlements farther to the south along the valley of the Upper Rio Virgen, made their way into what is now known as Meadow Valley, thence to Pahranagat Valley, and, passing to the northward, reached Sierra Valley, an uninviting situation; thence they found their way to the tracks of the other parties, and made their return upon them.

Our return trip from Hawawah Springs to camp in Cave Valley, followed their route very nearly.

MAPS.

The maps, carefully compiled from the original data, giving details of the topography, will appear, *one upon a scale of 1′ to six miles; another, upon a scale of 1′ to twelve miles.

The elevations along a line projected for a railroad to connect the Central Pacific Railroad with the Colorado, are shown on a special profile map.

Great care has been exercised in the topographical details, and the attempt has been made to exhibit the light and shade as it actually falls upon the mountains when the sun occupies a position

* The map upon the scale of 1 to six miles has never been published.

45° from the meridian, which improves the appearance of the map, and does not consume the time necessary for mathematical hachuring.*

NARROW-GAUGE RAILWAYS.

Since the writing of my preliminary report in the fall of 1869, much information has been gathered and progress made in the introduction of narrow-gauge railways into this country. Several narrow-gauge tracks have been constructed, notably those in Utah reaching from Bingham City to a point in Cache Valley at the north; from American Fork, and to the vicinity of the mines in the American Fork Cañon; in Colorado, from Denver to Pueblo, known as the Denver and Rio Grande Railway, and from Golden City to Central City, and to Floyd's Hill and Clear Creek Cañon. These roads prove available and economical. The latter relation applies to their construction and repair, and to the current expenses of the road. The highest grade reached on the American Fork road is two hundred and ninety-six feet per mile. This has been found practicable with ordinary traction-engines. Considerable has been written as to the utility of introducing narrow-gauge roads as a means of transit for passengers and freight. Nothing definite appears to have been decided upon as to the width of track, size and power of engine, accommodations for passengers, the capacity of freight-cars, &c., most desirable to answer all the wants of a varied travel and traffic. It is a notable sign of the spirit of the times, however, that the Erie Road, long run upon the wide gauge similar to that first introduced into England, where latterly with success narrow gauges have been introduced, has made arrangements to change its gauge so that it may be uniform with the ordinary broad-gauge roads of the country. In my belief, the introduction of this class of tracks, not exceeding three feet in width, with rolling-stock to match, will mark an era of competition among lines of transportation most beneficial to interior commercial interests.

WHEELER'S PEAK.

This name has been given to the most elevated point of the Snake range, which is one of the highest crests between the Sierra Nevada and Wahsatch. It was found by careful barometric observations to be thirteen thousand and sixty-three feet above sea-level; corroborated by angles of elevation taken from points whose altitudes were determined barometrically, thereby checking errors that are likely to arise from the use of barometric results at such large altitudes. Some peaks in the Uintah range, I am informed, have been found by the geological survey of the 40th parallel to exceed fourteen thousand feet; others on the Humboldt range approximate thirteen thousand feet, but none are found to exceed that height.

Our party, consisting of Rev. Mr. White, acting geologist, State of Nevada; Lieutenant Lockwood, Messrs. Hamel and Rahskopff, and the guide, Mr. Butterfield, all succeeded in reaching the top on the morning of the second day, having left camp at Rattlesnake Springs at 2 p. m. Messrs. White, Lockwood, and myself reached the summit at 8 p. m. same evening, but were obliged to return to the limit of vegetation for food and fuel.

Meteorological observations were taken during the day, as well as those for time and latitude; the latter have doubtless seldom been attempted at a greater altitude. The party by mutual consent, and at the suggestion of Professor White, proposed that hereafter this point should be called Wheeler's Peak,† which name has been adopted upon the map.

REPORT OF LIEUT. D. W. LOCKWOOD.

HEADQUARTERS DEPARTMENT OF CALIFORNIA,
San Francisco, Cal., January 25, 1870.

SIR: I have the honor to submit the following report of special reconnaissances made under my charge, in compliance with instructions received from you at various times during the progress of your exploration from the White Pine mining district to the Colorado River, and return; the

* Several manuscript maps have been prepared, the information upon which has been introduced upon the later atlas-sheets or may be made available in further publications.

† This peak has been called indiscriminately, on published maps, Union or Jeff Davis Peak.

first being from Cave Valley, near Patterson, to the Muddy River via Hyko, and undertaken in obedience to the following order:

CAMP NEAR CAVE, CAVE VALLEY, NEVADA,
August 31, 1869.

Special Field Orders, }
No. 10. }

Lieut. D. W. Lockwood, United States Engineers, will proceed from the Cave in Cave Valley to make a careful reconnaissance of the country due south, passing through Pahranagat Valley to Saint Thomas, at junction of Virgin and Muddy Rivers. Mr. Rahskopff will act as topographer. The ambulance driven by Davis and the heavy wagon driven by James Kelly will accompany him. The following-named soldiers will act as escort, &c.: Corporal Augustine Myers, Company H, Eighth United States Cavalry; Privates William Ramsay and Otto Behrend, Company I, Twelfth Infantry, and Marion Minnel, Edward Leach, Edmund Wildenmuth, Charles M. Jones, James Smith, John Kelly, and Francis Johnson, Company H, Eighth United States Cavalry.

GEO. M. WHEELER,
Lieutenant of Engineers.

As directed, I left camp at the Cave on the morning of the 1st of September, 1869, and taking a southeasterly course, crossed the Egan range of mountains through a somewhat high and difficult pass, entering Sierra Valley near Butterfield Springs, at which place the first camp was made, distant about twenty-one miles from the camp at the Cave.

The Sierra Creek takes its rise near this point, and is fed by a series of springs, some cold and others warm, which break in the foot-hills on the western slope of the Egan mountains. The warm springs are about one mile south of the first camp.

The country in this vicinity is of a very alkaline character, and the creek, after continuing for twenty-five or thirty miles down the valley, sinks; its whole course being marked by a heavy growth of tules. The sink varies in locality at different seasons of the year, being due to the varying quantity of water supplied by the springs. The original bed of the creek extends for some distance below where there are any indications of water having been within a recent time. The road down the valley skirts along the foot-hills, and, crossing the dry bed of the creek, passes over a low divide, entering Coal Valley. There are few indications of a road leading from the creek to the divide, however, while a clear and distinct track leads off to the left through a perfectly desert valley, about thirty miles in extent. By reason of some misunderstanding of the directions given by the guide, the latter-mentioned road was taken, and the result was that, after making a march of over thirty miles, a portion of the train was at Butterfield Springs again, and the remainder at the sink, having been compelled to turn back, the mules having given out, so that the heavy wagon was left in the desert twenty-five miles away. This march occupied two days, and was made without forage or water for the animals.

The next move was down the course of the creek, and from thence across country to the main road leading to Simmond's Springs. This latter course is undoubtedly the best one for wagons not too heavily loaded, as the distance from Butterfield Springs to Simmond's Springs is too great a distance for one day's march by the regular road, and, although the way by the creek is a trifle greater, the distance between the watering-places is less. Simmond's Spring is of very little account during the summer, as the supply of water is very limited and of poor quality.

From this point the road turns off somewhat to the west, and, crossing a broken range of mountains by an extremely difficult pass, comes out into Pahranagat Valley, the upper portion of which is nothing but a heavy sandy wash.

Owing to the many delays that had already occurred, it was not until late in the night of the 9th of September that the whole party had arrived at Hyko, which by regular marches, with everything in good order, ought to have been accomplished in four days.

HYKO.

The village of Hyko is situated near Hyko Spring, and contained at this time from two hundred and fifty to three hundred souls, including the miners at Silver Cañon. The population varies continually with the mining excitements springing up in different parts of the State. The same might be said of the town itself, as at the breaking out of the White Pine excitement houses were taken to pieces and transported entire to the latter place.

The Hyko Silver Mining Company owns nearly all the mines in the district, and has erected a

fine ten-stamp mill, with all the modern improvements, for milling silver-ores. The supply of water is ample, and the only disadvantage connected with the mining interests of this district is the distance of the mines from the mill, which cannot probably be obviated.

The mines are located to the east of Great Quartz Mountain, and extend in an almost continuous line of cropping for the distance of five miles to the south. The ore is generally of a rather low grade, but can be obtained in almost any quantity, so that in case the cost of milling can be reduced to a reasonable figure, there is every prospect of success for the company, which has done so much to develop the interest, in every respect, of the district and surrounding country. The distance from the mines to the mill is about twelve miles.

The ranches, lower down the valley, furnish forage and provisions sufficient for the maintenance of a much larger settlement, and prices are consequently very reasonable.

Plenty of timber is found in the vicinity of Great Quartz Mountain, and the foot-hills on either side of the valley are, as a general thing, covered with a fine growth of bunch-grass.

So much time having already elapsed since leaving the Cave, it was not deemed advisable to make a longer delay here than was positively necessary; for this reason, I was unable to visit the mines, and on the morning of the 11th started down the valley, passing Crystal Spring, estimated to flow one thousand five hundred inches; Ash Spring, two thousand inches; and at night camped at a point on the road a short distance above the lake, near a small spring of brackish water. Throughout the day the road had led by a succession of ranches which all appeared to be in a thriving condition; barley, wheat, potatoes, and melons being the principal productions. The valley is from three-fourths to one and one-half miles wide, and in consequence of the great supply of water from the various springs along its whole extent, and the steady fall to the south, irrigation is rendered comparatively easy. The lower portion of the valley is much more alkaline than near the village, while below the lake, which is very strongly alkaline, there is very little cultivatable land.

Coyote Springs were reached on the evening of the 12th, but a delay of one day was rendered necessary in consequence of the heavy character of the road, part of the load of the heavy wagon not getting into camp until the night of the 13th. At this place very little grass was to be found, and that of a character not suited to what was needed for animals that were so reduced as those in the train were by this time; the water was of a very poor quality, being stagnant, of a greenish color, and filled with insects and tadpoles. A very curious feature of these springs is that in the different holes that have been dug on the slope where the springs are located, the water does not stand at the same level, although in some cases the holes are separated only by a distance of ten feet and even less.

The next march was to what are termed the Pockets, the water being that which has fallen during the rainy season and collected in a narrow cañon, through which the wash from the Hyko Lake to the Muddy runs; it was very muddy and literally alive with tadpoles. No grass whatever was found here.

The next day's march was to West Point, on the Muddy River, over a rough mountain road and through heavy sandy washes. The road passes around Arrow Cañon, leaving it to the right. This cañon is one through which the main wash runs, and is so named from the fact that the Indians of this vicinity, in passing through it, always shoot an arrow into a cleft in the rocks high up, for some superstitious reason that I was unable to learn.

The road after reaching the valley of the Muddy is good until reaching West Point, four miles farther down.

There can be no doubt but that the real headwaters of the Muddy River are at and near Hyko, as the heavy wash from Hyko Lake down to the Muddy Springs shows that formerly a considerable body of water must have passed down to the Colorado River by this course.

There are also indications of water existing at no great depth in several places along the dry, gravelly bed of the wash, as shown by willows growing and remaining green during the extreme heat of the summer. The temperature of the water at Hyko Spring is about 78° Fahrenheit, while at the Muddy Springs it is 87°.

Upon leaving camp at the Cave it had been deemed certain that a junction would be effected with the main party before the 15th September, and in consequence rations had been taken for only

fifteen days, so that upon arriving at West Point on the evening of the 15th the supplies were nearly exhausted, and no news had been heard regarding the whereabouts of your command. Scarcely anything in the way of subsistence stores could be obtained of the Mormons; their cattle, of which they had quite a number, being prized too highly to admit of their ever killing one, unless for some possible reason which, unfortunately for us, was not considered to exist while we were there. They had no bacon to sell, and apparently but very little had ever been in the town, and that brought them by parties traveling south. The only articles, in fact that could be obtained were water-melons and squashes.

WEST POINT

is situated about five miles down the valley from Muddy Springs, on a low mesa near the river. The houses as a general thing are made of small willows wattled together. The inhabitants appear to be of the lowest class, and but little superior to the Indians of the vicinity, so far as general cleanliness is concerned. They cultivate the bottom-lands near the town and use the upper portion of the valley for grazing. The crops did not appear to be very large, but will increase in time by cultivation, as the alkali in the soil, in this way is, to a certain extent, eliminated. No potatoes to speak of have as yet been grown at this settlement.

On the morning of the 16th September we left camp at West Point and proceeded down the valley, the road running near the river until reaching a point about four miles below, where the road from Salt Lake to Los Angeles crosses the Muddy. Here the river runs through several narrow, precipitous cañons, and the road passes around through the hills. The sand was so deep and heavy that the wagon had to be partly unloaded, and even then, after proceeding about half a mile, the mules gave out completely, and I was reluctantly compelled to turn back and encamp near the river, at which place we were when, in the afternoon upon your arrival, you assumed command.

RECAPITULATION.

ROADS.

The road from the Cave to the Muddy River is quite practicable for wagons not heavily loaded, and the journey can be made readily enough in seven or eight days provided the animals can have grain. At most of the places grass can be found, although in some instances, as at Simmond's Spring, it is some distance from where the camp would usually be made. The hardest marches are from the slough of the Sierra Creek to Simmond's Spring, and from Coyote Spring to the Muddy. The pass to the north of Hyko is very difficult in places, but by partly unloading and making an extra trip, the march may be accomplished. The heavy sand below Hyko Lake will always render this portion of the route very severe, as the steady, constant strain upon the teams soon tells upon them.

WATER.

At Butterfield Springs, along Sierra Creek, throughout Hyko Valley, and at the Pockets, (generally,) there is plenty of water. At Simmond's and Coyote Springs there is usually sufficient for only eight or, at most, ten animals, and in case of much travel not enough for that number, as the water only collects slowly. There is more or less alkali at all the places mentioned, and it has a very bad effect upon animals not accustomed to drinking water impregnated with it.

GRASS.

The ordinary bunch variety is found generally throughout the whole route, growing in nearly all cases upon the foot-hills, in some instances at a considerable distance from the camps. The whole course of Sierra Creek affords plenty of grass, but it is of an alkaline character, and, to animals unaccustomed to it, furnishes very little sustenance. At Simmond's Springs none was found, although I was told there was bunch-grass within a mile or two. Throughout Hyko Valley there is an abundance, but alkaline and quite poor. At Coyote Springs there is very little, and at the Pockets none whatever. The grass throughout the valley of the Muddy is similar to that in Hyko Valley.

WOOD.

The pass through the Egan range shows a considerable growth of nut-pine and scrub-cedar; the same is true of the pass to the north of Hyko, and generally of the mountains along the whole route, although the amount is less as progress is made toward the south. Pine timber, suitable for sawing, is found upon the high peak near the mill, in the Egan Pass, and to the west of Hyko, a short distance from the mines. The Mormons obtain their timber, to a certain extent, from a place about forty or fifty miles from the Pockets; the road leading thereto branches off to the west at a point a little to the north of that place.

CULTIVATABLE LAND.

But very little land fit for cultivation was found before reaching Hyko, although, possibly, one or two hundred acres near Butterfield Spring might be so classified. Throughout nearly the whole extent of Hyko Valley, for about twenty-five miles below Hyko, the land can be farmed profitably, and as the valley is from a half to one and a half miles in width, there is a very fair chance for successful ranching.

The valley of the Muddy can be cultivated in several places, although the upper portion is very alkaline. At present only a portion of it, in the vicinity of West Point, is tilled.

Astronomical observations were taken from time to time, when possible, for latitude and longitude.

Barometrical observations were taken throughout the trip.

Should it ever be deemed necessary to establish a military post in this part of the country, the most eligible location would, in my opinion, be in Hyko Valley, as it possesses all the requisites for the establishment and maintenance of a post.

Respectfully submitted.

D. W. LOCKWOOD,
Lieutenant of Engineers.

Lieut. GEO. M. WHEELER,
United States Engineer Officer, Department of California, San Francisco, Cal.

HEADQUARTERS DEPARTMENT OF CALIFORNIA,
San Francisco, California, January 25, 1870.

SIR: I have the honor to make the following report of a trip from Las Vegas Ranch to Potosi, in the Yellow Pine District, undertaken in compliance with verbal instructions received from you a few days previous.

On the morning of the 12th October, 1869, I left camp at Las Vegas, taking one ambulance and three men, and Mr. Hamel, topographer. The road taken was the old Salt Lake road, running in a southwesterly direction until reaching a point about five miles from Potosi, when the trail leading to the latter place branches off to the south. The first night's camp was made at the Cottonwoods, a spring at the head of Las Vegas Wash. These springs rise and sink at several places, and receive their name from the cottonwoods growing near. The next day's march took us to Potosi.

POTOSI.

This camp was established some years previous to the date of our arrival, and traces of former habitations were visible all around: the original settlement was said to have been broken up by the Indians.

A smelting-furnace had formerly been erected, but failed, in consequence of the operators not understanding the proper method of separating the precious metal (silver) from the complication of base-metals which exist in the ore taken from the principal mine worked, namely, the Old Potosi.

Only one small spring is found here, insufficient for supply of a mill. The present locators of claims in this district were at work on the Potosi mine, which was visited and found to be a regular, well-defined ledge, situated high up on the western slope of the mountains. The ledge crops out from an almost perpendicular cliff, and shows a width of ten or twelve feet, and has been stripped for about five hundred feet. The ore, which consists of galena, antimony, arsenic, and silver, occurs in large, irregular masses, in some cases beautifully crystallized, and assays, by actual working, about six hundred dollars in silver to the ton. Some of the ore had, I believe, been sent to the lead-works in San Francisco, and there reduced.

Other claims had been located in the district, but none of them had been opened sufficiently to enable one to define their character, so far as formation was concerned. The few miners engaged here were taking out the galena ore in quantities sufficient to supply a furnace all the time, and, although their receipts in money amounted to practically nothing, they seemed confident of success, which, under the most favorable circumstances that may occur, must be regarded as a question admitting of a great deal of doubt. Supplies have to be hauled a long distance, over the worst kind of roads, and the want of water necessary for carrying on operations on an extensive scale will always be a great drawback here.

Wood in great abundance is found on the mountain slopes in the vicinity, principally nut pine.

Bunch grass grows near at hand.

The next morning we started back for Las Vegas, taking the same road as before, arriving at the Cottonwoods in the afternoon, and receiving information that two soldiers had deserted from Las Vegas. I went on that night, and reached camp about midnight, when I discovered that Privates Murran and Leach had deserted on the morning of the 11th, and taken with them five animals, the best ones left at that time. Pursuit was ordered, but the worn out condition of the horses and mules would not allow of our overtaking them.

Respectfully submitted.

D. W. LOCKWOOD,
Lieutenant of Engineers.

Lieut. GEORGE M. WHEELER, *United States Engineers,*
Headquarters Department of California, San Francisco, California.

SIR: I have the honor to submit the following report of a trip from Quinn Cañon to Monte Christo Mill, via Reveille, Hot Creek, and Morey Mining District, made by me in compliance with verbal instructions received from you November 12, 1869.

As directed, I left camp at Quinn Cañon in the afternoon of the above-mentioned day, and encamped that night at Red Bluff Springs, the northeastern corner of Lincoln County, Nev. The next morning the odometer-cart, driven by Private John Smith, was sent on to Twin Springs by the regular road, while Mr. Rahskopff and myself started for Reveille, taking the trail leading across the valley. But one wagon had ever been over it, and that was to take a load of ore to Hyko to be reduced; the track was found to be very sandy.

REVEILLE.

situated on the Reveille range of mountains, was reached quite late in the afternoon, so that it was found impracticable to visit the mines; such information as I was able to obtain with regard to the district was due to the kindness of the recorder of the district. There had been at the time about four hundred and sixty locations made, principally contained in a space about six miles in length and two in width. The principal locations are near each other, and are all, so far as had then been determined, deposits. No indication of a fissure-vein or regular ledges had been discovered, and generally, the same showing existed here as at White Pine, some of the specimens being almost exactly similar to those shown at the latter place, containing horn silver in very considerable quantities. The principal claims are the Park, assaying from $800 to $1,400 per ton; Desert

Queen, $500 per ton; Sweepstakes, Montrose, Queen of the West, and some others, ranging in value from $100 to $300 per ton. The results given were those obtained by actual milling, the ore being carefully selected, as it had to be hauled a considerable distance to the mill. The mines are quite high up on the mountains.

The country rock is dolomitic in its character, without stratification. The decomposition of the feldspar in the porphyritic mountains which surround the dolomitic range in which the mines are located, has caused the formation in several places of beds of alum, some of considerable extent, particularly the one a little north of the camp. Water is obtained in sufficient quantity for the use of the camp by digging wells near at hand in the porphyry; a few miles away plenty can be obtained. Wood and grass are found a short distance away.

A mill was in process of construction on the opposite side of the valley, to the west.

On the morning of the 13th we left for Hot Creek, about forty miles away, passing by Twin Springs, where the odometer cart was. To this point there is only a trail, and a very difficult one; the main road was here taken and followed on to Hot Creek, which place was reached about 8 p. m. The valley lying between Reveille and Hot Creek Mountains is a large alkali flat in places, and has a steady fall to the south and east from Hot Creek, and opens into the valley lying east of the Reveille range through a break in the mountains a little east of Twin Springs.

HOT CREEK.

Very little of anything was being done at this district beyond rebuilding a ten-stamp mill, which had been partially burned down. The company known as the Hot Creek or Old Dominion, which formerly owned the mill, failed some time ago, the ore from the mines worked, namely, the Norfolk, Old Dominion, and some others, not paying as soon as any depth was reached. At the time, considerable excitement, purely local, however, existed with regard to some mines recently discovered in Rattlesnake Cañon, about five or six miles to the south; the principal mines located being the Wyoming, Philadelphia, and Pure Metal; some of the ore showing a great amount of copper. The specimens shown were not of a character to cause much enthusiasm. One great peculiarity of this region is the Hot Spring, from which the town takes its name, situated near the eastern opening of the steep cañon, which runs through the mountains at this point. These springs flow continuously, the water containing sulphur and iron. In some cases, springs of cold water are found in close proximity to the hot ones, which appear to break out from between the limestone and porphyry.

MOREY DISTRICT.

The next day Morey District was reached, situated quite high up in the mountains, about fifteen miles to the north of Hot Creek. The weather was very severe here, particularly at night; water freezing, the animals suffered greatly in consequence.

The mines were visited and carefully examined the next day, and were found to be true fissure-veins, with nearly a uniform dip and strike, the former being 45° to 50° to the east, the latter 53° west.

Considerable more had been done here; shafts had been sunk to different depths, running down generally on the inclines, the character of the ore remaining nearly unchanged, the amount in sulphuret, however, increasing. The ore is of a soft, friable nature in most cases, composed of bromides, chlorides, and sulphurets, the chlorides being found principally in pockets. The base metals are iron pyrites, and some antimony.

The Magnolia and Eagle are the two principal mines, and in these the soft, friable nature of the ore is particularly noticeable; in those cases where much pyrites is found the ore is harder and more compact.

The mines are situated in a small hill at the foot of a high peak, and the veins can, in places, be traced by croppings for several hundred feet along the surface. Assays have been made ranging from $300 to $1,100 per ton, although the milling value of the ore does not, as a matter of course, run so high. Water is obtained near at hand from springs, and I think that by constructing a dam across the narrow cañon, sufficient could be obtained to supply a mill during most of the year.

Wood and grass are found near the camp.

Chinese miners are employed here, and are found to get along very well; their expenses of living being much less than those of white miners, the wages are consequently smaller.

On the morning of the 17th we left for Monte Christo Mill, taking a trail across the mountains to the road running from Hot Creek to White Pine, and encamped at night at Sand Springs. Next day went on to Yokum's, passing Duck Water, a settlement of considerable size; the creek of the same name has its origin in a large spring north of the road, and spreads out over a large tract of land, where hay in great quantities is cut each year, most of it finding a ready market at White Pine. From Duck Water on, the road, after breaking through a low range of mountains, turns north into the valley which you passed through on your way from Quinn Cañon.

Respectfully submitted.

D. W. LOCKWOOD,
First Lieutenant, Corps of Engineers.

Lieut. GEO. M. WHEELER,
First Lieutenant Corps of Engineers,
Headquarters Department of California, San Francisco, California.

TABLE OF DISTANCES.

TABLE No. 1.—*Distances from Toano, on Central Pacific Railroad, to Prescott, Ariz., via Egan Cañon, Murray's Creek, and Mouth of Virgin River.*

Camps and stations.	Miles	Miles.	Remarks.
Toano			Station on Central Pacific Railroad
Egan Cañon, (estimated)	80.00	.....	Mining camp on overland road
Murray's Creek, (estimated)	40.00	120.00	Fine camp; plenty water, wood, and grass
Ice Creek	16.16	136.16	Good camp; plenty water, wood, and grass.
The Cave	28.80	164.96	Fine camp; good grazing; pure water
Butterfield Springs	20.92	185.88	Water, good grazing; no wood.
Sink of Sierra Creek	16.67	202.55	Do
Simmond's Spring	31.67	234.22	Water, short supply; little bunch grass; no wood.
Hyko	19.12	253.34	Mining town; good accommodation.
Camp near Pahranagat Lake	26.77	280.11	Water and grass; wood scarce.
Coyote Springs	20.47	300.58	Alkali water; little grass; no wood.
Water Cañon	19.69	320.27	Do
West Point	16.57	336.84	Good camp; wood scarce; water and grass plenty.
Saint Thomas	26.10	362.94	Mormon settlement; good accommodation.
Mouth of Virgin	25.25	388.19	Scant grazing; little wood; poor place.
Yuma Creek, (estimated)	35.00	423.19	Not known.
Peacock Springs, (estimated)	31.00	457.19	Grazing good; water excellent; fine camp.
Fort Rock Springs, (estimated)	23.00	480.19	Grazing and water good; wood scarce.
Camp Toll-Gate	35.33	515.52	Cavalry camp; fine accommodation.
Prescott	42.93	558.45	Mining town of considerable size

NOTE.—In case further developments prove that the distances marked "estimated" in the above table are on feasible routes, the above line of communication will be the practicable one of the future for through travel from Central Pacific Railroad to Northern Arizona. All distances, except those marked "estimated," were measured during the trip.

TABLE NO. 2.—*Distances from Elko, on Central Pacific Railroad, to Prescott, Ariz., via White Pine, Railroad Valley, Quinn Cañon, Indian Spring, Las Vegas, and Hardyville.*

Camps and stations.	Miles.	Miles.	Remarks.
Elko	.....	.....	Station on Central Pacific Railroad.
Crescent Station	7.83	.....	Ranch; wood, grass, and water; good accommodation.
Willow Creek	16.09	23.92	Do.
Camp V	17.16	41.08	Do.
Camp VI	16.10	57.18	Wood, grass, and water.
Overland-road station	4.74	61.92	Telegraph-station; good accommodation.
Warm Springs	13.15	75.07	Ranch; no wood; good accommodation.
Big Tent	21.10	96.17	Stage-station; no extra water; poor accommodation.
Monte Christo Mill	26.10	122.27	Quartz-mill; grazing and water.
Yokum's Station	17.62	139.89	Bull Creek; no grass or wood.
Currant Creek	19.27	159.16	No station; no grazing or wood.
Butterfield Ranch	16.43	175.59	Hay-ranch; no wood; fair accommodation.
Big Creek	25.30	200.89	Water one and one-half miles to east of road; no wood.
Quinn Cañon	19.83	220.72	Toll-gate; ranch, and good accommodation.
Penoyer Spring	24.39	245.11	Small station; little grazing, good water, no wood.
Shafer Springs	9.06	254.17	Water two miles from road; good grazing, no wood.
Crescent Mill	7.15	261.32	Quartz-mill; water scarce, grass scarce, wood plenty.
Summit Spring	27.15	288.47	Muddy water—enough for fifteen or twenty animals; little bunch-grass; no wood.
Quartz Spring	21.32	309.79	No wood or grass; water for six or eight animals.
Indian Spring	27.74	337.53	Water pure, but warm; little wood, scant grazing.
Corn Creek	20.87	358.40	Salt-grass, fair water, no wood.
Tule Springs	11.46	369.86	Good water, no wood, no grazing.
Las Vegas	12.20	382.06	Ranch; good accommodation; salt-grass; forage can be bought; no wood.
El Dorado Cañon	44.83	426.89	No grass, no wood; poor place.
Hardyville, (estimated)	55.00	481.89	Small town on Colorado; grazing and wood scarce.
Alexander's Camp	1.71	483.60	Water, little wood, no grass.
First Water, Union Pass	12.09	495.69	Water, grass, no wood; fair camp.
Union Spring	1.46	497.15	Water; no wood or grass.
Coyote Spring	15.91	513.06	Water, wood, and grass.
Beale Spring	1.92	514.98	Fine water; too limited for camping.
Hualapais Spring	14.38	529.36	One-half mile to right; water bad; good grass.
Natural Tanks	12.82	542.18	Water in rainy season; very little wood; poor camp.
Cottonwood	8.31	550.49	Cottonwood Creek; good camping-ground.
Camp Willow-Grove	3.99	554.48	Military post changed to the Toll-gate.
Fort Rock-Spring	10.21	564.69	Road generally good; deserted ranch; water and grass; no wood.
Anvil Rock	16.20	580.89	Water and grass; no wood; road good
Oaks and Willows	8.06	588.95	Water, wood, and grass; road good.
Camp Toll-Gate	11.05	600.00	Road rough; fine accommodation; cavalry post.
Deserted Ranch	16.30	616.30	Water and wood; no grass; road good.
Lee's Ranch	13.82	630.12	Ranch; good accommodation.
Prescott	11.35	641.47	Mining-town of considerable size.

NOTE.—This route has been traveled to some extent in the fall and winter of 1869 and 1870, principally by small parties of prospectors, going from the vicinities of Elko and White Pine into Northern Arizona. It presents many difficulties, such as tedious and long marches, scarcity of grass, water, and wood, and would not be used if there was a point higher up than Hardyville, at which a crossing of the Colorado connecting with a road leading through to Prescott could be made. Such a point cannot be found before reaching the mouth of the Virgin.

TABLE No. 3.—*Distances from Elko, on Central Pacific Railroad, to mouth of Virgin, via White Pine and Pahranagat Valley.*

Camps and stations.	Miles.	Miles.	Remarks.
Elko	.....	.....	Station on Central Pacific Railroad
Crescent Station	7. 83	.....	Ranch; wood, grass, and water; good accommodation.
Willow Creek	16. 04	23. 92	Do.
Camp V	17. 16	41. 08	Do.
Camp VI	16. 10	57. 18	Wood, grass, and water.
Overland-road station	4. 74	61. 92	Telegraph station; good accommodation.
Warm Springs	13. 15	75. 07	Ranch; no wood; good accommodation.
Big Tent	21. 10	96. 17	Stage station; no extra water; poor accommodation.
Monte Christo Mill	26. 10	122. 27	Quartz mill; grazing and water.
Yokum's Station	17. 62	139. 89	Ball Creek; no grass or wood.
Currant Creek	19. 27	159. 16	No station; no grazing; no wood.
Silver Cañon, (estimated)	55. 00	214. 16	Mining camp; wood plenty; water scarce.
Hyko	9. 50	223. 66	Mining town in Pahranagat Valley.
Camp near Pahranagat Lake	26. 77	250. 43	Good camp; water and grass plenty.
Coyote Springs	20. 47	270. 90	Water bad and in small quantity; little grass; no wood.
Water Cañon	19. 69	290. 59	Water bad; little grass; no wood.
West Point	16. 57	307. 16	Mormon settlement; good camp.
Saint Thomas	26. 10	333. 26	Do.
Mouth of Virgin	25. 25	358. 51	Scant grazing; wood scarce.

NOTE.—This is a route lately opened by fixing the grades of a pass near the Grant District, through which the road, bearing to the southeast, comes into Garden Valley, thence via Silver Cañon to Hyko.

LIST OF CAMPS, &c.

Geographical positions from sextant observations in the field for latitude and time; longitude by telegraphic signals; chronometer differences, &c., during the year 1869.

Station.	Approximate longitude.	Latitude.	Altitude above sea-level.	Variation of needle.	Observer.	Computer.	Remarks.
			Feet.				
Camp Halleck	115 19 31 05	40 48 34.35	5,789.7	16 21 24	Lieuts. Wheeler and Lockwood.	Lieuts. Wheeler and Lockwood.	Longitude by telegraph.
Walker's Ranch	115 27 56.61	40 43 50.67	5,145.9	No obs'n.	Lieut. Wheeler..	Lieut. Wheeler..	Single altitude.
Elko	115 45 37.20	40 49 38.44	5,148.4	17 35 3	Lieuts. Wheeler and Lockwood.	Lieuts. Wheeler and Lockwood.	Longitude by telegraph.
Peko	115 30 14.50	40 55 46.35	5,180.0	.....	.....do	.....do	Do.
Crescent Station	115 40 14.52	40 44 50.73	5,138.3	17 52 23	Lieut. Wheeler.	Lieut. Wheeler..	Single altitude.
Willow Creek	115 49 49.92	40 31 13.91	5,518.5	17 27 7	Lieuts. Wheeler and Lockwood.	Lieuts. Wheeler and Lockwood.	Do.
Pearl Creek	115 40 32.27	40 17 10.54	5,965.1	16 18 51	.....do	.....do	Do.
Camp west of Cold Spring	115 42 2.52	40 4 1.86	6,273.1	17 12 27	.....do	.....do	Do.
Camp Ruby	115 31 6.75	40 3 38.63	6,152.6	17 9 4	.....do	.....do	Longitude by telegraph.
Slough, Long Valley	115 23 11.25	39 49 27.28	6,215.6	16 59 5	.....do	.....do	Single altitude.
Antelope Spring	115 27 36.87	39 25 42.19	7,201.0	17 00 27	.....do	.....do	Do.
Camp near Hamilton	115 25 58.38	39 15 48.87	7,601.3	16 43 29	.....do	.....do	Longitude by telegraph.
Murray's Creek	114 52 13.05	39 15 15.80	6,411.2	16 35 18	.....do	.....do	Time by equal altitudes.
Ice Creek	114 50 24.45	39 2 28.34	7,084.2	16 35 6	.....do	.....do	Do.
Camp in Cave Valley	114 48 52.65	38 39 00.69	6,460.8	16 16 13	.....do	.....do	Do.
Benson's Creek	114 37 26.01	38 40 41.33	6,004.6	16 24 00	.....do	.....do	Single altitude.
Clear Creek, Spring Valley	114 23 18.34	38 50 7.73	6,022.5	16 26 41	.....do	.....do	Do.
Rattlesnake Springs	114 21 18.60	38 57 21.17	6,038.2	16 17 54	.....do	.....do	Time by equal altitudes.
Wheeler's Peak	114 19 46.70	38 58 23.01	13,036.0	.....	Lieut. Wheeler..	Lieut. Wheeler..	Do.
Sacramento District	114 22 4.35	39 9 46.08	6,574.7	16 27 22	Lieuts. Wheeler and Lockwood.	Lieuts. Wheeler and Lockwood.	Do.
Snake Creek	114 8 28.55	39 00 5.18	5,369.0	16 37 50	.....do	.....do	Single altitude.
Hawawah Springs	113 29 27.75	38 28 47.40	5,455.0	16 39 56	.....do	.....do	Time by equal altitudes.
Source of Lake Creek	114 8 45.95	38 40 38.45	5,464.0	15 57 42	.....do	.....do	Do.
Monument Cañon	114 27 28 80	38 38 6.00	6,114.0	16 31 54	.....do	.....do	Single altitude.
Wild Hop Creek, Pioneer Cañon.	114 29 45.60	38 23 16.80	6,928.9	15 59 29	Lieut. Wheeler..	Lieut. Wheeler.	
Sheep Ranch, Cedar Valley	114 20 24.50	38 13 48.10	7,072.7	16 16 26	.....do	.....do	
Homer, Cedar Valley	114 10 12.00	38 3 23.40	5,821.0	17 20 47	.....do	.....do	
Rose Valley	114 15 26.55	37 54 51.20	5,401.0	17 50 9	.....do	.....do	Time by equal altitudes.
Spring below Panaca	114 25 50.50	37 45 27.07	4,718.1	16 58 51	.....do	.....do	Do.
Clover Valley	114 13 50.50	37 30 27.00	4,902.0	14 25 19	Lieuts. Wheeler and Lockwood.	Lieuts. Wheeler and Lockwood.	
Mormon Cañon, Meadow Crk	114 27 24.90	37 16 23.06	3,092.9	No obs'n.	.....	.....	Time by equal altitudes.
West Point	114 34 18 55	36 40 33.56	1,754.9	15 18 29	Lieuts. Wheeler and Lockwood.	Lieuts. Wheeler and Lockwood.	Do.
Near Saint Thomas	114 19 1.95	36 26 33 13	1,600.0	15 47 29	.....do	.....do	Longitude from dead reckoning.
Mouth of Rio Virgen	114 22 33 13	36 8 15.54	1,200.0	15 47 14	.....do	.....do	Do.
Mouth of Vegas Wash	114 10 57.99	36 6 34.85	.....	16 1 5	.....do	.....do	Do.
El Dorado Cañon	114 39 40.98	35 43 55.36	828.0	No obs'n.	.....do	.....do	Do.
Las Vegas Ranch	115 2 49.50	36 14 15.15	2,074.1	15 8 11	.....do	.....do	Time by equal altitudes.
Indian Spring	115 35 33.60	36 34 1.04	3,402.1	15 41 29	.....do	.....do	Do.
Mud Spring	115 36 4.10	37 11 6.88	4,900.0	.....	.....do	.....do	
Crescent Mill	115 25 16.40	37 29 6.88	6,100.0	.....	.....do	.....do	Time by equal altitudes.
Near Schafer Springs	115 26 11 36	37 33 42.88	6,186.0	.....	Lieut. Lockwood.	Lieut. Lockwood.	
Quinn Cañon	115 15 46.35	37 58 18.29	6,326.0	.....	Lieuts. Wheeler and Lockwood.	Lieuts. Wheeler and Lockwood.	Time by equal altitudes.
Monte Christo Mill	115 31 19 20	39 13 16.83	7,596.0	.....	..... do	.....do	Chronometer error on San Francisco determined by telegraph.

ENGINEER DEPARTMENT, U. S. ARMY.

PRELIMINARY REPORT

UPON

A RECONNAISSANCE

THROUGH

SOUTHERN AND SOUTHEASTERN NEVADA,

MADE IN 1869,

BY

FIRST LIEUT. GEO. M. WHEELER, Corps of Engineers, U. S. Army,

ASSISTED BY

FIRST LIEUT. D. W. LOCKWOOD, Corps of Engineers, U. S. Army.

UNDER THE ORDERS OF

BRIG. GEN. E. O. C. ORD,

BVT. MAJ. GEN. U. S. ARMY,

COMMANDING DEPARTMENT OF CALIFORNIA.

WASHINGTON:

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1875.

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