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TREASURY DEPARTMENT,
U. S. COAST AND GEODETIC SURVEY.

HENRY S. PRITCHETT,
SUPERINTENDENT.

DESCRIPTIVE REPORT.

GEODESY.

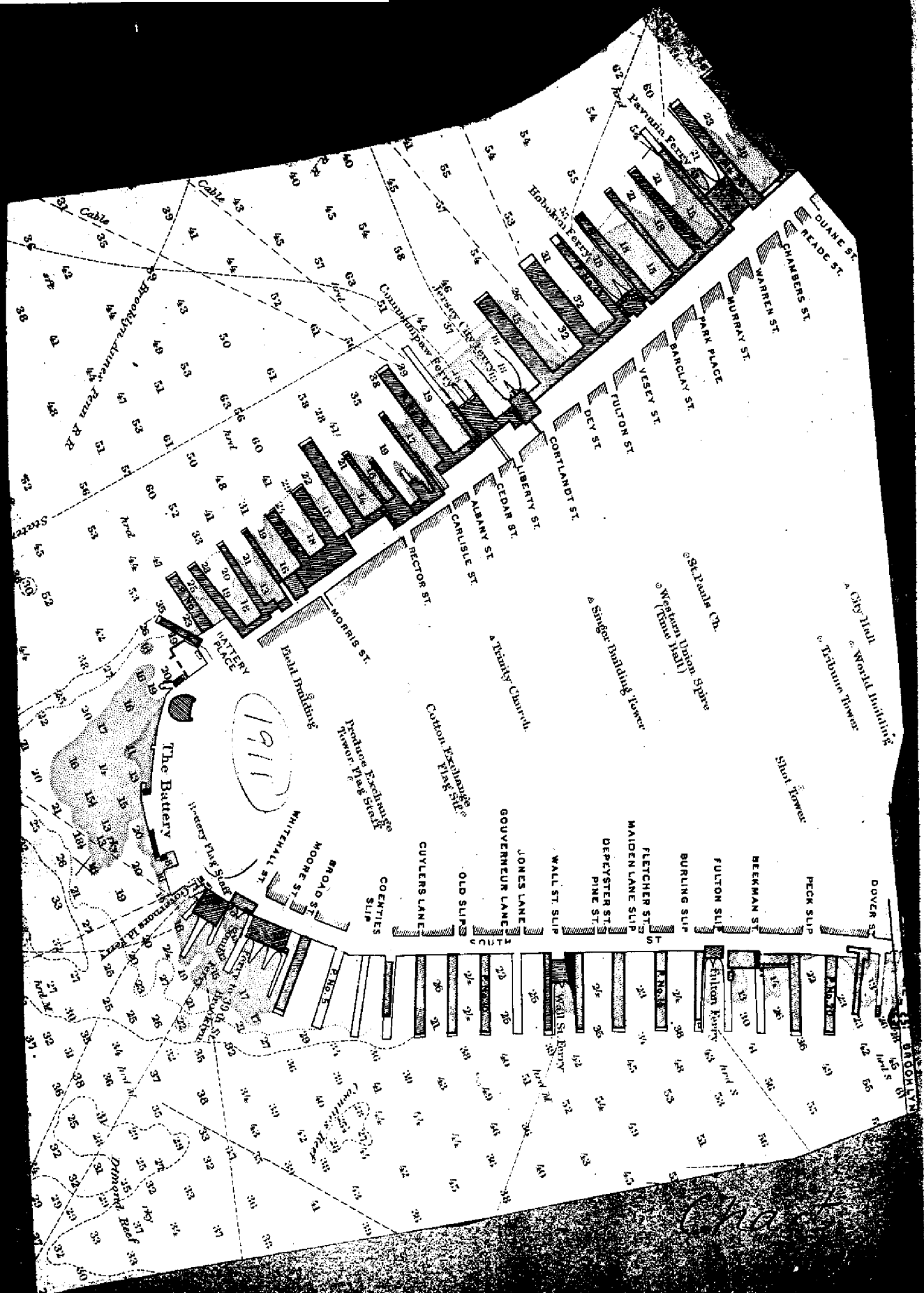
OBLIQUE BOUNDARY LINE BETWEEN
CALIFORNIA AND NEVADA.

By C. H. SINCLAIR, Assistant,
Coast and Geodetic Survey.

APPENDIX No. 3—REPORT FOR 1900.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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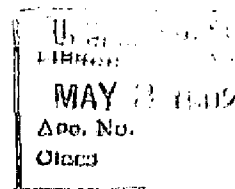
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INTRODUCTORY NOTE.

In 1893 Prof. George Davidson, Assistant, United States Coast and Geodetic Survey, undertook to collect information concerning the early surveys of the eastern boundary of California. His extensive acquaintance with men on the Pacific coast and with the events which have transpired since 1849, from many years residence in San Francisco, and numerous expeditions through the western coast region, gave him great facilities for obtaining accurate knowledge, and he corresponded with many of the surveyors who had been engaged upon the eastern boundary survey in order to ascertain facts in connection with it. This information, in the shape of letters, was kindly turned over to me by him.

While the material concerning work executed less than fifty years ago is not so abundant as might be supposed and some of it is entirely without value, an effort has been made to give an outline of the principal surveys, and to bring together data that may be of future use. The matter here incorporated is limited, principally, to extracts from reports, and to a reproduction on a small scale of such early maps and sketches as could be found. Although it has not been practicable to investigate thoroughly all of the possible sources of information, it is believed that most of the important documents have been examined.

In April, 1900, Assistant Frank W. Edmonds, Coast and Geodetic Survey, examined the records in the offices of the United States surveyors-general at San Francisco, Cal., and Reno, Nev., as well as the offices of the State surveyors-general at Sacramento, Cal., and Carson City, Nev., for material bearing upon the early surveys of this boundary. No trace of the Goddard map could be found, but copies of the map of Houghton & Ives of 1863, and of the extension of that survey by Lawson & McBride in 1865 were found, and a tracing was made of each.

Mr. Edmonds was also able to settle conclusively the fact that a telegraph line ran from San Francisco to Sacramento and Placerville, and thence, via Lake Valley and Genoa, to Carson City, so it is presumed that Lieutenant Ives, who made observations for latitude and longitude in Lake Valley at the south end of Lake Tahoe in 1861, utilized this wire for longitude, as there was a telegraph office at the Lake House, which was very close to his astronomic station near the lake shore.

Nothing could be found relating to the work executed by Lieutenant Ives in 1861 except the allusion to it by Mr. Houghton, surveyor-general, California (Rep. for 1863, pp. 36-37), in which he states that the "field notes and topographic maps" of Lieutenant Ives were delivered to him for examination; that both initial points were determined by Lieutenant Ives, and that the Colorado terminus was marked in three places as $114^{\circ} 36'$. The sketch which shows the river as it was in 1861, is believed to have been copied from the map of Lieutenant Ives.

The Coast and Geodetic Survey Office was drawn upon for computation of the geodetic line, geographic positions, etc. Assistant W. B. Fairfield prepared nearly all of the tabulation, description of stations, and computation of heights. Assistants Baldwin, Nelson, Flynn, Edmonds, and McGrath rendered valuable aid in the computations.

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APPENDIX NO. 3. 1900.

THE OBLIQUE BOUNDARY LINE BETWEEN CALIFORNIA AND NEVADA.

I. FORMATION OF CALIFORNIA AND NEVADA.

After the Mexican war a large territory was ceded to the United States by the treaty of Guadalupe-Hidalgo, February 2, 1848. A portion of this territory was formed into the State of California September 9, 1850. Its limits, in part, as defined by the State constitution, are as follows:

Commencing at the point of intersection of the forty-second degree of north latitude with the one hundred and twentieth degree of longitude west from Greenwich and running south on the line of said one hundred and twentieth degree of west longitude until it intersects the thirty-ninth degree of north latitude; thence running in a straight line in a southeasterly direction to the river Colorado, at a point where it intersects the thirty-fifth degree of north latitude; * * *

The above defines the eastern boundary of the State, but this report only treats of the oblique portion of the eastern boundary—namely, that which is included between the intersection of the thirty-ninth degree of latitude with the one hundred and twentieth meridian and the thirty-fifth degree of latitude with the center of the Colorado River.

Utah was organized as a territory, also, on September 9, 1850, from a portion of the Mexican cession. Its western boundary was made to conform to the eastern boundary of California.

Nevada Territory was formed from Utah Territory on March 2, 1861. It became a State October 31, 1864. Several additions were made to its area before it reached its present dimensions. Its western boundary was made to conform to the eastern boundary of California. Only the oblique portion of this boundary was retraced by the United States Coast and Geodetic Survey.

II. EARLY SURVEYS BEARING ON THE EASTERN BOUNDARY OF CALIFORNIA.

A. SITGREAVES, 1852.

In 1852 Capt. Lorenzo Sitgreaves, United States Topographical Engineer, reached the Colorado River of the West. His sketch of the river and his report are published in Executive Document No. 59, Thirty-second Congress, second session. His nearest camp to the present Camp Mohave was No. 33. One day's march north of this, at

No. 32, observations were made for latitude and longitude. The latitude is given as $35^{\circ} 08' 55''.4$, longitude $114^{\circ} 39' 27''$. From the sketch it will be seen that the longitude of Camp No. 33 is nearly the same as that of No. 32, on the east bank of the river.

The California oblique boundary is shown on the sketch, but it is not prolonged to the river; its prolongation would intersect the thirty-fifth parallel of latitude in longitude $114^{\circ} 40'$, very nearly. This topographic sketch is on a scale of 10 miles to the inch and the topography is too general to be of value here, but it has an historic interest because Mr. G. H. Goddard used Sitgreaves's longitude ($114^{\circ} 40'$) of the Colorado terminus to compute the oblique line from Lake Tahoe (Bigler) to the Colorado River.

B. GODDARD, 1855.

1. INSTRUCTIONS OF SURVEYOR-GENERAL MARLETTE.

The following extracts are made from the "Report of a survey of a portion of the eastern boundary of California and of a reconnaissance of the old Carson and Johnson immigrant roads over the Sierra Nevada, by George H. Goddard, civil engineer."

SURVEYOR-GENERAL'S OFFICE,
Sacramento, August 3, 1855.

SIR: As you are now provided with the necessary men, animals, and instruments, you will proceed without delay to Placerville, en route for Carson Valley. * * *

At or near Carson Valley you will determine, astronomically, with some precision, the position of the *eastern boundary of the State*; and I would suggest that such portion of the *State line* as shall fall *in Carson Valley*, or so much of it as you may deem necessary, be measured and defined with tolerable accuracy. * * *

Very respectfully, your obedient servant,

S. H. MARLETTE, *Surveyor-General*.

GEO. H. GODDARD, Esq., *Civil Engineer, etc.*

INSTRUMENTS.

(1) An altitude and azimuth instrument, by Parkinson & Frodsham, of London; 12-inch horizontal circle, divided to $10'$ and reading to $10''$; 16-inch vertical circle, divided to $5'$ and reading to $5''$; telescope, 4-foot focal length, 3-inch objective, 2 eyepieces, 120 and 180 diameters. The instrument was supported on a central pillar, and the telescope revolved at one extremity of its axis, by which it was more adapted to astronomic than to geodetic purposes.

(2) A very fine $6\frac{1}{2}$ -inch theodolite, of English make and usual construction.

(3) One large chronometer, by Dent, London, No. 1946.

(4) One small chronometer, by Parkinson & Frodsham; London, No. 1628.

Also, a cistern barometer and an aneroid barometer; a sextant and two artificial horizons.

2. LAKE BIGLER (TAHOE) ASTRONOMIC STATION.

"Bigler Lake is a noble sheet of water from 15 to 20 miles in length by 6 to 7 in width. We arrived at its shore at dusk and camped at the point of timber which forms the eastern boundary of the swamps on the southern end of the lake.

"September 15.—I went along the beach of the lake to the mouth of the Truckee River. This beach is a strip of firm, solid ground inclosing the swampy flats. I selected a favorable site for our

astronomical station. * * *. It was near the mouth of the river and sufficiently far from the timber to prevent its interrupting our view. I had a block cut and prepared for the instrument. * * *.

"September 16.—Had a raft made, and floated the block half a mile along the lake shore to the place chosen yesterday. * * *.

"September 18.—* * * In the afternoon crossed the Truckee on our raft and went to the point of timber on the western side of the flats, from which I took bearings on our tent and the flag on the granite block. * * *—(Goddard's report, p. 112.)"

"September 21.—* * * The continued bad weather had prevented my getting the observations I most desired at this camp; still, considering the means I had at my disposal, the result of the survey had been satisfactory, and its main object attained. The position now of the boundary line between Eldorado County and Carson Valley was determined with a very small amount of error, and it only remained to carry that line over the mountains to see exactly where it would fall in the valley.

"Previous to doing this, however, the observations had to be recomputed with the corrected result already obtained, and on that being done a monument should be erected at the point where the boundary leaves the lake, and a station fixed in line therewith on the summit of the ridge above Carson Valley. As this, however, could not be done before the office work required in the first instance was completed, I concluded that it would answer all present purposes to connect Carson Valley with the survey and locate the several settlements there, so that when the map of the entire work was completed the boundary line could be drawn thereon with accuracy, leaving the tracing it off on the ground to a future occasion. (Same, p. 115.)"

3. LONGITUDE, LATITUDE, AND AZIMUTH OF THE OBLIQUE BOUNDARY.

The latitude and longitude of this camp, by a mean of our best observations, is latitude $38^{\circ} 57' 01''$; longitude $119^{\circ} 58' 02''$, and its altitude above the sea 5,850 feet. The initial point formed by the intersection of the thirty-ninth parallel with the one hundred and twentieth meridian is therefore 4 miles distant from the camp, on an azimuth of $30^{\circ} 30'$ west of true north. Assuming the longitude given by Capt. L. Sitgreaves, United States topographical engineer, of the point where the Colorado River crosses the thirty-fifth parallel as $114^{\circ} 40'$, the boundary line will form part of a great circle uniting these two points, and at the thirty-ninth parallel and one hundred and twentieth meridian the line will make a spherical angle with the meridian of S. $48^{\circ} 25' 55''$ E., and at the junction of the $114^{\circ} 40'$ meridian and thirty-fifth parallel of N. $45^{\circ} 13' 05''$ W.

It may prove of interest to insert the results of observations at this station:

Date.	Latitude and longitude.	Remarks.
Sept. 16	38 57 06.1	Mean of transit observations.
18	57 13.2	Mean of transit observations.
20	57 01.1	Mean of 10 transit observations.
21	56 20.6	Mean of sextant observations.
Adopted latitude	38 57 01.1	
Sept. 18	119 58 15	By rate.
18	56 30	First satellite of Jupiter.
19	58 00	Third satellite of Jupiter.
20	58 48	Lunar transit, imperfect.
Adopted longitude	119 58 08.2	

Accompanying the report the following maps were mentioned:

(1) A topographic map of the country embraced in the survey, showing the boundary line between the State of California and the Territory of Utah from the

intersection of the one hundred and twentieth meridian and thirty-ninth parallel, as far as surveyed, on a scale of 2 miles to the inch.

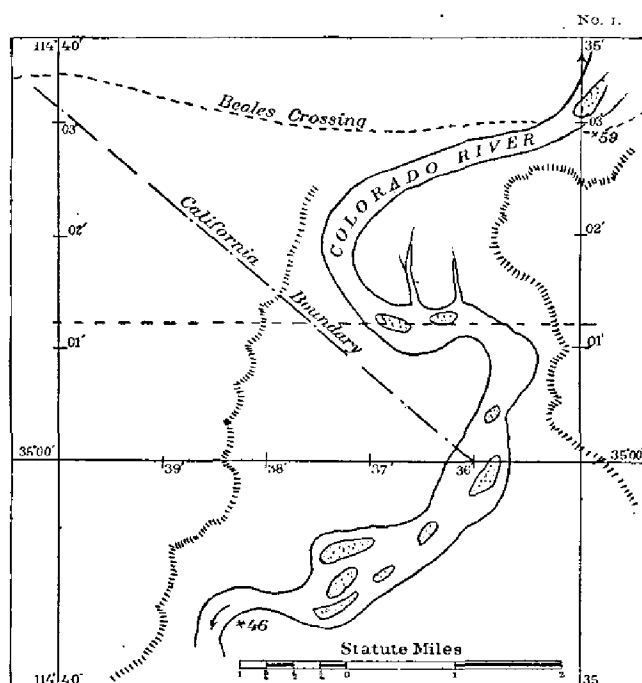
(2) Map of the lines of the triangulation.

(3) Section showing the profiles of the old Carson and Johnson roads, etc. None of these maps could be found.

C. LIEUT. JOSEPH C. IVES, 1858 AND 1861.

1. COLORADO RIVER EXPLORATION, 1858.

In 1858 Lieut. Joseph C. Ives, United States topographical engineer, made a reconnaissance of the Colorado River, and a map of the expedition was published on a scale of 6 miles to the inch. That



From Explorations of Lieut. Ives, 1858

portion of the map near the thirty-fifth parallel was enlarged and is inserted to show the approximate shape and direction of the river at that time. A report of the expedition is found in House Executive Document No. 90, Thirty-sixth Congress, first session, Washington, 1861.

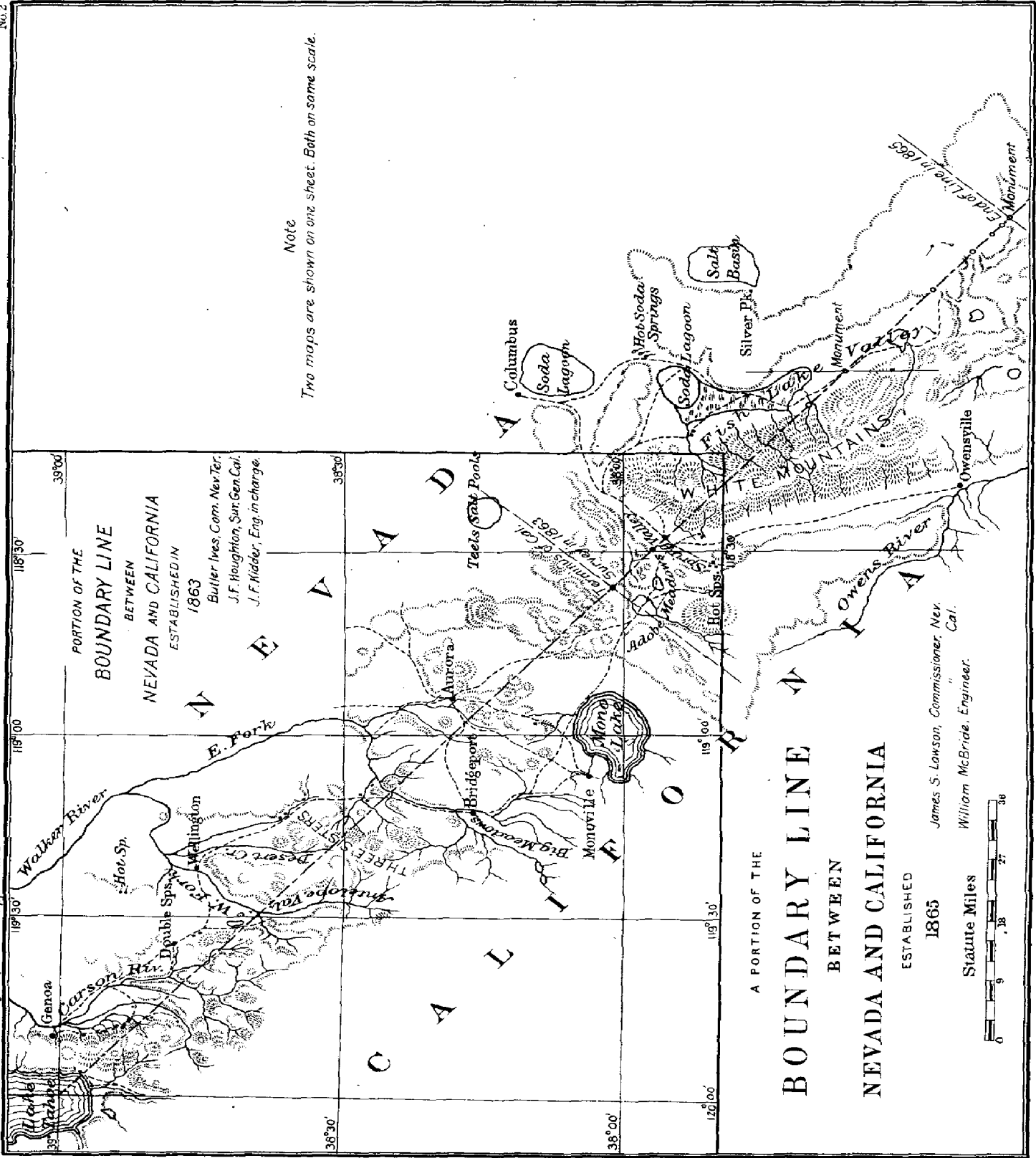
Another sketch, headed "From Lieut. Ives's Topographical Notes, 1863?" (1861 probably), shows Ives's observatory, and the Colorado River, at latitude 35°, with longitude 114° 36' drawn at the channel crossing. Very little could be learned about his Colorado River work in 1861. This sketch is on a scale of 1 inch to the mile.

Lieut. J. C. Ives did no work on the Colorado in

1863 because it was during the civil war, but he is sometimes confounded with Butler Ives, commissioner from Nevada in 1863, for tracing the boundary southeast from Lake Tahoe in connection with Surveyor-General J. F. Houghton, of California.

2. LONGITUDE AND LATITUDE, SOUTH END OF LAKE TAHOE.

In 1861, Lieut. Joseph C. Ives, under direction of the Department of the Interior, made observations for latitude and longitude at the south end of Lake Tahoe to locate the northwest terminus of the oblique boundary of California. These observations were completed and he reported to the Secretary of the Interior under date of August 30,



1861, that the field astronomic duty was completed, and it only remained after the computations were made to run the line, which any surveyor could accomplish. Finally, on the 11th September, 1861, Lieutenant Ives, pursuant to instructions from the Department, turned over to the United States surveyor-general's office (California) the field notes, maps, reports, and computations of the astronomic observations which had been taken. (See Annual Report General Land Office, 1865, pp. 13, 14.) These field notes, maps, etc., were in the office of the surveyor-general of California (E. F. Beale) in 1863, and were examined by Mr. J. F. Houghton.

I have no evidence as to when the work on the Colorado River at latitude 35° was executed, but presumably in 1861, from reference to it by Mr. Houghton. No one knows what became of these maps, etc., of Lieutenant Ives; letters were written to Mr. Houghton, who examined them personally, to the United States surveyors-general of California and of Nevada; to the surveyors-general of the same States, and to the General Land Office, Washington, D. C., and finally Assistant F. W. Edmonds searched the offices of the surveyors-general in California and Nevada in vain.

Although the legislature of Nevada authorized the governor to have the boundary between California and Nevada established from Lake Bigler (Tahoe) as far southeast as Esmeralda, by act approved November 29, 1861, the following letter from the surveyor-general of Nevada shows that nothing was done until 1863:

CARSON CITY, NEV., June 21, 1900.

MR. C. H. SINCLAIR,

United States Coast and Geodetic Survey, Washington, D. C.

DEAR SIR: In reply to your inquiry of the 16th instant, I beg to state that the Territorial legislature of Nevada, by act approved November 29, 1861, authorized the governor "to have the boundary line between the State of California and the Territory of Nevada surveyed and established from Lake Bigler to below or south of Esmeralda, at as early a day as practicable." One thousand dollars were appropriated for the purpose, but the act provided "that if the State of California shall establish the boundary line before the 1st day of March, 1862, then this act shall be null and void."

The records do not show that any action was taken by the Territory of Nevada or State of California until 1863, when the line was surveyed from Lake Bigler to Mount Diablo base line in Esmeralda County, Nev.; Butler Ives, commissioner for Nevada; J. F. Houghton, surveyor-general of California; J. F. Kidder, engineer in charge. This is the first survey of the boundary line south of Lake Bigler or Tahoe of which I can find any record.

* * * No field work was done under the act of 1861 in 1861, nor, so far as I can ascertain, before 1863.

Respectfully, yours,

E. D. KELLEY,
Surveyor-General and State Land Register.

D. J. F. HOUGHTON AND BUTLER IVES, 1863.

1. LONGITUDE AND LATITUDE, SOUTH END OF LAKE TAHOE.

The Report Surveyor-General California, 1863, contains the following statement:

"By an act of the legislature approved April 27, 1863, it was made the duty of the surveyor-general of the State to define and establish the entire eastern boundary line of the State by running, measuring, and marking a transit line between the point of intersection of the thirty-ninth parallel of north latitude with the one hundred and twentieth degree of longitude west from Greenwich, near Lake Tahoe and the point where the thirty-fifth degree crosses the Colorado River, as the said points were established by Lieutenant Ives, chief astronomer of the United States Boundary Commission, appointed for that purpose." * * *

In 1861 the Territorial legislature of Nevada authorized the governor to have the boundary line run from Lake Tahoe as far southeast as Esmeralda to determine the position of Aurora with reference to the boundary line.

3. LONGITUDE RESULTS OF LIEUTENANT IVES AT LAKE TAHOE AND THE COLORADO RIVER.

"In order to establish the initial point at Lake Tahoe, which was necessary before the work could proceed, Mr. Kidder placed himself in communication with Lieutenant Ives, then at work at his observatory in Lake Valley, who in his answer, dated August 28, 1861, says: "I trust our observations this week will give us our longitude with reference to San Francisco." And fourteen days later he telegraphed from San Francisco, September 11, 1861, to Mr. Kidder as follows: "Approximate longitude of station is seven hours fifty-nine minutes and fifty-three seconds west of Greenwich," all of which correspondence and telegrams are in my possession, on file in this office.

* * * * *

"The initial point on the Colorado River is by act of Congress admitting the State of California into the Union where the thirty-fifth parallel crosses the Colorado, which is marked in *three different places upon the topographical field books and maps accompanying Lieutenant Ives's survey as 114° 36' west* from Greenwich, at which place a monument was placed, distant about 2 miles from Fort Mojave. (Report Surveyor-General California, 1863, p. 36.)"

The azimuth of the line was computed at the Office of the United States Coast Survey.

The oblique line was run 102 miles and 46 chains southeast from Lake Tahoe beyond Aurora nearly to the White Mountains, where Indians and the approach of winter put a stop to the field work. No work was executed at the Colorado River end of the line, as it was evidently the intention to trace the line through from Lake Tahoe to the terminus located by Lieutenant Ives on the Colorado, and correct back.

A copy of the map showing this survey on a scale of 6 miles to the inch is in the office of the surveyor-general of Nevada, at Carson City. A tracing was made for the United States Coast and Geodetic Survey, where it is on file. This map is shown here, on a reduced scale, on the same sheet with the map of the continuation of the boundary survey, for a distance of 73 miles 1192 chains, in 1865, by William McBride, engineer, and James S. Lawson, commissioner, of Nevada.

INSTRUMENTS.

For astronomic work an alt-azimuth by Parkinson and Frodsham, of London, with a 12-inch horizontal circle reading to ten seconds and 16-inch vertical circle reading to five seconds, telescope 4 feet focal length, was used. This is probably the instrument used by Goddard in 1855. For ranging out the line a straight-line transit by Temple, of Boston, a model of superior workmanship, was secured.

4. SOUNDINGS IN LAKE TAHOE ALONG THE ONE HUNDRED AND TWENTIETH MERIDIAN.

The average depth of 21 soundings taken on the one hundred and twentieth meridian is 934'24 feet; that of 12 soundings extending over a distance of 12 consecutive miles, exclusive of 3 on the north and 6 on the south shore, is 1424'6 feet. The greatest depth reached was 1523 feet. The deep soundings invariably show the bottom to be composed of fine, impalpable mud, except one made some 3 miles from the north shore, where the lead was bruised upon a rocky bottom at a depth of 1242 feet. The shoal soundings gave a bottom of sand, or sand, gravel, and bowlders. Its waters are transparent, and abound in the finest quality of lake trout. Its outlet is the Truckee River, which at the

point where it debouches from the lake has a capacity equal to a current 4 feet deep by 60 in width moving at the rate of 3 miles per hour. It is fed by numerous streams from the surrounding mountains, many of whose highest peaks are covered with perpetual snow. Its shores for the greater part are bold and rocky, alternating with sand and shingle beaches in the more sheltered places. (Report Surveyor-General California, 1863, p. 54.)

E. JAMES S. LAWSON. 1865.

This line was a prolongation of the line run by Houghton and Ives in 1863. James S. Lawson was appointed commissioner by the governor of Nevada under the act of February 7, 1865, amended March 10, 1865, these being the dates of approval by the legislature. The commissioner was directed to survey and establish the western boundary line of the State of Nevada for a distance of 70 miles from the point where the same had been suspended by the joint commission from the State of California and the Territory of Nevada in 1863. He says:

"I engaged the services of William McBride, a thorough and competent surveyor and engineer, at the maximum rate allowed, to wit, \$45 per mile. * * * On the 1st of May we reached the terminus of the California survey, which was readily found, as I had been one of the party comprising that expedition in 1863, and had been upon the ground again in 1864 to aid in further securing the points of the line at this place.

"The monuments and marks were undisturbed, and no difficulty was found in determining the course of the line from the center points established beneath the mounds, as well as from the original stakes, which were still standing, and which were found to coincide with the holes drilled in the rocks.

"From these center points the line was continued with a new and carefully adjusted instrument of superior make by reversals at each setting upon fore and back sights. * * *

"No new observations were necessary in extending the line from the end of the California survey, as those above referred to are believed to be correct, and the fullest assurance is felt of the accuracy of that work in the field; hence it was deemed advisable to extend the boundary from the points already established. * * *

"On the 1st of June we had reached the end of the seventieth mile, the limit of the work by the provision of the act authorizing the survey. This point being difficult of access as well as description, I deemed it advisable to continue the line to a more favorable point, which was found upon an isolated ridge of rocks at the head of a valley extending south and eastward at a distance of 3 miles 11.92 chains in advance, and which, being marked by hole in rock and mound of stone, may readily be found from the map and field notes accompanying the report.

"Substantial monuments and marks were made at the most conspicuous points, sufficient to define the course of the line and perpetuate it for a long time and until cut-stone or other monuments shall be required."

A reproduction of this map, reduced from a tracing, will be found among the illustrations of this report. This map is on the same sheet with the Houghton and Ives survey of 1863, being a prolongation of that survey to the southeast. The original, which is in the surveyor-general's office, was on a scale of 6 miles to the inch. Three thousand four hundred and fifty dollars were appropriated to meet the expenses of this survey.

F. EXAMINATION OF ARCHIVES IN CALIFORNIA AND NEVADA BY ASSISTANT F. W. EDMONDS, FOR MATERIAL BEARING ON EARLY SURVEYS.

SAN FRANCISCO, CAL., May 3, 1900.

Dr. HENRY S. PRITCHETT,

Superintendent United States Coast and Geodetic Survey, Washington, D. C.

SIR: I have the honor to submit the following report upon the work assigned to me by your instructions dated March 24, 1900, to gather data bearing upon the early surveys of the eastern boundary of California, from Lake Tahoe to the Colorado River:

I. SEARCH FOR NOTES AND MAPS OF LIEUTENANT IVES IN SAN FRANCISCO.

On Monday, April 2, I called upon the United States surveyor-general at San Francisco, who immediately ordered a search made through the files of his office for maps and field notes, etc. Nothing was found there but the records of the Von Schmidt survey of 1872-73. While this search was going on I examined the letter books of United States Surveyor-General E. F. Beale, who held office in 1863, and found the following letter addressed to Surveyor-General Houghton, dated March 23, 1863:

"Yours of the 20th instant duly at hand. I have made careful examination of books and sketches left in my charge by Lieutenant Ives, late of the boundary commission. I find upon his topographical sketches that the initial point is set down as $114^{\circ} 36'$ west of Greenwich."

"I can find no data referring to Lake Bigler, of the intersection of the thirty-ninth parallel north latitude and the one hundred and twentieth parallel west longitude from Greenwich."

The foregoing letter is doubtless the basis of the following statement, quoted from Surveyor General Houghton's Report for 1863, p. 36:

"A careful search for his observations for longitude resulted * * * in a failure to find them among his notes."

a. *Telegraph line from San Francisco to Placerville, Lake Valley, Genoa, and Carson, in 1859 or 1860.*

I have taken considerable pains to settle, if possible, the question of Lieutenant Ives's longitude observations in Lake Valley, and have corresponded with a number of persons and interviewed others. I here submit the result of my inquiries.

In regard to the existence of a telegraph line at that time there is no doubt. I quote the following extracts from letters written to me by Mr. James Gamble, who had charge of the lines of the old California State Telegraph Company:

"I can not give you the exact date of the completion of the first line connecting San Francisco with Carson City without referring to my scrapbook, which is in my desk at San Francisco, but will do so the first time I am in San Francisco if desired. It was about 1859 or 1860. I think that a company known as the Humboldt Telegraph Company completed a line between Placerville and Carson City, Virginia, and Gold Hill. At Placerville this line connected with the California State Telegraph Company of which I was the general manager. The Humboldt and other lines in California were consolidated with the California State Company in 1860, and all placed under my management, when the Overland Telegraph Company was organized to build the line from Virginia City to Salt Lake, there to connect with the Western Union, which was then building west. This line was built under my direction in 1861 and completed on the 24th day of October of that year, giving California direct communication with the eastern States. * * *

"The telegraph station in 1861 was at Yank's, on the old stage road, and from there the wire followed the road to Genoa. I am under the impression that Ives had a telegraph connection with his camp, but cannot locate it. * * *

"Yank, or Clements, his proper name, had his station on the old stage road some distance south of the lake. He afterwards rented or purchased Tallac, where he kept a place for tourists. * * * Mr. Clements is not living."

The following is extracted from two letters of Mr. Frank Bell, one of Mr. Gamble's old assistants, who had personal charge of the mountain wires:

"I took charge of the lines in 1862. Yank's station was about 6 miles from lake, the shortest route, and about 7 miles from the Lake House. The Lake House was situated directly on the lake, our wire passing it. *We had an office at Lake House.* Goddard's station was $1\frac{1}{2}$ miles east of Lake House or 1 mile west of Friday's station, but at the time the first survey was made Captain Lapham kept this station; Goddard did not keep it for some years afterward. It is only a few hundred yards from the lake. Lake House was nearest point the wire ran to the lake." * * *

b. Telegraphic longitude by Lieutenant Ives, 1861.

"At time you refer to (August and September, 1861) I was in Los Angeles. My recollection is that this matter was talked over after my return. I have an impression that an attempt was made to use the telegraph which had been completed shortly previous, but not being very well equipped with repeaters, was not very successful."

Mr. George Senf was stationed at Sacramento at the time of the Ives survey, and he tells me that he *remembers* Lieutenant Ives and the fact of *his using the telegraph line for his longitude work in Lake Valley*, but he does not recall whether the results were successful. He is now employed in the Western Union Telegraph office at San Francisco.

On September 11, 1861, Lieutenant Ives telegraphed Mr. Kidder the "approximate longitude" of his station, and as he had made use of the wire for three weeks from San Francisco it would seem to indicate that some difficulty was experienced in successfully obtaining the exchange with San Francisco; probably, as Mr. Bell says, due to the lack of a sufficient number of repeaters along the line.

2. SEARCH FOR NOTES AND MAPS IN SACRAMENTO.

At Sacramento I made a very careful search in the surveyor-general's office for the maps and field notes of Lieutenant Ives, personally opening and examining all the rolls of old maps in the office. I was given free access to the files, but could find nothing bearing upon his work. Professor Davidson in writing to me said:

"The Ives story I long since consigned to the unattainable. His notes were not in the public office, nor were they in the private papers of General Houghton, because he had them all looked over. I was well acquainted with the keeper of the archives in San Francisco and they were not findable."

a. Goddard map (of 1855) lost.

Neither the Goddard nor the Houghton and Kidder maps could be found in the Sacramento office. Upon returning to San Francisco I called on Mr. Goddard at his office, and he told me that his map was not turned over by him, owing to the fact that he was not paid to complete it, but that later it was purchased by Lieutenant Wheeler for the sum of \$100; it finally fell into the hands of the State university, where it was lost track of, and when Mr. Goddard himself sought to recover it the map could not be found.

b. Goddard monuments on oblique boundary.

It (the Goddard map) was on a scale of 2 miles to the inch, and showed the position of *his astronomic station at the lake*, the monument marking the line there, and the *two monuments* which he set at the terminus of the line near the crossing of the road, about

15 miles southeast of the lake. One of these monuments was placed close to the road and the other on the summit of a hill about 200 feet above the surrounding valley. No intermediate marks were established.

Mr. Goddard spoke of some of the hardships he encountered while making his survey, one of the most serious of which was the hostile Indians, who killed some of his animals.

In his longitude work at the lake he used two chronometers, which he says varied considerably in their rates, due to transportation over the mountains. His longitude depended on the mean of several observations made of the eclipses of the satellites of Jupiter. About this time some of his party left him, and he remained with one man for some time to obtain a "lunar." The weather was cloudy, however, and he had to leave, destroying much of his equipment to prevent it from falling into the hands of the Indians.

When his survey was made the Territory of Utah wanted to establish a court at the Mormon town of Genoa, and it was made a part of his duty to determine on which side of the line the town was situated.

In the surveyor-general's office at Sacramento I discovered three maps rolled together, marked on the outside in pencil "Higley's East Boundary Survey." One of these I traced and refer to as Exhibit A.* It shows topography along the shore of the lake, while the one adjoining this on the north extends a distance of 35 miles to Sierra Valley and shows the topography on either side of the one hundred and twentieth meridian for a width of 4 or 5 miles. The third sheet extends to the westward of Sierra Valley about 25 miles to Jackson, on the Yuba River. No one in the office knew anything about these maps, and they bear no title except the pencil inscription on the back. Higley was surveyor-general of California from 1858 to 1861, to near the end of the year. He did not personally go into the field. The shore line on the west side of the lake is in pencil, as well as a portion of the oblique line, and I have copied the ink and pencil portions just as they were on the original.

Later, in Carson City, I came across the following, which I believe refers to this map:

"LAWS OF THE TERRITORY OF NEVADA, PASSED AT THE FIRST REGULAR SESSION OF THE LEGISLATIVE ASSEMBLY, WHICH WAS HELD AT CARSON CITY, OCTOBER AND NOVEMBER, 1861.

CHAP. XLIII.—*An Act to audit the claim of John F. Kidder for surveying the boundary line between California and the Territory of Nevada. (Approved November 28, 1861.)*

Be it enacted, by the Governor and Legislative assembly of the Territory of Nevada, as follows:

SECTION 1. That the account and claim of John F. Kidder, deputy United States surveyor, for making survey of the boundary line between California and the Territory of Nevada, from the initial point at Lake Bigler to Honey Lake, be, and the same is, hereby audited and allowed as indebtedness against the Territory.

SECTION 2: It shall be the duty of the Territorial auditor, as soon as said officer shall have been elected or appointed, to issue a warrant, payable out of the revenue, to said John F. Kidder, for the amount of five hundred and fifty dollars (\$550) of his claim. The said warrant shall draw interest from the time of its issuance until paid, at the rate of ten per centum per annum.

SECTION 3. It shall be the duty of the Territorial treasurer to pay said warrant out of any moneys not otherwise appropriated, collected into the treasury of the Territory".

*This tracing is at the United States Coast and Geodetic Survey Office, Washington, D. C. It is not of special interest and is not shown here.

About this time Mr. Kidder was chief clerk in the United States surveyor-general's office for Nevada Territory, and an act of the Territorial legislature approved November, 1861, provided for the running of the line to below Esmeralda, provided the same was not run by the State of California before the 1st day of March, 1862.

I feel confident that this map is the work of Mr. Kidder, the more especially as I am informed there was no other work to the north of the lake as early as 1861.

Mr. Kidder is now in too critical a condition to be communicated with.

* * * * *

3. SEARCH FOR NOTES AND MAPS IN RENO AND CARSON CITY.

On April 12 I arrived at Reno, Nev., where I called upon the United States surveyor-general, but found nothing pertaining to the boundary except the map and field notes of the Von Schmidt survey.

a. *Maps of 1863 and 1865.*

The following morning I went to Carson City, and there called upon the surveyor-general of the State. I was much pleased to find the maps of Houghton and Kidder of 1863, showing the entire survey from the lake northward to the Oregon line, and from the lake southeastward to the White Mountains, where the survey terminated. * * *

In addition to the above I found a map of the same scale (6 miles to the inch) by James S. Lawson, in 1865, commissioner for the State of Nevada to survey and establish the western boundary of the State for a distance of 70 miles from the terminus of the survey of 1863.

* * * * *

Very respectfully submitted.

FRANK W. EDMONDS,

Assistant, United States Coast and Geodetic Survey.

G. DANIEL G. MAJOR, 1868.—ONE HUNDRED AND TWENTIETH MERIDIAN.

The following extracts from the field notes of Daniel G. Major, on the California and Oregon boundary, were obtained from the United States Land Office, Washington, D. C.:

Latitude of observatory established near Camp Bidwell.....	41° 51' 34''·4
Thence north to forty-second parallel	8' 25''·6
8' 25''·6=9 miles 55 chains.	
Longitude of observatory established near Camp Bidwell.....	120° 05' 47''·55
Thence east to California-Nevada boundary.....	5' 47''·55
5' 47''·55=5 miles 35 yards.	

* * * * *

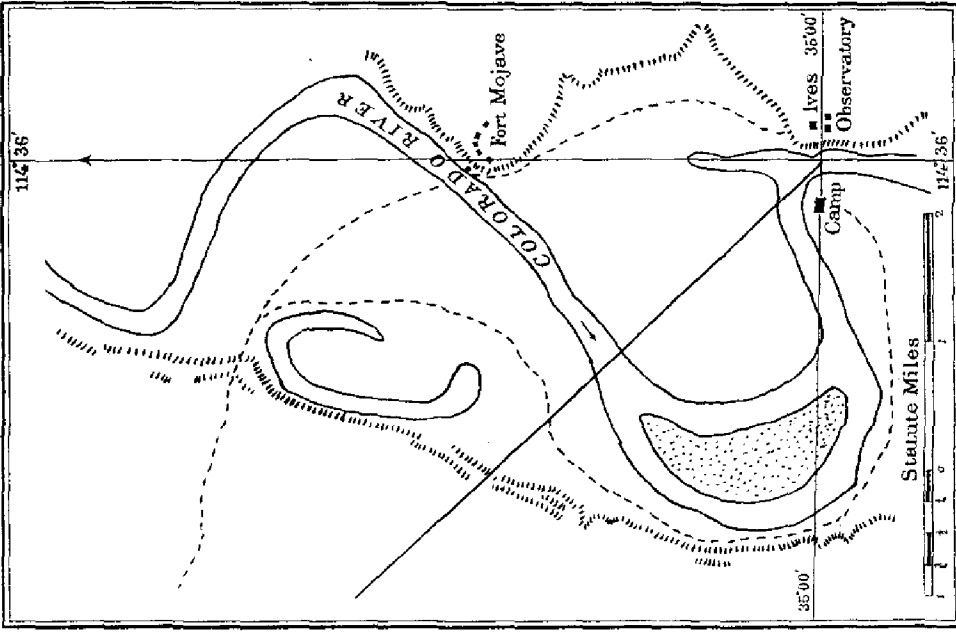
Thence measured east 38·38 chs. and reached the intersection of the 120° meridian of west longitude with 42nd parallel of north latitude the corner of the boundary of California and Nevada on the southern boundary line of the State of Oregon.

Established, therefore, at a point 4 m. 78·38 chs. E. and 9 m. 56 chs. north of the observatory at Camp Bidwell, the initial point and monument at the intersection of the 120th meridian with the 42nd parallel on southern boundary of Oregon, situated on the north side of a long rocky hill 13 chs. north of a station known as "12 Mile Creek" (from Bidwell), also 10 chs. north of a new military road from Camp Bidwell and Surprise Valley to Fort Warner.

On night of Sept. 11th, having transit instrument over the initial point of boundary, observed Polaris at greatest eastern elongation and found that the mean of several determinations marked off

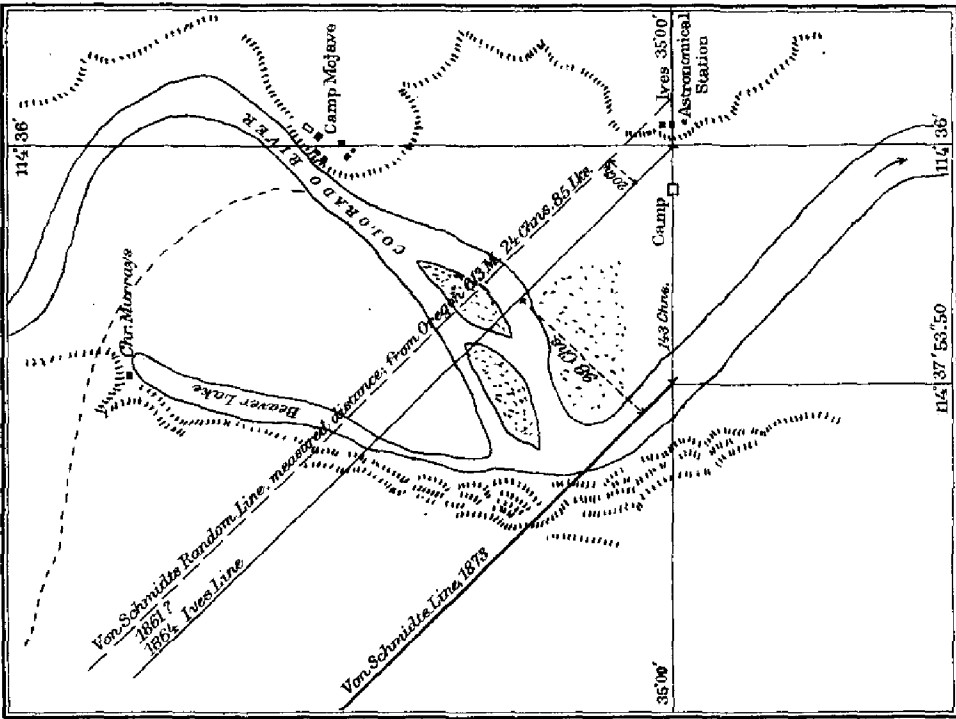
Coast and Geodetic Survey Report 1900, Appendix 3

No. 4



From Lieut. Ives Topographical Notes, 1863 (1861?)

No. 5



From Topographical Notes of A. W. Von Schmidt, 1873

THE ABOVE NOTES ON PHOTOGRAPHIC SURVEYING

on the earth's surface agreed substantially with line as run by observations at observatory, Camp Bidwell. * * *

Made deep excavation near rocky ledge; deposited three large black bottles (glass), also charred cottonwood stake 30 inches long and 6 inches circumference; built about it a monument of large stones, well shapen, circular, 9 ft. diameter, 7 ft. high, 4 ft. diameter at top, surmounted by a dressed sandstone 20" x 20" x 10", marked as follows in deeply cut characters, viz: On north face, "Oregon;" on south face, "Long: 120°," "Lat: 42°;" on east face, "Nevada;" on west, "California;" on top, "D. G. Major, U. S. Astr., 1868."

Distance to large rock 4 ft. x 4 ft. 30 links, direction S. W. to large rock 3 ft. x 3 ft., dist. 22 links, direction N. Planted a juniper post 6 ft. long, 8 inches square at top, marked on S. E. "N," on S. W. "C," on N. W. face "O," on N. E. face "1868, 120° L, 42° L." Blazed and marked many trees in creek bottom."

This extract from the field notes does not describe the method of determining the latitude and the longitude, nor the instruments used, except a mention of transit. It may be assumed that the longitude was not telegraphic, because in 1872 Von Schmidt found, by prolonging the one hundred and twentieth meridian from Verdi northward to the forty-second latitude, that the northeast angle or corner of D. G. Major was 3 miles too far west. The Verdi longitude was determined by telegraph, from San Francisco.

The notes of D. G. Major state that at the observatory established at Camp Bidwell—

"A lengthy series of astronomical, magnetic, and barometric observations were made, extending into three lunations, for the purpose of ascertaining the intersection of the one hundred and twentieth meridian with the forty-second parallel, a geographical position of much importance, it being the initial point of the California-Nevada line on the Oregon boundary.

Over three thousand observations were made at this observatory, and the results deduced after a rigorous discussion were reduced to Camp Bidwell, and are perpetuated on a stone monument. * * *

On the cap stone surmounting the monument I engraved the latitude, longitude, magnetic variation, and altitude above mean sea level; also the hour lines for a sun dial."

Col. Robert S. Williamson, United States Engineer Corps, about 1868 set a monument near Verdi, supposed to mark the one hundred and twentieth meridian.

H. THE ALEXEY W. VON SCHMIDT LINE, 1872-1873.

On July 20, 1872, Willis Drummond, Commissioner of the General Land Office, entered into contract with Alexey W. von Schmidt to run the eastern boundary of California, as defined by article 12 of the constitution of said State and confirmed by act of Congress entitled "An act for the admission of the State of California into the Union," approved September 9, 1850 (Stat. L., Vol. IX, p. 452). The consideration was \$41 200, and bond was given for \$82 400. He was required to make all of the determinations of latitude, longitude, and azimuth in his own proper person. For determining longitude on the line of the Central Pacific Railroad he was permitted to use the telegraph either with Salt Lake City or San Francisco. The northeast corner of California, as established by D. G. Major, was made by the Department the initial point of the survey, and the numbering of the successive miles was to begin from the Oregon boundary, or forty-second parallel of latitude.

In his field notes Von Schmidt states that he established a point at Crystal Peak, near Verdi, Nev., by telegraph, as the one hundred and twentieth degree of longitude west from Greenwich, and traced that meridian north to the forty-second degree of latitude, the south boundary of Oregon, and established the northeast corner of

California more than 3 miles to the east of the point located as such northeast corner by Daniel G. Major in 1868. He states:

From Major's corner I therefore ran east * * * 258.73 chs., at which point I established a large stone monument for the northeast corner of the State of California * * *. The monument consists of a post 8 ft. long and 8 inches square, marked on the north side "O Lat. 42 deg.;" east side, "Nevada;" south side, "1872, Long. 120 deg.;" west side, "California." This post is solidly built into a stone mound $6\frac{1}{2}$ ft. high with 8 ft. base and projects three feet from the mound. * * *. At the half height of the mound four large stones are inserted, the one facing to the south marked "1872 A. W. von Schmidt, Long. 120°, Lat. 42°;" one facing west marked "C;" one facing to the north marked "O;" and the other, facing to the east, marked "N."

From the longitude established at Verdi the one hundred and twentieth meridian was carried to the north shore of Lake Tahoe. In 1873 he began field work on the north shore of Lake Tahoe, set up two signal poles for a range on the one hundred and twentieth meridian, and noted where the prolongation of this meridian struck the mountains and a snow patch on the hills south of Lake Tahoe; then, having procured the steamer *Truckee*, on a calm day he went across the lake, keeping in line by means of the range, and put up a flag at the point of landing. He states:

I next proceeded to take observations of Polaris * * *. Having laid off the true meridian, I proceeded to observe my fire signals and flag at the northerly end of the lake, and found that by moving my position at the south end of the lake two chains to the west from the flag set up at the point of landing I was on the true 120th meridian.

I continued these observations for three days and nights in succession, using flag signals by day and fire signals by night, until I became satisfied I was on the true meridian as brought down from Verdi, where it had been established by telegraph, namely, the 120th degree of longitude west from Greenwich.

1. LONGITUDE OF VERDI, ONE HUNDRED AND TWENTIETH MERIDIAN, 1872.

In 1872, at the request of another Department, the Superintendent of the United States Coast Survey directed Assistant George Davidson to determine the one hundred and twentieth meridian at the crossing of the Central Pacific Railroad. This was done by the interchange of telegraphic longitude signals at Washington square, San Francisco, the old Coast Survey station of 1869, and a station established to the east of Verdi by Mr. S. R. Throckmorton, Aid, United States Coast Survey. Six nights' exchanges of signals were obtained, and personal equation was determined on five nights by the observers. The one hundred and twentieth meridian was located by triangulating a distance of something like 2 miles west from the astronomic station. This work was tested in 1889, when the primary longitude of the United States reached Verdi, and the difference was less than 3 feet.

In the report of the surveyor-general of California for 1890, page 15, the following statement is made by Grunsky and Minto:

The initial point of the Von Schmidt survey was the observatory station occupied by Prof. George Davidson at Verdi in 1872. From this point the position of the 120th degree of longitude west from Greenwich was established, and thence the meridian line was extended northward to the 42nd degree of north latitude and southward to Lake Bigler. The accuracy of the work along this part of the boundary of the State has never before been brought into question; but the results of our work, as hereinafter shown, indicate that, although the point near Verdi was correctly established, the line marked by monuments as the boundary is 1 609 ft. too far west at the northern shore of the lake.

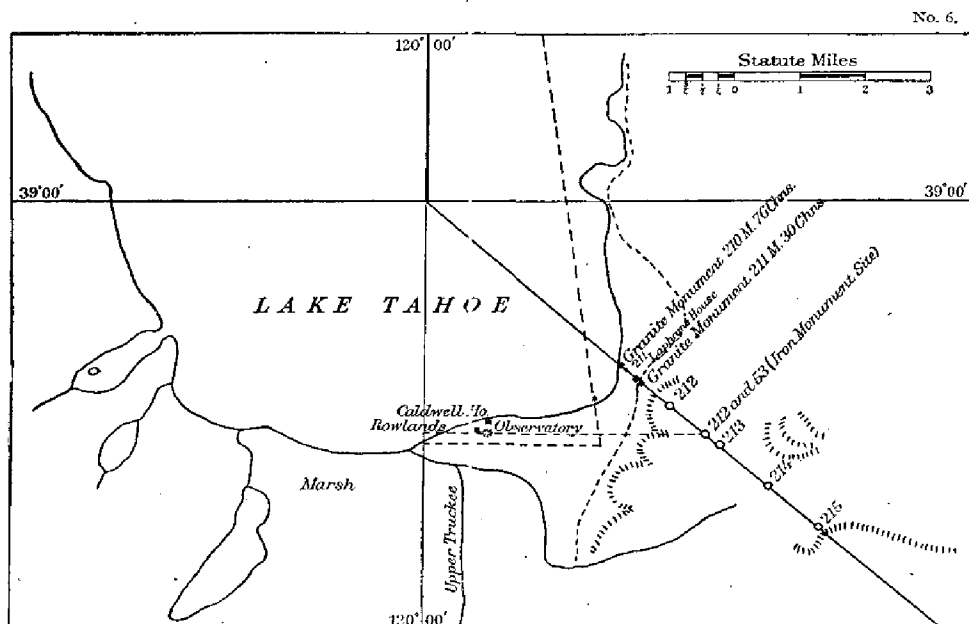
Finding the shore near the one hundred and twentieth meridian unfit for instrumental work, Von Schmidt ran east 77.55 chains on a course N. 89° 58' 30" E.; thence

north 13'25 chains, where he set up blocks and mounted the meridian telescope and zenith sector for both latitude and longitude observations. He made the latitude of this station $38^{\circ} 56' 45''$ by observations on Polaris and the sun with sextant and zenith sector, and the longitude $119^{\circ} 58' 55''$.

His azimuth line was calculated by using the intersection of 120° with 39° at Lake Tahoe and Lieutenant Ives's determination of the Colorado River end, longitude $114^{\circ} 30' 00''$, latitude 35° . He then ran 454.77 chains on a course N. $89^{\circ} 58' 30''$ E. from the one hundred and twentieth meridian in latitude $38^{\circ} 56' 45''$, making the longitude of this point on the azimuth line $119^{\circ} 55' 13''$. From this point he ran toward Lake Tahoe N. $48^{\circ} 51' 59''$ W. 137.14 chains to the lake shore, which is calculated to be 317.63 chains from the "initial corner in Lake Tahoe."

2. MONUMENTS NEAR LAKE TAHOE.

At the lake shore he "set a cut-granite monument, $10\frac{1}{2}$ inches square at the base, $8\frac{1}{2}$ inches at the top, 6 feet long, 2 feet in the ground; marked same with cut letters



Von Schmidt. 1873

on the northwest side, 'O. 210 miles 76 chains 7 links;' SE. side, '1873;' NE. side, 'Nev.;' and SW. side, 'Cal.:' This stone was fully identified in 1893, and it may be plainly seen that "1873" was changed from "1863," showing that it was one of the monuments placed by Houghton and Ives in 1863.

At 211 miles 30.02 chains he "set cut-stone granite monument on southeast side of road leading to Carson and Virginia City. Monument $10\frac{1}{2}$ inches square at base, $8\frac{1}{2}$

inches square at top, and 6 feet long, set 2 feet in the ground. Marked same, NW. side, 'O. 211 miles 30 chains;' NE. side, 'NEVADA;' SW. side, 'CALIFORNIA;' and SE. side, '1873.' " This stone has never been disturbed; 1873 was changed from 1863, as is plainly seen by inspection. The Coast and Geodetic Survey longitude pier of 1893 was placed $61\frac{1}{2}$ feet south and 33 feet west of this monument.

The field notes continue:

On 212 miles 53'21 chains to point on lat. $38^{\circ} 56' 45''$ brought up from 120th degree of west longitude, where I perpetuated Observatory Station No. 1 by setting up cast-iron monument 8 ft. long, 12 inches square at base, 6 inches at top, 2 ft. in the ground, in rock mound 8 ft. diam., 4 ft. high. Raised letters cast on monument as follows: NW. side, "O. 212 miles 53 chains;" NE. side, "Nev.;" SW. side, "Cal.;" and SE. side, "Lat. $38^{\circ} 56' 45''$, Long. $119^{\circ} 55' 13''$, 1873." A. W. Von Schmidt, U. S. Astronomer and Surveyor.

Also marked pine tree 8 inches diam. on NW. side, "O. 212 miles 53 chains 21 links;" NE. side, "Nev.;" SW. side, "Cal.;" and SE. side, "1873."

This tree was found as described in 1893. It then appeared to be about 8 inches in diameter, but the marks proved its identity. The cast-iron monument, however, was never put in place, as there was no evidence of its existence. The point is very difficult to reach, from the steepness of the mountain side, and on account of the weight

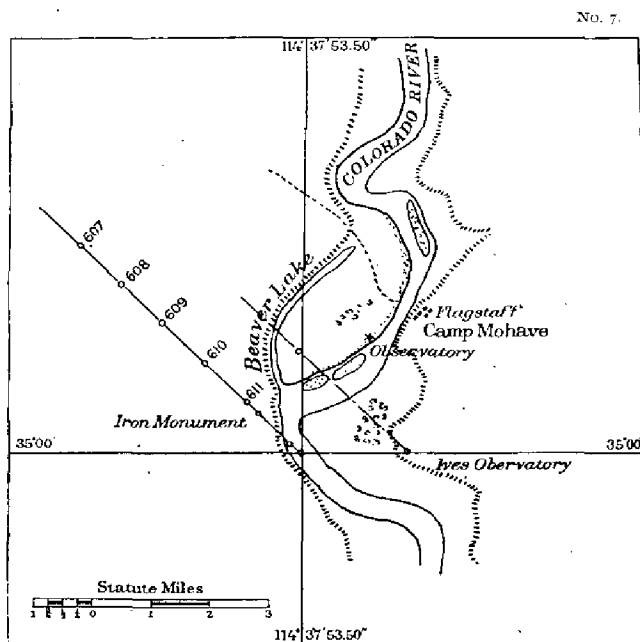
of such a monument it could never have been carried there without building a road, unless it had been made in sections so as to permit its being packed on animals or men.

No other monuments southeast of this iron monument were looked for in 1893.

3. COLORADO RIVER TERMINUS.

Transferring now to the Colorado end of the line, and referring to Von Schmidt's field notes:

"On 612th mile."—* * * 59 chains 87 links. To point selected for perpetuating Astronomical Station No. 5 on the Colorado River, and as witness to corner in same. Set cast-iron monument, 6 inches square at top, 12 inches square at base, 6 ft. long, 2 ft. in



Von Schmidt, 1873

ground, with raised letters cast thereon, viz: N.W. side, "O. 611 miles 59 chains;" N.E. side, "Nev.;" S.W. side, "Cal.;" S.E. side, "1873." A. W. von Schmidt, U. S. Astronomer and Surveyor." (Report Surveyor-General California. 1890.)

This monument was found in 1893. In 1899, after the prolongation of the Von Schmidt line to the Colorado River by means of several mileposts that were recovered, the iron monument was found to be about 150 meters northeast of the line. In proof of the fact that it no longer stands in the position originally intended for it, the following letter is taken from the Report of the Surveyor-General of California for 1890, p. 29:

FORT MOJAVE, ARIZ., *March 17, 1890.*

TO HON. SURVEYOR-GENERAL OF THE STATE OF NEVADA.

SIR: As the iron corner post between the State of Nevada and the State of California was washed over the bluff into the river by the last overflow of the Colorado River, and would surely have been lost in the next overflow, I went to work and hired ten Mojave Indians to get it out of the water and to dig a wagon road up to the bluff, and with my team hauled it up and reset it again still farther back from the river, so it is safe now from an overflow.

As I have been at considerable expense and trouble to replace it, you will please do me the favor to write and let me know how to proceed in getting pay from the State for my trouble, and oblige, yours, etc.,

W. H. SAILSBURY.

NOTE.—The above letter is contained in the report of the surveyor-general and State land register of the State of Nevada for the years 1877 and 1878.

J. E. JONES,

Surveyor-General and State Land Register.

"On 613th mile."—29 chains 96 links to the intersection of north latitude 35° with middle of the channel of the Colorado River, at longitude $114^{\circ} 37' 53'' 5$ west from Greenwich.

From north latitude 39° to the center of the channel of the Colorado River, at latitude 35° , the total measured distance is 405 miles 26.52 chains; calculated distance is 405 miles 5.73 chains; difference 20.79 chains.

Total distance from Oregon to the Colorado River is 612 miles 24.96 chains.

Field notes connecting my random line with true line at the Colorado River.

I found my observatory station on random line on right bank of the Colorado River to be in latitude $35^{\circ} 01' 53'' 43$ north, longitude $114^{\circ} 36' 45'' 45$ west from Greenwich. * * *

From this point to reach latitude 35° north at a point due south the difference is $0^{\circ} 01' 53'' 43 = 173.75$ chains. I therefore ran as follows (var. $14^{\circ} 45'$ E.):

West 17.46 chains; thence
 South 20.28 chains to shore of Colorado River; thence
 West 15.93 chains; thence
 South 10.13 chains to river; thence
 West 52.32 chains; thence
 South 30.33 chains to river; thence
 West 29.86 chains to slough; thence
 34.55 chains across slough; thence
 44.13 chains to bluff; thence
 South 113.01 chains to 35th degree north latitude,

Making the total from observatory station on random line, southing, 173.75 chains; westing, 128.74 chains. At this point set a cottonwood post 6" x 6" x 6 ft. long, marked on north side, "1873"; south side, "Lat. 35° ;" east side, "Von Schmidt, U. S. Surveyor." Made mound of earth and stone 6 ft. diameter.

* * * * *

I then ran east on 35th degree north latitude 23.00 chains to point selected for triangulating across the Colorado River, at which point I set a cottonwood post 7" x 7" square, 7 ft. long, marked on N. side, "1873"; south side, "Lat. 35° ;" east side, "Von Schmidt, U. S. Survey."

Made mound of stone 8 ft. diameter, 3 ft. high, set stone 9" x 18" x 18" on mound by side of post. Marked stone, "Lat. 35° , 1873," V. S. Also deposited stone in mound 5" x 5" x 12", marked

"Lat. 35° ." * * * This point and mound are on a prominent point, and can be seen from the river, and from all sides.

* * * * *

These two posts were well preserved in 1893 and 1899. The east 35° latitude post is the one used for azimuth, triangulation, and determination of latitude by observation with the zenith telescope in 1893.

When Lieut. J. C. Ives established the Colorado terminus in 1861, presumably, the river was on the eastern side of the alluvial bottom, and his longitude of the center of the river was given as $114^{\circ} 36'$ at the thirty-fifth degree of north latitude. In 1873, when Von Schmidt reached the Colorado River, the bed of the stream had changed to the west side of the bottom, making a difference of 143 chains along the thirty-fifth degree. Being in some doubt as to whether he should take the center of the river as he found it or adopt that of Lieutenant Ives, he referred the matter to the Commissioner of the Land Office, the Hon. Willis Drummond. A copy of both letters is here inserted:

SAN FRANCISCO, CAL., October 9, 1873.

HON. WILLIS DRUMMOND, *Washington, D. C.*

SIR: I beg most respectfully to make the following statement and to ask for instructions as to what your department considers the intersection of the thirty-fifth degree of north latitude and the middle of the channel of the Colorado River.

In striking my azimuth from the thirty-ninth degree of north latitude and one hundred and twentieth meridian to the thirty-fifth degree of north latitude and the middle of the channel of the Colorado at longitude $114^{\circ} 36'$, as given by Lieutenant Ives (assuming his point for a matter of convenience as a random line), I found on reaching the Colorado that while my line came within 20 chains of a perfect closure on Ives's old point the channel of the river was not there, but had materially changed.

To show the change in the bed of the river I forward you herewith two sketches, one showing the position of the river in 1863 (1861, probably), as per Lieutenant Ives's topographical sketches, and the other as I found it in 1873.

The Colorado at this point runs between two banks formed of gravel wash, distant from each other an average of 2 miles. Between these gravel banks it is all sand, and the main channel of the river changes through this sand bed at pleasure. The two sketches show its relative position on the thirty-fifth degree of latitude in 1863 (1861?) and 1873; the difference is 1 mile 63 chains. I was credibly informed by United States officers at Mohave that the river constantly changes its channel at the point indicated in the sketches. The camp sutler at Mohave also informed me that the river bed at this point had changed back and forth twice since his stay there—about twelve years. What I desire your opinion on is whether I shall recognize the intersection of the thirty-fifth degree of latitude with the old channel of the river as it was established by Lieutenant Ives, or the intersection of the thirty-fifth degree of latitude with the present channel as I now find it.

I have been led to make this inquiry of you for my guidance in the matter from the fact that the subject has been the cause of much adverse discussion among the surveyors and scientific men here, leaving me in great doubt as to my duty in the matter.

Very respectfully, yours,

A. W. VON SCHMIDT,

United States Surveyor and Astronomer, Eastern Boundary California.

(Land Office, vol. 4. California Record, p. 312.)

DEPARTMENT INTERIOR, GENERAL LAND OFFICE,

Washington, D. C., October 22, 1873.

A. W. VON SCHMIDT, Esq., *San Francisco, Cal.*

SIR: I have received your communication of the 9th instant asking what this office considers the intersection of the thirty-fifth degree of latitude with the middle of the channel of the Colorado

River, and whether you shall recognize the old channel of the river or the present channel as you now find it. * * *

In reply I have to say that, under the circumstances, in reference to the changes in the river channel at different times, and the fact that Lieutenant Ives's survey has never been returned to or recognized by the Department, your obvious duty will be to consider the intersection of the thirty-fifth degree of latitude with the middle of the channel of the river as you find it by your own determination and survey. * * *

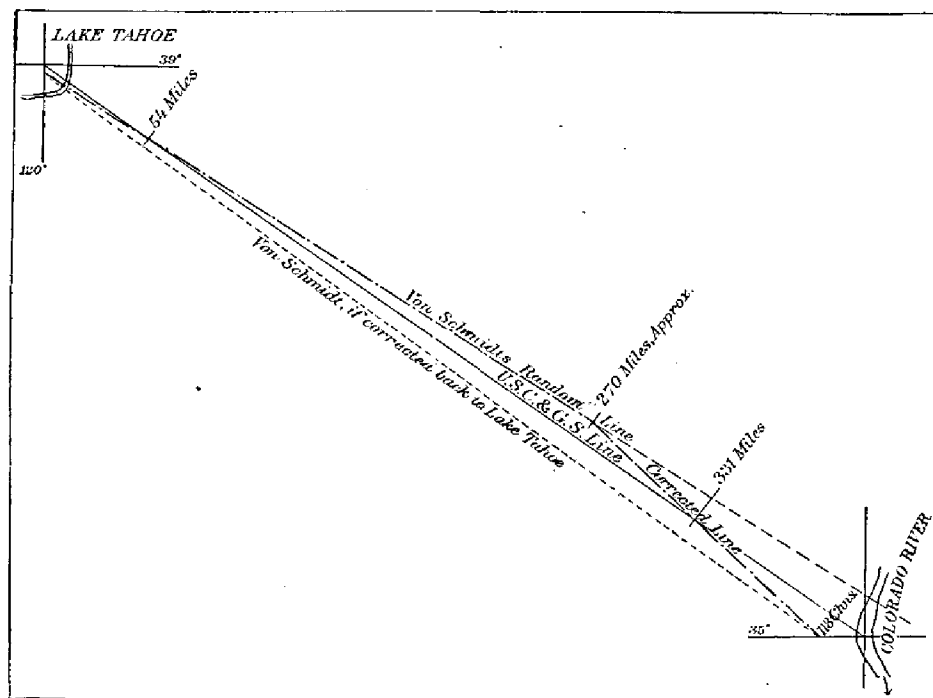
Very respectfully, your obedient servant,

WILLIS DRUMMOND, *Commissioner*.

Copies of the two sketches are shown here. (See illustrations Nos. 4 and 5.)

In compliance with the requirements of the Commissioner a correction to the west

No. 8.



Von Schmidt and C. & G. Survey lines.

along the thirty-fifth degree of latitude of 143 chains was to be made from the terminal as located by Lieut. J. C. Ives in 1861, and of 118 chains southwest of the random line run by Von Schmidt, namely, 20 chains to the southwest, being the error of closure on the Ives point; and 98 chains to the southwest, being the amount of correction due to the shifting of the river between 1861 and 1873.

This correction of 118 chains—nearly $1\frac{1}{2}$ miles—to the southwest at the Colorado River terminus of the Von Schmidt random, was not distributed proportionately along the entire line from the Colorado River to Lake Tahoe, but was limited to a distance of

about 130 miles from the Colorado River, or approximately one-third of its length, making a line with an angle in it. On account of this failure to correct the line all the way back, the United States Coast and Geodetic Survey line, which started about one-third of a mile to the northeast of the Von Schmidt line at Lake Tahoe, crossed it twice, once at a distance of 54.3 miles from Lake Tahoe, in Sweetwater Valley, and again at a distance of 331.3 miles from Lake Tahoe, in Mesquite Valley. If the Von Schmidt line had been corrected all the way the Coast and Geodetic Survey line would not have crossed his line at all. As it is it crossed both his random line and his so-called corrected line.

Illustration No. 8 shows clearly the relation of the different lines to each other. The first 270 miles of the Von Schmidt line is simply his uncorrected random, and the remaining 130 miles bends away from the random to the southwest so as to strike the corrected terminal at the Colorado.

While no systematic effort was made to find all of the old marks on the Von Schmidt line, search was made for them from time to time at different points where it could be done without retarding the regular work too much. Enough marks were recovered to reproduce with a fair degree of accuracy the entire line and thus give a comparison of the two surveys. Fifty marks were recovered as shown in the tabulated description.

In his field notes relating to the oblique part of the eastern boundary of California, Von Schmidt makes the following statement:

I next proceeded to lay off azimuth of transit line running in a southeasterly direction from the thirty-ninth degree of north latitude, where it intersects the one hundred and twentieth degree of west longitude in Lake Tahoe, to where the thirty-fifth degree of north latitude intersects the middle of the channel of the Colorado River. To do this, it was necessary to know the longitude at the terminus in the Colorado River. There being no telegraphic facilities at that point, I concluded for the time being to assume the longitude of that place as determined by Lieutenant Ives in 1863 (1861-?) * * * run a line to Ives's point, then establish the intersection of the thirty-fifth degree of north latitude with the middle of channel of the Colorado River by a series of observations, correct my line back, should I find error in longitude, and mark and establish the true line in the field, ALL OF WHICH WAS DONE.

The line as reproduced by the Coast and Geodetic Survey fails to confirm the terminal phrase of the above quotation.

The Von Schmidt map was made on a scale of 2 miles to the inch. A photographic copy of the map and a copy of his report and field notes are in the possession of the United States Coast and Geodetic Survey.

INSTRUMENTS.

In his field notes Von Schmidt mentions a meridian telescope, a zenith sector, a field transit, a sextant, and a barometer. His distances were obtained by chaining, when practicable, and by triangulation when the ground was very rough. His method was to measure a chain base at right angles to the line, observe the angle at the other end of the base, but not the small, acute angle at the distant, elevated point on the line. This gave rough distances, but perhaps close enough for the purpose.

I. GRUNSKY AND MINTO, 1889-90.

The Report of the Surveyor-General of California for 1890 contains the copy of "An act to provide for the correction and establishment of the eastern boundary of the State of California, and to appropriate money therefor," approved February 26, 1889 (pp. 11 and 12); the letter of instructions to C. E. Grunsky and William Minto, civil engineers, and the report of these engineers to the surveyor-general (pp. 14-40).

They were directed to use the primary line, Lola to Round Top (91 038.53 meters = 56.6 miles, nearly) of the United States Coast and Geodetic Survey as a base for triangulating Lake Tahoe and for connecting, by this means, with points on the Von Schmidt line on the north end of the lake and on the southeast shore.

The iron boundary monument on the north shore of the lake was found to be in—

Latitude $39^{\circ} 13' 19''.30$,
Longitude $120^{\circ} 00' 20''.45$,

showing this monument to be too far west $20''.45 = 1.609$ feet. The granite monument on the southeast shore of the lake was found to be in—

Latitude $38^{\circ} 57' 25''.06$,
Longitude $119^{\circ} 57' 05''.90$.

The longitude of the State line in latitude $38^{\circ} 57' 25''.06$ by calculation with the azimuth $311^{\circ} 19' 36''.99$ as furnished in 1890 by the United States Coast and Geodetic Survey, for the azimuth of the State line at the intersection of 39° latitude and 120° longitude is made to be—

Longitude $119^{\circ} 56' 14''.33$,

a difference of $51''.57$ or 4.0733 feet. So the conclusion is drawn that the meridian boundary at the north end of the lake is 1.609 feet too far west, and the first stone on the lake shore making the oblique boundary is 4.0733 feet too far west. They state as follows:

"Having, as above set forth, ascertained the longitude of a point on the State line in the same latitude as the granite monument on the southeastern lake shore, the survey was continued from this granite monument as follows:"

"N. $89^{\circ} 59' 43''.79$ E. * * * 4.0733 feet to a point (J') on State boundary line in the same latitude as the granite monument on the lake shore (J). Set a pine post*. * * Made a stone mound around post, thence on the boundary line with an azimuth of $131^{\circ} 21' 58''.94$ toward Lake Tahoe * * * 70.46 chains to shore of Lake Tahoe, bearing north and south, set a tamarack post*. * *"

From the point (J') which is on the State boundary line, and 4 miles 39.64 chains distant from the point o in the lake where the thirty-ninth parallel of north latitude is intersected by the one hundred and twentieth degree of longitude west from Greenwich, the survey of the State boundary was continued in the direction toward the intersection of the thirty-fifth parallel of latitude with the Colorado River as follows:

"With the same azimuth above noted for this point, azimuth $311^{\circ} 21' 58''.94$, ascending steep mountains bearing NE. and SW. and noting all distances as though measured from the above-named point in Lake Tahoe * * * 16 miles $7'$ chains, west fork of Carson River, 30 feet wide runs N. 20° E. Beyond which this survey could not be extended owing to lack of necessary funds."

* These two posts were found in 1893, the one on the lake shore lying on the sand, but identified by the marks, and the other one still in place.

The determination of the iron boundary monument on the north shore of Lake Tahoe by the United States Coast and Geodetic Survey in 1893 was—

Latitude $39^{\circ} 13' 19''$.18,
Longitude $120^{\circ} 00' 21''$.94,

which makes the monument $21''$.14 = 1 727 feet too far west.

The stone monument at the north end of the lake was found to be in

Latitude $39^{\circ} 13' 17''$.25.
Longitude $120^{\circ} 00' 21''$.96.

The work at the Colorado end of the line was done in September, 1889, by William Minto, assisted by L. H. Taylor. Mr. Minto says:

"The work of determining the longitude of the intersection of the middle of the Colorado River with the thirty-fifth degree of north latitude was much simplified by the action of the United States Coast and Geodetic Survey."

This "action" was the determination of the latitude and longitude of the Needles, a station on the Atlantic and Pacific Railroad about 12 miles south of the thirty-fifth degree of latitude.

Latitude $34^{\circ} 50' 18''$.17.
Longitude $114^{\circ} 36' 11''$.04.

A meridian line was also marked from the longitude pier to a point on the mesa about 300 meters south by the United States Coast and Geodetic Survey. The report continues:

"In September, 1889, the Coast and Geodetic Survey station thus established was connected by a system of triangulation with the monuments established by Col. A. W. Von Schmidt on the thirty-fifth parallel of north latitude, as determined by him in running the State boundary in 1873. The Von Schmidt monuments found standing were the two posts designated in his field notes as being on the line of the thirty-fifth degree—one on the bluff west of the river and 2076 chains west of his intersection of the middle of the river by the said parallel of latitude, and the other 2300 chains farther west, both in mounds of stone and earth and marked as described in his field notes. There is also a stone marked, as the notes describe it, "L 35° N" in the mound around the most easterly post."

* * * * *

"Station was found to be in latitude $35^{\circ} 00' 23''$.39 and in longitude $114^{\circ} 39' 23''$.61, and the terminal point L₁ of the Von Schmidt boundary survey of 1873 is in latitude $35^{\circ} 00' 23''$.39 and in longitude $114^{\circ} 39' 07''$.08."

"Incidentally the latitude and longitude of the flagstaff at Camp Mojave was also established by this work: Latitude $35^{\circ} 02' 30''$.22, longitude $114^{\circ} 37' 14''$.48."

"As nearly as could be determined from the Von Schmidt survey of 1873, the Colorado River from L to L' had a southeasterly course, and this course as nearly as it could be determined was made the basis of the computation of the longitude of the intersection of the thirty-fifth degree of latitude with the center line of the Colorado River in its position of 1873. The latitude $35^{\circ} 00' 23''$.99 and longitude $114^{\circ} 39' 07''$.08 of the point L₁, with an azimuth $322^{\circ} 32' 25''$.65 from L₁ to L', the latitude of L' being $35^{\circ} 00' 00''$, established the longitude of L' at $114^{\circ} 38' 45''$.30, and the distance from L to L' was found to be 907.97 meters."

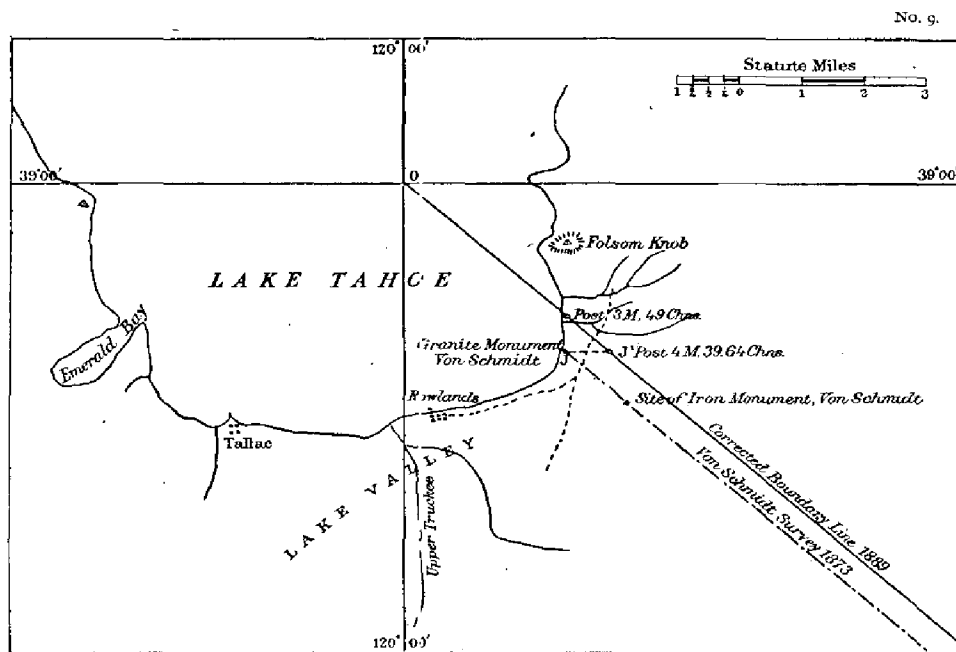
"The boundary line from Lake Bigler southeastward to the Colorado River must therefore connect a point in latitude $39^{\circ} 00' 00''$, longitude $120^{\circ} 00' 00''$, with a point at the Colorado River in latitude $35^{\circ} 00' 00''$ and longitude $114^{\circ} 38' 45''$.30."

"From Colonel Von Schmidt it was learned before the above field work was undertaken that he was directed by the department in authority to make the center line of the Colorado River as he

APPENDIX NO. 3. BOUNDARY LINE BETWEEN CALIFORNIA AND NEVADA. 285

found it in 1873 the objective point of his survey, and not the river as it might have been at the date of the admission of California. It was for this reason that L' was established as above noted. The correct azimuth of the boundary line northwestward from the point L' is $134^{\circ} 33' 09'' \cdot 29$, and this line, which the above work indicates as the corrected position of the State boundary, passes about 414 feet to the southwest of the Von Schmidt terminal point L.

As soon as the results of the work at the Colorado River became available, a calculation of the azimuth and length of the line from the point in Lake Bigler to the Colorado River was made, at our



Grunsky and Minto line, 1889.

request and for our use, by Charles A. Schott, of the United States Coast and Geodetic Survey, and reported by him as follows, under date of January 6, 1890:

"Azimuth from Lake Bigler end of line to the Colorado River end $311^{\circ} 19' 36'' \cdot 99$.

Distance 651 056 meters = 404 551 miles."

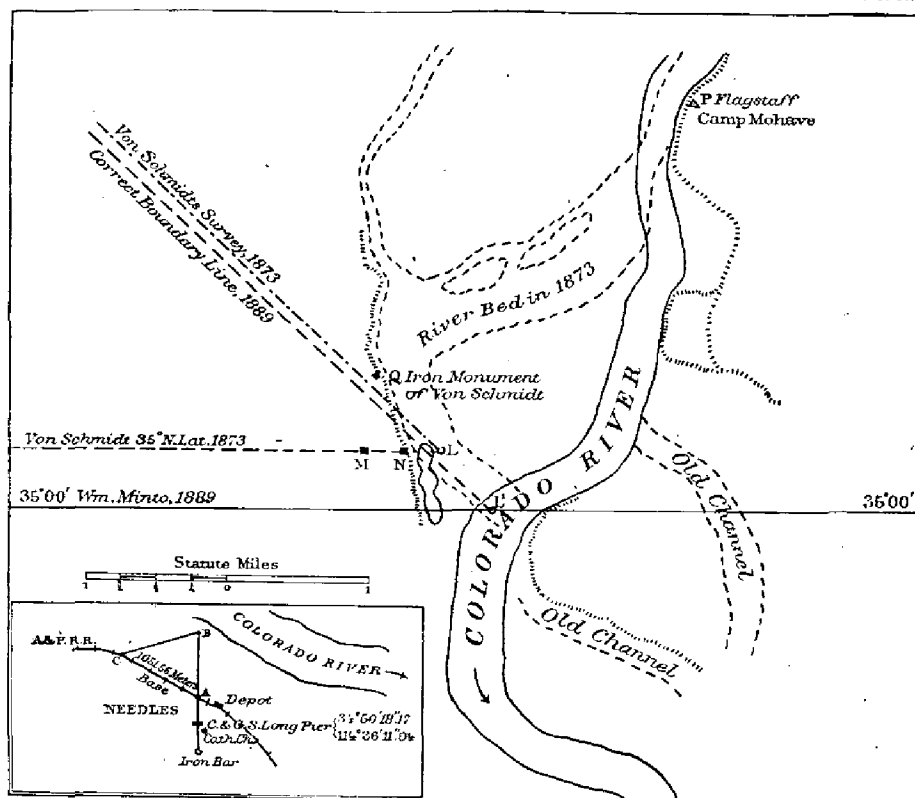
"Azimuth from the Colorado River end of the line to the Lake Bigler end $134^{\circ} 33' 09'' \cdot 29$." * * *

Three copies each of two maps are filed herewith and made a part of this report, as follows:

Sheet No. 1.—State Boundary Survey. Map of the boundary line of California near Lake Bigler, showing position of the United States Coast and Geodetic Survey primary stations Lola and Round Top, and the triangulation work of June and October, 1889; also the boundary line as surveyed and marked in the field by A. W. Von Schmidt in 1872 and 1873, and the position of the boundary line southeastward from the lake as surveyed by C. E. Grunsky and William Minto in 1889 and 1890, under instructions from Theo. Reichert, State surveyor-general.

Sheet No. 2.—State Boundary Survey. Map of the boundary line of California at the intersection of the thirty-fifth degree of north latitude with the Colorado River, showing the position of the United States Coast and Geodetic Survey Station Needles, and the triangulation work of William Minto in September, 1889, done under directions from Theo. Reichert, State surveyor-general.

No. 10.

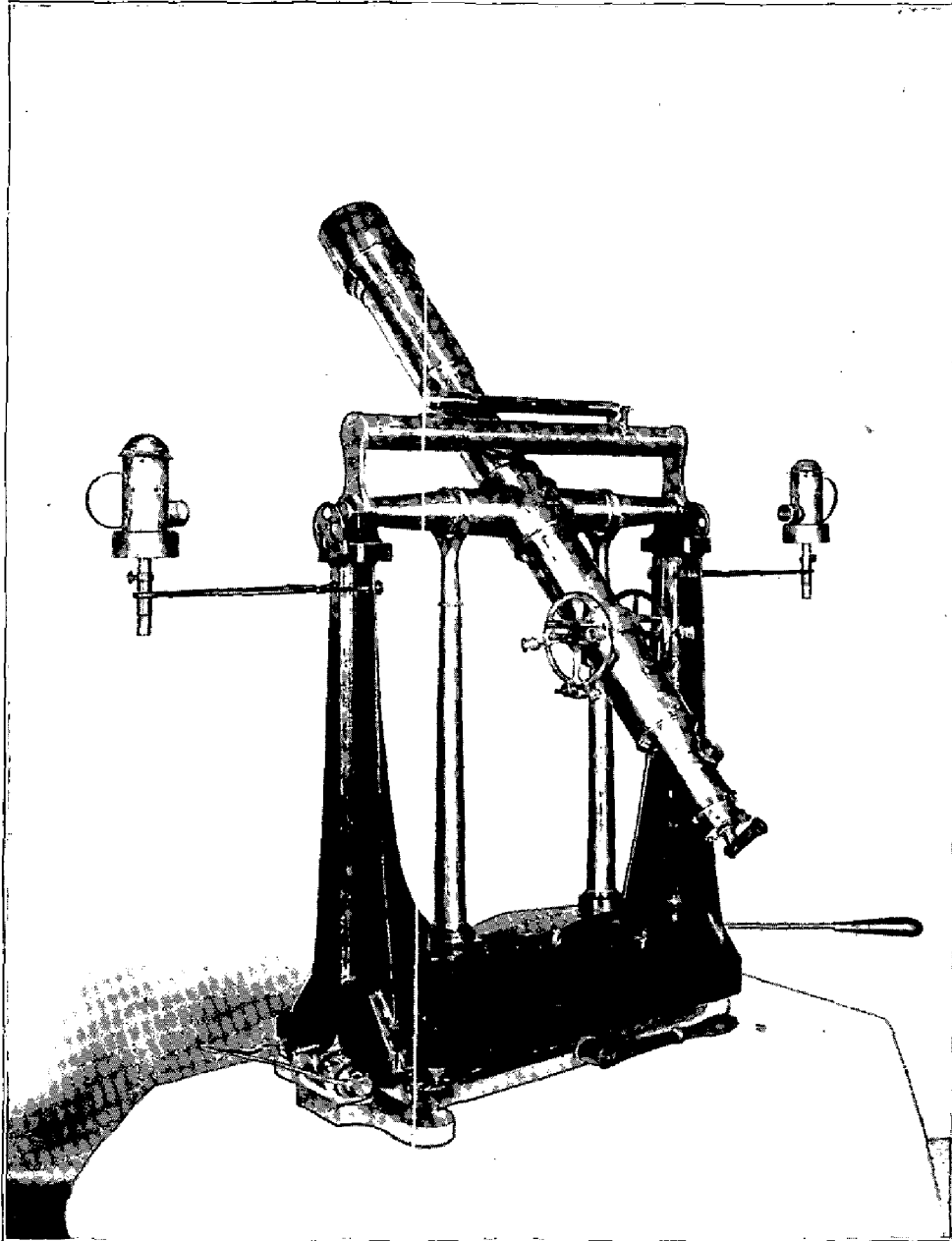


Grusky and Minto line, 1889.

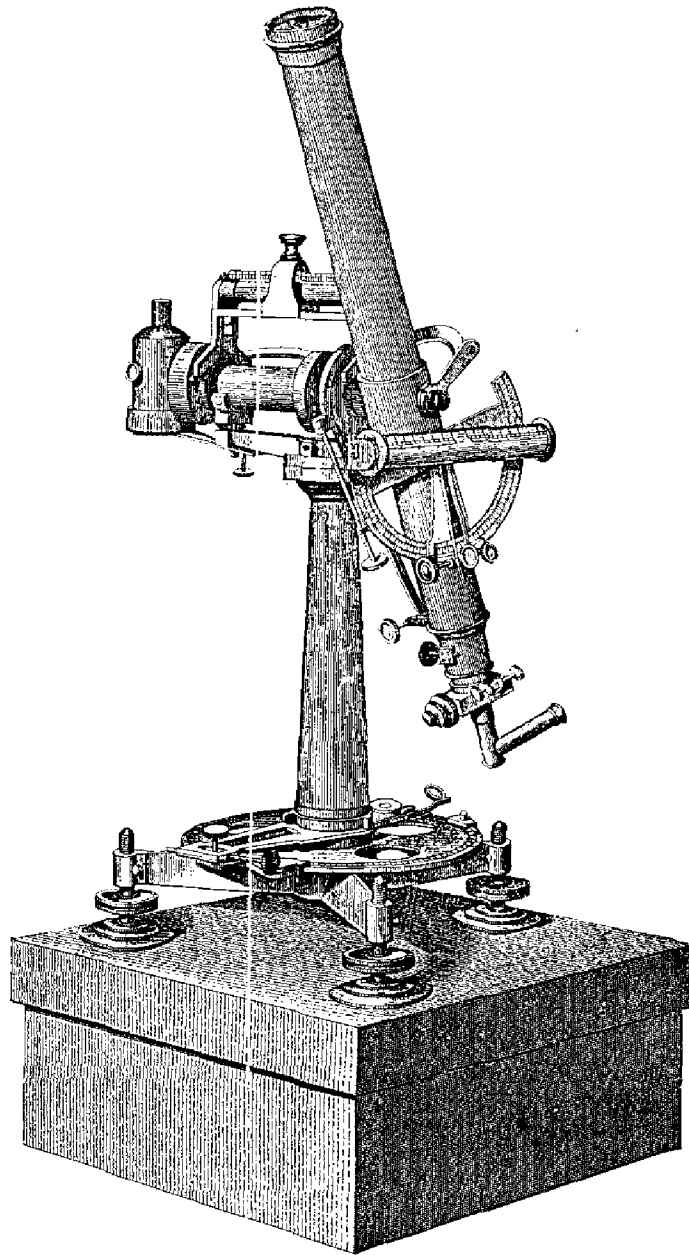
Blue prints of these two maps are in the Office of the United States Coast and Geodetic Survey, Washington, D. C. Reduced copies of them are shown above.

III. UNITED STATES COAST AND GEODETIC SURVEY LINE—1893-1899.— CALIFORNIA AND NEVADA OBLIQUE BOUNDARY.

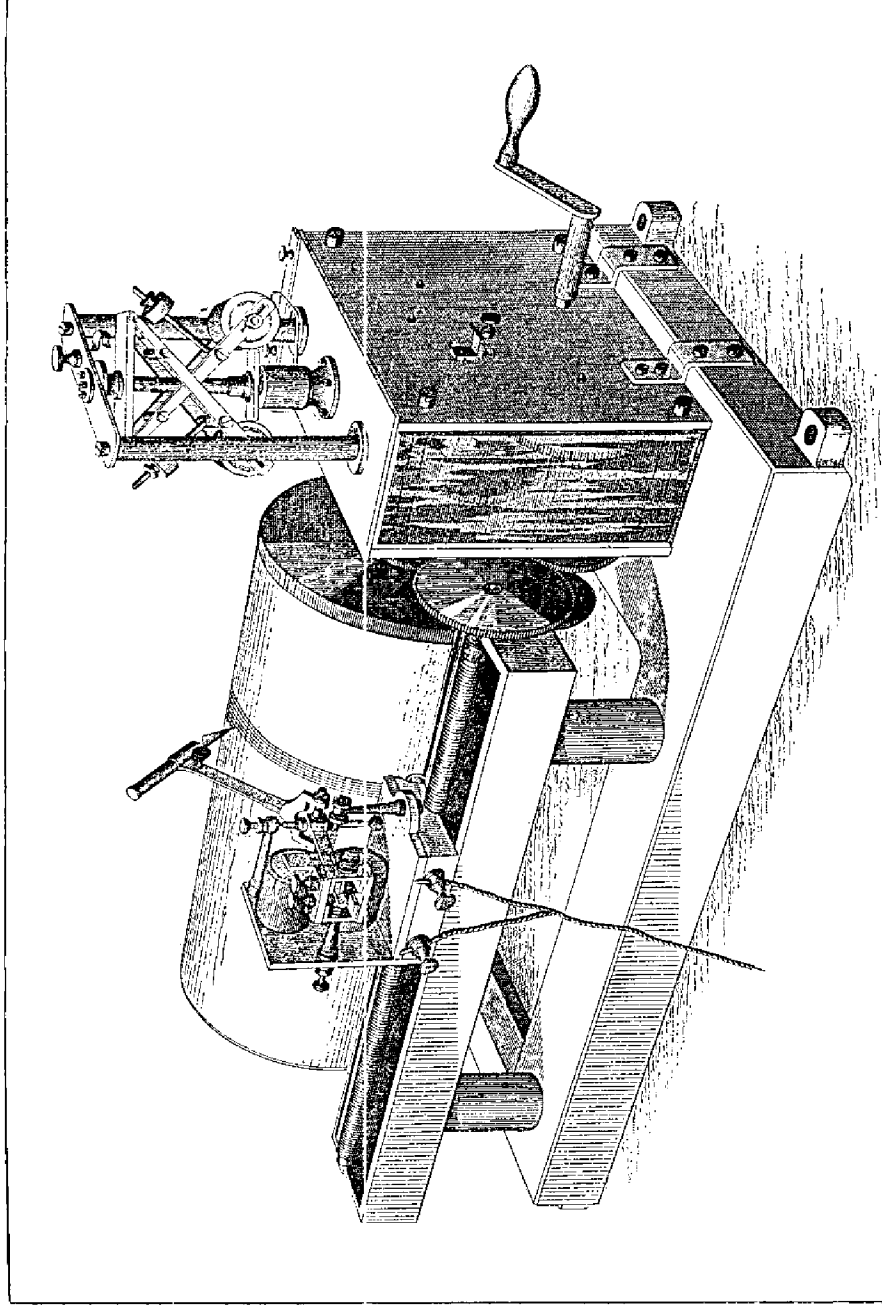
The oblique boundary between the States of California and Nevada begins at the intersection of the thirty-ninth degree of north latitude with the one hundred and twentieth degree of longitude west from Greenwich and runs southeasterly to the intersection of the thirty-fifth degree of north latitude with the Colorado River. The first of these points falls in Lake Tahoe about 3.6 miles from the southeast shore; the second was taken as midway between the bluff or stable banks of the stream. These



PORTABLE TRANSIT.



ZENITH TELESCOPE.



CHRONOGRAPH.

banks are 2.75 miles apart along the thirty-fifth degree, and the river changes from one side of its bed to the other during the different periods of high water, which prevails usually in the months of May, June, and July, when the snow is melting in the mountains. It 1861 the river was on the east side of the alluvial bottom; a slough, or lake, the remains of an old channel, is still there. In 1873, when Alexey W. Von Schmidt reached the Colorado River with his survey of the boundary line, the river was on the west side of the bed; a small lake still exists on that side also, showing the old channel. In 1893, when the Colorado River terminus was located by the Coast and Geodetic Survey, the center of the stream coincided very nearly with the middle point between the permanent bluff banks. This was during the high water in the month of June. In 1899 the river was practically in the same position as it was in 1893. When the party completed the tracing of the boundary in January, 1899, it was during the period of low water, and while the middle point came on a low sand flat, a rise of 1 foot in the water would have covered this flat and brought the middle of the stream and the middle point between the permanent banks nearly into coincidence. The water was less than 3 feet deep in the channel at that time.

A. INSTRUCTIONS TO PROF. GEORGE DAVIDSON.

The letter of instructions to Prof. George Davidson, Assistant, United States Coast and Geodetic Survey, from the Superintendent, dated April 17, 1893, giving the general method of procedure and defining the position of the Colorado River terminus, is here inserted, with a few slight changes:

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE SUPERINTENDENT,
Washington, D. C., April 17, 1893.

Prof. GEORGE DAVIDSON,
Assistant, United States Coast and Geodetic Survey, San Francisco, Cal.

SIR: Congress having provided for a resurvey of that part of the boundary line between California and Nevada which extends from a point in Lake Tahoe to the Colorado River, and for the re-marking of the same, the general direction of the field operations connected with the work is placed in your hands. Assistant C. H. Sinclair and Subassistant W. B. Fairfield have been instructed to report to you for active duty upon this survey. Their experience and skill is such that it is believed that your presence in the field will not be necessary, except occasionally for purposes of inspection or for making personal examination of the more difficult parts of the field work.

This boundary, as defined by act of Congress, is a "straight line" joining two points. One of these points is astronomically defined, the other only partially so, it being dependent for its longitude on the location of the Colorado River. The actual location of these two points, the termini of the line, is a necessary preliminary. As much of the present season as is necessary will be devoted to this part of the work. The amount of money available during the present fiscal year is \$5,000, and about the same amount can be used during the fiscal year 1894. It is not desirable, therefore, to put two parties into the field, and, besides, the different climatic conditions obtaining at the two ends of the line make it advisable, at least for the present, to begin with one party at the southeastern terminus, rather lightly equipped, so that the expense of transfer to the vicinity of the lake on the approach of extremely hot weather will be small.

Mr. Sinclair and Mr. Fairfield will doubtless be able to accomplish all that is necessary for the location of the terminus near the Needles by June 1, or perhaps a little later. They should then proceed to Lake Tahoe and locate the first monument of that end of the line. In the meantime, the coordinates of the termini having become accurately known, the azimuth of the line can be computed

and plans can be formulated for the execution of the chain of secondary triangulation necessary to its exact location.

Beginning with the southeastern end of the line, the method used in locating that terminus should be essentially as follows:

By definition this point is at the intersection of the thirty-fifth degree of north latitude with the Colorado River. From this point the line proceeds, according to the constitution of the State, "along the middle of the channel of said river;" from which it must be inferred that said point is itself in the middle of the channel of the Colorado River. At the latitude of 35° the river flows between two well-defined bluffs, separated from each other by a distance of $2\frac{1}{4}$ miles. Between these the actual bed of the river vibrates from time to time, now being near one side and now near another.

In 1860 Congress passed an act appropriating money for a survey of this boundary line, and in this act the line is defined as "beginning at the intersection of the thirty-ninth parallel of north latitude and the one hundred and twentieth degree of longitude west from Greenwich and proceeding in a southeasterly direction in a straight line to the point where the thirty-fifth parallel of north latitude crosses the Colorado River." This is, perhaps, the latest definition of the line, and it would be proper to assume that the southeastern terminus must be determined by the position of the river at the time of the passage of the act. As throwing light upon this point, the only information available here at this time consists of a published map of [Lieutenant] Ives's exploration survey or reconnaissance of 1858 and a map of his survey of (1863) 1861? (see sketch No. 1, and No. 4), the latter having doubtless been made for the purpose of locating the boundary line. In the former his latitude, as shown on the map, is in error a little more than one minute, according to his own record for his nearest astronomical station. If this correction is made, the two maps show the river in essentially the same position. It may be inferred, therefore, that its bed did not change materially from 1858 to (1863) 1861?, and that these maps show it practically as it was in 1860, the date of the act of Congress.

If the latitude as shown in the later map is not seriously in error, the thirty-fifth parallel was along the bed of the river for a mile or more, as the river at that time and place ran nearly west to east across the valley separating the bluffs between which its bed is confined. From this it appears that all of the conditions to which this terminus is subjected will be satisfied by assuming it to be *midway between the two bluffs between which the Colorado River flows, on the line of the thirty-fifth degree of north latitude*. Two points in latitude 35° north on these bluffs, equidistant from the point agreed upon as the terminus of the line, should be carefully determined and well marked.

This definition will, therefore, be adopted as furnishing the most equitable, the most prominent, and hence the most easily reproduced location of the southeastern terminus. Besides, it is believed to be historically correct and in accord with the act of Congress of 1860.

It may be assumed that the iron monument placed in 1873 will afford a first approximation to this point. An astronomical station should be established near it, and latitude observed. It should be connected by triangulation with the Coast and Geodetic Survey astronomical station at Needles. An azimuth should also be observed to connect with the triangulation. Having the latitude and longitude of this point, the location of the thirty-fifth degree of north latitude on the bluffs of the river may be determined and the proper position of the first boundary monument completed. For this purpose the azimuth of the line may be assumed to be $134^{\circ} 33'$. The monument should be located on hard high ground on the bluff of the river, as near as may be, so that any defect in azimuth may have little effect. Before leaving it will be well to set up another monument in the line, say a mile or two away.

In the execution of the work at Needles it will doubtless be necessary to establish a camp in the vicinity of the terminus of the line. It is not believed, however, that the outfit need be very extensive or expensive.

If possible, such wagons and animals as are needed should be hired at the Needles or Mohave, as it will not be found necessary to transport them to the northern end of the line. If necessary to purchase them, they may be taken away after the work is done, and kept where it may be done at the least cost. Possibly much of the outfit for this camp can be furnished from the stores now on hand and under your charge in San Francisco. Mr. Sinclair has, at my request, prepared an estimate of the cost of doing the work at this point, which he will submit to you for your consideration. The object in view is the equipment of the party in such a manner that there will be no loss, and as far as possible nothing to dispose of when the work is completed.

At Lake Tahoe it is assumed that the party will not need a camp, unless the astronomical work should be completed in time to take up some of the geodetic work before the close of the season.

This work is not immediately necessary, however, although a necessary and important part of the complete scheme.

At Lake Tahoe the work will consist of the verification of the location of the "initial boundary monument." Establishing an astronomical station near it, latitude will be observed and longitude determined by the most convenient and available method. It is understood there is a telephone wire connecting Tallac with some telegraphic point, as Carson City or some other station already occupied for longitude by the Coast and Geodetic Survey. If this is the case, telegraphic connection can doubtless be obtained with little difficulty. Three nights' exchange of signals, with another three nights after exchange of observers, will give sufficiently accurate results.

If Tallac fails, the line to Glenbrook may be utilized, and if found absolutely necessary a temporary line may be erected connecting Genoa and the astronomical station on the shore of the lake. In case of either of the first two places being used, the longitude of the station may be determined by using heliotrope or powder signals, exchanged with Tallac or the transport of chronometers from Glenbrook on the lake; or it may be found cheaper to connect the astronomical station directly with telegraph connected by temporary line.

The azimuth of this end of the line may be assumed to be $48^{\circ} 41'$, but the result of the fixing of the southeastern terminus will make a revision of this value possible.

The location of a monument at the beginning of the line is impracticable owing to the fact that it is in Lake Tahoe, but with the observed latitude and longitude of the astronomical station and the azimuth of the line, the distance from the station to the nearest point on the boundary may be computed. It will be desirable to make this initial point as near the lake as may be, and also to establish a second point on the line at some distance from the first.

At the conclusion of this part of the work, should the season and available funds permit, some geodetic work may be undertaken before leaving the vicinity of Lake Tahoe. The position of Tallac should be determined by using the base Freels and Round Top and the new astronomical station. The old and the new initial boundary monuments should be connected with Freels and Tallac. It is understood that Tallac will be easy of occupation, but that Freels will offer more difficulties. It is believed, however, that it can be easily occupied with special equipment or camp outfit.

You will know better than anyone else what is required for the occupancy of Round Top. A single day of fair weather at each of those stations will be sufficient. Magnetics should be observed at each station. The work of locating the two termini of the boundary line will probably extend through the summer months, and when it is entirely completed it will not be too early to begin preparations for pushing the work from the southeastern point.

A secondary triangulation, with sides 20 to 40 miles in length, and closely clinging to the lines, is to connect the two ends. It is hoped that the work of locating the termini can be so conducted as to leave a considerable fund available for the execution of this work during the coming autumn and winter, beginning at the Colorado River.

This will require a tolerably extensive outfit in the way of camp equipage and working force. Just what this should be can be better known, it is believed, after the experience gained in the execution of the above instructions. You will, of course, avail yourself of all sources of information relating to the subject, and be ready to submit plans and estimates in advance of the time for beginning operations in the field. As \$5 000 can be expended before July 1, and as it is believed that the party in the field, first at Needles and afterwards at Lake Tahoe, will not require so large an amount up to that date, you will endeavor to expend such balance as is available before July 1 in the purchase of portions of the field equipment for the triangulation party. As before stated, but one party can be kept in the field, but it is possible that by active work during the coming winter such advance may be made from the southern end that the operations of that party will not be cut off by high temperature in the early summer.

Mr. Sinclair has estimated for the pay of a recorder at \$45 per month, and in selecting some one for this position it is very desirable to secure some young man who is a graduate from the engineering or physics courses in one of your two leading institutions of learning, as it is from this class that the professional corps of the survey should be recruited as opportunity is offered from time to time.

When the results of the observations at the two termini are in hand it will be possible to finally

compute the lines, after which general instructions for the execution of the scheme of triangulation can be prepared.

Finally, these instructions are not to be considered as unalterable, and this is especially so with regard to details, in which you must be largely governed by local conditions. In case you think it necessary to make any considerable departure from the general scheme indicated above, you will as soon thereafter as possible explain such deviation and give your reasons for the same. While it is expected that the work will be of such a character as to assume absolute confidence in the result, it is not thought necessary to maintain in its execution that high standard which is regarded as essential to the success of our primary triangulation. The instrumental equipment need not be so elaborate, nor the observations so often repeated. Much money has already been expended in the location of this line, with unsatisfactory results. It is our ambition, first, to do the work so that it will never need to be done again, and second, to show that with our organization, instrumental equipment, corps of skilled observers and professional esprit, we can execute a piece of work like this at a less cost than any other body of men, especially those temporarily created under the authority of a "joint commission," which is itself generally an expensive adjunct, not necessary, and with which we are not burdened.

I trust, therefore, that in submitting a scheme and estimates for the coming triangulation work you will not lose sight of this important consideration, and I believe that through your extensive knowledge of the country and local conditions, together with the excellent opportunities for gaining information which are available to you, you will be able to reduce the cost of the work to as low a limit as is compatible with its proper execution.

Respectfully, yours,

T. C. MENDENHALL, *Superintendent.*

B. LOCATION OF THE SOUTHEAST TERMINUS, COLORADO RIVER.

In compliance with instructions of the superintendent dated April 8, 1893, I went to San Francisco, Cal., early in May to report to and confer with Assistant Davidson, accompanied by Assistant W. B. Fairfield, who was associated with me on this boundary survey from its beginning in 1893 to its completion in 1899.

As the instructions to Professor Davidson state, the thirty-fifth degree of latitude was to be determined by observations (with the zenith telescope); the longitude to locate the center of the river where it crosses the thirty-fifth degree was to be carried up by triangulation from the telegraphic longitude station at the Needles, which was determined in 1889, the distance being about 13 miles; an azimuth was to be observed near the thirty-fifth degree and a point located approximately in the boundary line by using the old azimuth of the line derived from imperfect data of former years. After this, a recomputation of the work was to be made by the office, the error determined of the points approximately placed, and the corrected boundary marks set in position.

Between May 2 and 13 arrangements were completed in San Francisco for executing the work, and on May 13 the party and outfit started to the Needles, Cal., as the base for conducting the field operations.

The party consisted of Assistants C. H. Sinclair and W. B. Fairfield, of the Coast and Geodetic Survey; Mr. G. J. Kammerer, recorder; William Diercks, foreman; and George Simons, hand, brought from San Francisco, and Sam Costello, hand, hired at the Needles, who also did the rough cooking required at the astronomic station. Mr. Fairfield succeeded in hiring a buckboard with a pair of horses at the Needles for reconnaissance, signal building, and triangulation between the Needles and the thirty-fifth degree of latitude.

Upon reaching the Needles steps were taken to secure a team for hauling the instruments, observing tent, lumber for the platform, cement to construct the pier, and other material up to the thirty-fifth degree of latitude, about 13 miles over a rough, sandy road on the west side of the Colorado River.

Before doing this I made a preliminary trip with the mail carrier to Fort Mohave, then converted into a school for Indians, the distance being nearly 18 miles over a sandy road on the east side of the river. The officials at the school were very obliging, furnishing me with a boat and men to cross the river and visit the iron monument that was supposed to be the terminal mark of Von Schmidt's line run in 1873.

Fort Mohave was too far from this point, being on the wrong side of the river, so the idea of living there was abandoned. I therefore returned to the Needles and on May 19 moved up to the thirty-fifth degree latitude post of Von Schmidt by team. This place was the nearest known position to the latitude required. Two of these posts were set in 1873 to mark the parallel of thirty-five degrees, and the east one, which is on a bluff of sand and gravel about 50 feet above the water and overlooking the alluvial bottoms of the river, was selected as a triangulation and azimuth point. Just 5.87 meters due west of this eastern post, a latitude pier 17 inches by 17 inches by 5½ feet high was built of concrete during the afternoon of our arrival at the thirty-fifth degree. An observing tent 8 by 10 feet was erected on a platform to shelter zenith telescope No. 6, which was used to make the observations. The latitude was determined by 97 observations on 20 pairs of latitude stars on May 22, 23, 25, 27, and 28—five nights—and value of micrometer on 43 H. Cephei through lower culmination on one night, May 29. Time was observed with the zenith telescope to determine the error of pocket chronometer Karr No. 1012.

The latitude was determined by what is commonly known as Talcott's method. Two stars are selected on different sides of the zenith and nearly at equal distances from it; the difference of zenith distance is measured by means of a delicate micrometer, noting the level and the approximate time of culmination of each star; only the differential refraction is introduced.

Upon the completion of the latitude preparations were made for determining the azimuth, which was done in the usual manner by measuring the angle between a fixed terrestrial mark and the moving star, noting the chronometer time when pointing on the latter, and referring the observations to the meridian, thus determining the angle between the plane of the meridian and the terrestrial mark. These azimuth observations were made on Polaris "at any hour angle," June 2, 3, and 4, by me, using an 8-inch theodolite No. 153, reading to 5" by 2 verniers; on June 22, 23, 24, and 25 further measurements of the azimuth were made by Assistant W. B. Fairfield with Gambey theodolite No. 20, a 10-inch instrument reading to 5" by 4 verniers. Thirty-seven separate results were obtained for this azimuth.

In order to determine points for the topography near the thirty-fifth degree of latitude a base of 462.5 meters was measured twice with a 30-meter steel tape, and a small scheme of triangulation developed, which also served to get the distance across the river. The field computations of the latitude showed that the thirty-fifth degree of latitude post of Von Schmidt was in $35^{\circ} 00' 15'' 16$, or that the point was about 467 meters too far north. This distance was laid off to the south, and 3 redwood posts, each 4 inches by 4 inches by 6 feet, were placed to mark the thirty-fifth degree, 2 of these on the west side of the river and 1 on the east bank in Arizona. Each of these posts has carved on it *Lat. 35°. 1893. C. G. S.* The 2 posts on the west bank are 440.07 meters apart. The most easterly is 83 meters from the foot of the bluff and 100 meters from the shore line of the lake (old channel). The post on the Arizona or east side of the river is 135 meters from the foot of the bluff and 140 meters from the shore

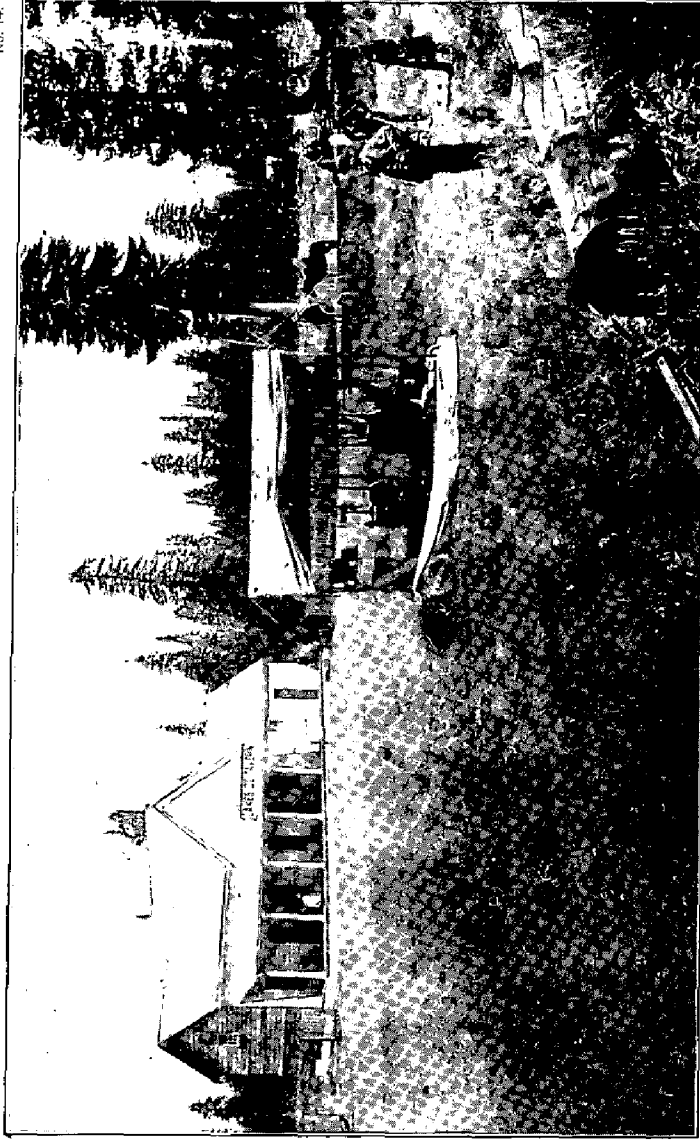
line of the lake (another old channel). The posts were placed on the high bluffs (40 to 50 feet) which overlook the trees on the river bottom. They were surrounded with mounds of stone and sand and each has a stone under it with a drill hole in the top to mark the point. The distance between the 2 posts nearest the river on the east and west banks is 4 580 meters; from foot of bluff to foot of bluff is 4 362 meters; one-half of this is 2 181 meters, the distance to the center of river, or the middle point between the bluff banks. Von Schmidt marked his thirty-fifth degree of latitude by 2 cottonwood posts, 1 on the bluff and the other 462.8 meters west. Both were found in good condition. The post near the river was carefully removed; a stone with a drill hole in it was placed 2 feet below the surface for an underground mark, and another stone placed over this with a drill hole in it for a surface mark. This station was used both as a point in the triangulation and for observing azimuth. Upon completing the azimuth observations the post was set back in its old place, a large nail driven in the top, and centered over the point below. A mound of stone and sand was built around the post. This post is also the north end of a meridian, the south end being 468.62 meters distant, marked by a drill hole in a block of concrete. A small pile of stone was placed over it.

The topography includes a mile on each side of the thirty-fifth degree of latitude, on a scale of $\frac{1}{100,000}$, covering an area of 7 square miles. It was executed by means of a small plane table, partly by me and partly by the recorder, Mr. G. J. Kammerer, for the purpose of defining clearly the bluff line along the river, which is the only stable shore line of the Colorado River at and near the thirty-fifth degree of latitude. These bluffs are formed of sand, gravel, pebbles, and bowlders washed down from the mountains. They are devoid of vegetation, except greasewood and sagebrush. They vary in height from a few feet to 70 or 80 feet, and sloping down toward the river are deeply furrowed into ravines by heavy rains, giving the appearance of numberless embankments or dumps from mines at right angles to the general direction of the stream, which has washed around the end of these embankments during high water, keeping the river ends precipitous.

The alluvial bottoms are from 2 to 3 miles wide, the soil being a sandy loam rising several feet above the river, but generally submerged during the time of high water. The growth is chiefly willow, interspersed with cottonwood and mesquite. Some of the land is cultivated by Indians; there are also a few ranches owned by whites.

The current is very swift and the channel changes rapidly during high water. Sometimes from 20 to 30 feet of the bank will be cut away in a day. The topographic sheet shows approximately the rate of change during the short time we were in that locality. In 1893 the east bank was being cut away. Trees from 5 to 12 years old were swept away like twigs. Lakes or remains of old channels are numerous.

After the preliminary computations had been made posts were set to mark the approximate position of the oblique boundary line on firm ground. The first of these was 2 080 meters north and 293 meters west of the Von Schmidt east latitude post, and 3 646 meters northwest of the center of the river. The second post is 2 250 meters northwest of the first post. These two posts are redwood, 4 inches by 4 inches by 6 feet, placed in the ground about 2 feet, with a mound of stone and sand around each. The one nearest the river has carved on it S. E. LINE POST, C. G. S.; the other N. W. LINE POST, C. G. S. All of these marks were of a temporary character, awaiting the Office computations of the observations before being permanently placed.

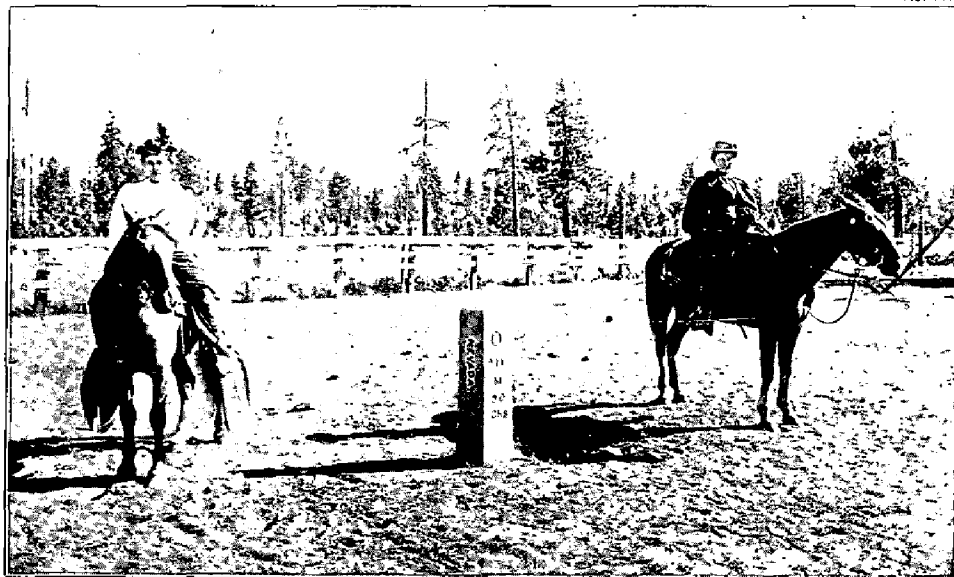


ASTRONOMICAL STATION AT LAKE TAHOE, 1893.

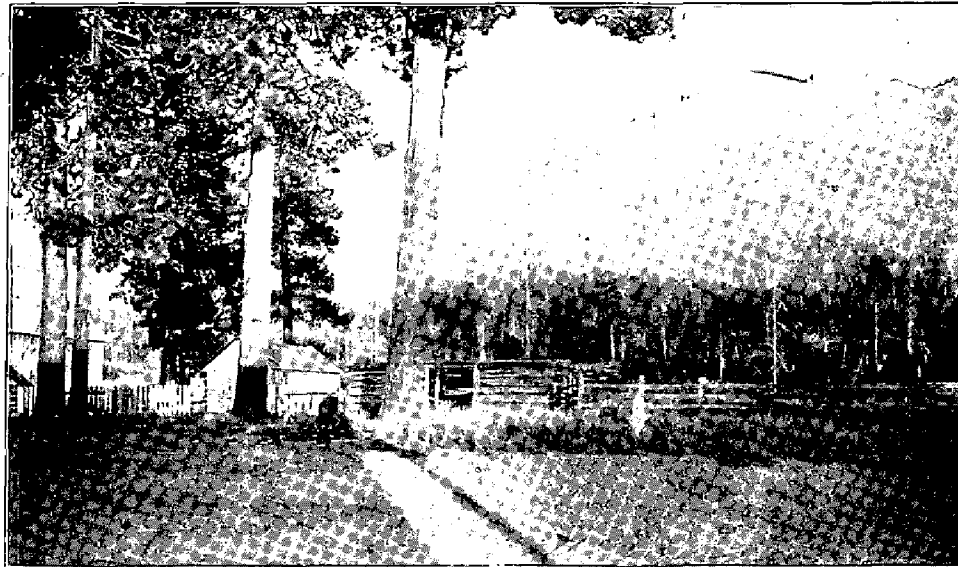
Von Schmidt stone, 1872.



VON SCHMIDT BOUNDARY MONUMENT—"211 M. 30 CHS."

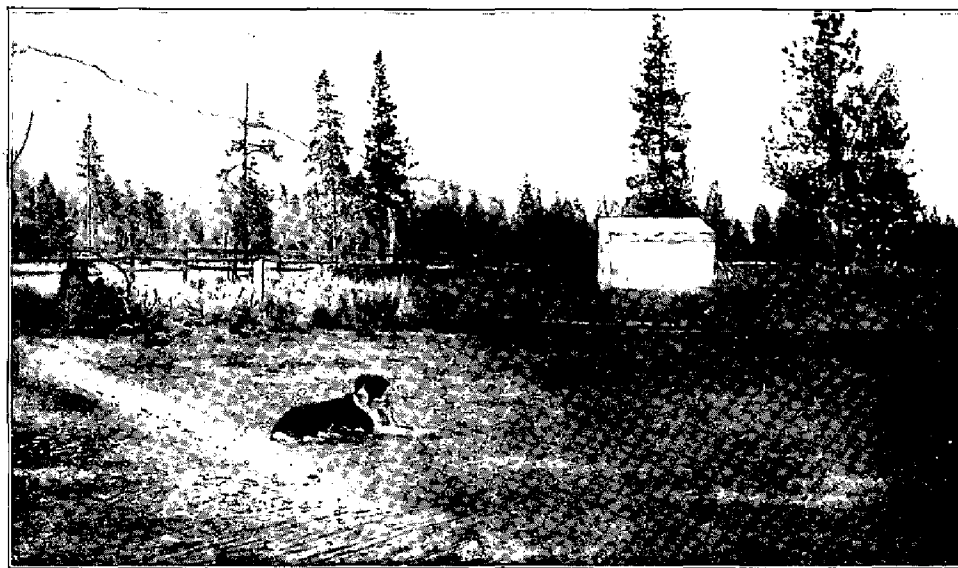


VON SCHMIDT BOUNDARY MONUMENT—"211 M. 30 CHS."



Line, 1893. Line, 1873.

VON SCHMIDT BOUNDARY MONUMENT—"211 M. 30 CHS." LOOKING SOUTHEAST.



Longitude station.

VON SCHMIDT BOUNDARY MONUMENT—"211 M. 30 CHS." LOOKING SOUTHWEST.



VON SCHMIDT BOUNDARY MONUMENT—"210 M. 76 CHS." LOOKING SOUTHWEST.



VON SCHMIDT BOUNDARY MONUMENT—"210 M. 76 CHS." LOOKING NORTHEAST.

The triangulation from the astronomic station at the Needles to carry up the longitude to the thirty-fifth degree was executed by Assistant W. B. Fairfield. He measured a base of 1 709'326 meters in length four times—twice in the day and twice at night—with a steel tape 100 meters long, under a strain of 10 kilograms. Posts were driven every 10 meters to support this tape, and the contacts were made on pieces of tin nailed on top of the 100-meter posts. Two thermometers were read during the measurements. The day temperatures ranged from 98° to 116° and the night temperatures from 69° to 86°. The base line was leveled by Mr. G. J. Kammerer, and also connected with the rail of the Atlantic and Pacific Railroad at the Needles. This latter point was given by the railroad authorities as 477 feet above the Southern Pacific Railroad datum, which is the level of high water in San Francisco Bay, 5.7 feet above the level of mean low water at Fort Point.

The distance between the Needles and the thirty-fifth degree east post of Von Schmidt was covered by two quadrilaterals. The latitude at the Needles was by this means connected with that at the Von Schmidt post and showed a difference of 9.19 seconds of arc, or 283 meters, due to local deflection.

The operations near the southeast terminus of the oblique boundary were completed by June 30, 1893, and the party returned to San Francisco to prepare for taking up the work on Lake Tahoe near the northwest end of the oblique boundary.

C. LAKE TAHOE OR NORTHWEST TERMINUS, 1893.

Preparations for this work were in progress from early in July to the 25th of the month. Horses, mules, wagons, harness, bedding, tents, instrumental outfit for longitude, latitude, azimuth, and triangulation were procured and shipped to Carson City; finally, the party left for the same point July 25.

The first step to be taken was the determination of longitude at a point on the Von Schmidt boundary of 1873 near Lake Tahoe. This was done by using Carson City as a base and connecting the lake station with it by the telephone line, which runs from Carson City to Glenbrook and thence along the shore of the lake to Bijou and Tallac, for exchanging longitude signals. The station used at Carson City was the latitude pier erected by me in 1889, 0° 8' 03" north and 8° 01' 15" east of the transit pier in the observatory of Mr. C. W. Friend. A rough wooden building was erected to shelter the instrument. The station on Lake Tahoe was placed in the open area on the east or front side of the Lakeside Tavern, formerly the property of Mr. Lapham, but in 1893 occupied by Mr. E. B. Smith.

This station is 61½ feet south and 33 feet west of the second granite monument from the lake shore, set by Von Schmidt in 1873 to mark the line at the road. This monument is "211 miles 30 chains" from the Oregon boundary. On one side is "CALIFORNIA," the other "NEVADA," and on the southeast face is "1873," evidently changed from 1863. The stone has a good foundation in gravel soil, and was in a vertical position.

The location of the longitude station was selected with reference to the telephone line from Carson City to Bijou. The use of this was given us by the owners.

The longitude pier was built of brick laid in cement, 2½ feet in the ground and 3 feet above. The top is 17 by 25 inches. After the astronomic work was completed the pier (called "Transit" in the triangulation records) was coated over with Portland cement, and a granite slab 17 by 25 by 6 inches placed on top. The station mark is a

copper bolt in top of the slab. In 1899 all of this cement coating had been destroyed by frost, and, to prevent the bricks from disintegrating, a concrete coating made of cement and broken stone was placed around this pier.

A latitude pier 17 by 17 by 40 inches was erected 50 inches due west of the transit pier for the zenith telescope (No. 6), but it was removed after completing the observations, except the brick foundation about a foot below the surface.

Upon the completion of the astronomic stations, longitude signals were interchanged between Carson City, where Professor Davidson made the observations, and Lake Tahoe on August 3, 4, 6, 7, 8. After this Professor Davidson went to Lake Tahoe and I went to Carson, and signals were again interchanged on August 9, 10, and 11, which completed the determination.

The longitude determination was made in the following manner: Both stations were fitted up with instruments as near alike as possible; the same stars were observed at both stations, so as to eliminate errors of right ascension; after half the observations were completed the observers changed places to eliminate the personal equation. The observations were made on two time sets divided into two groups containing each four time stars and an azimuth star. Eight levels were read during each time set, or 16 during the night's work. The two time sets gave two independent corrections for the chronometer, and hence a rate so that the chronometer corrections might be applied to the epoch of interchange of signals between the two stations. About 30 signals were sent in each direction and recorded on the chronographs which are arranged for double speed. The time observations were recorded at ordinary or single speed.

On August 16 zenith telescope No. 6 was mounted on the latitude pier at Lake Tahoe, and the latitude was determined by 108 observations on 22 pairs of stars during five nights—August 16, 17, 18, 19, 20—and value of micrometer on δ Ursæ Minoris through upper culmination with chronographic record on August 21.

A primary azimuth was determined by Assistant George Davidson about seven-eighths mile northwest of Lakeside Tavern, on the shore of Lake Tahoe, with 20-inch theodolite No. 115, and introduced in the triangulation computation.

Immediately after the observations were completed the preliminary computations of both latitude and longitude were made for field purposes.

Early in September a base of 930 meters was measured with a steel tape on the shore of the lake and a scheme of triangulation developed and executed for the topography and for locating a point approximately on the boundary due north of the longitude station ("Transit"). The following data for determining this point were available:

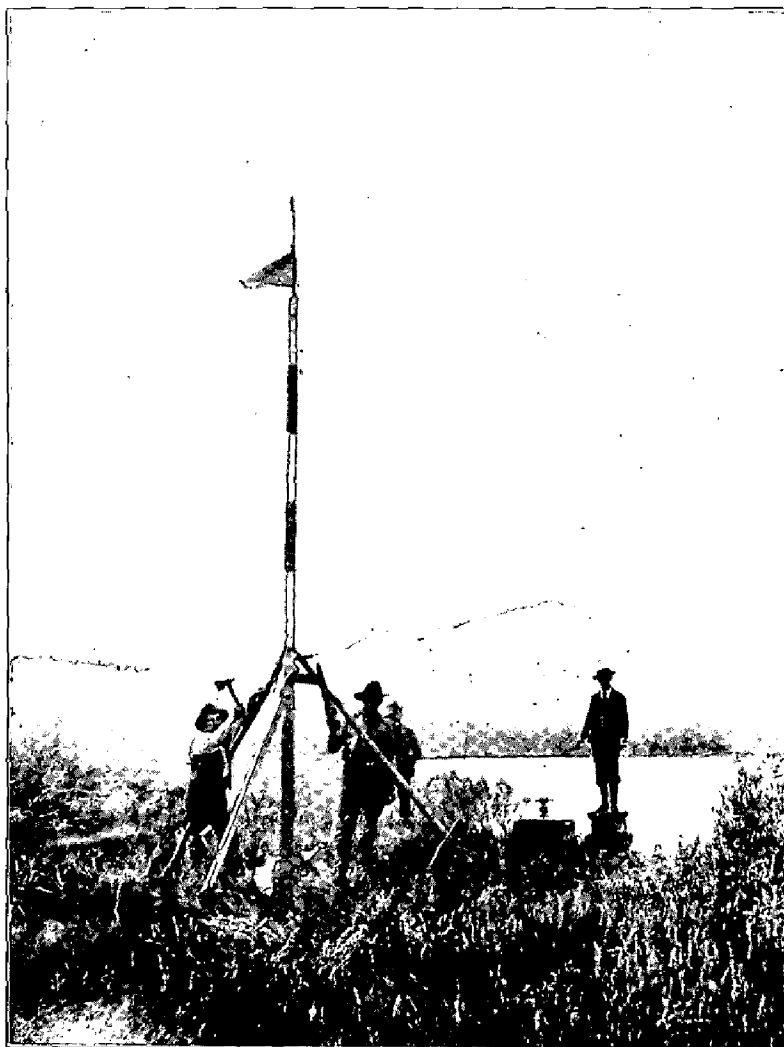
- (1) The observed latitude;
- (2) The observed longitude;
- (3) The approximate azimuth $311^{\circ} 19'$ at the intersection of 39° latitude and 120° longitude furnished by the United States Coast and Geodetic Survey Office from former determinations of the Colorado River terminal.

The preliminary computations showed that the longitude station was 790.9 meters due south of a point on the oblique boundary.

The meridian used in the preliminary work was laid off with the astronomic transit, and the distance, 790.9 meters north of the longitude pier, was measured with a steel tape; the point thus located was called "Turning Point 1893." It was marked by



OLD INSTRUMENT BLOCKS, UPPER TRUCKEE RIVER.



Upper Truckee Station.

OLD INSTRUMENT BLOCKS, UPPER TRUCKEE RIVER.

a block of granite with a copper bolt in the top. This station was occupied with a 10-inch Gambey theodolite and the preliminary azimuth of the line was laid off and three other points were placed approximately in line and marked:

- (1) "Initial stone 1893" on the lake shore, block of granite with copper bolt.
- (2) "Road 1893," west side of main road, block of granite with copper bolt.
- (3) "Mountain 1893," drill hole in stone on mountain 2.29 miles distant.

A meridian stone (granite) was placed 507.2 meters north of the longitude pier. It is in the east-and-west cut made by Grunsky and Minto in 1889, from Von Schmit's lake-shore stone, or 210 miles 76 chains monument. Another granite meridian mark was placed about 390 meters south of the longitude pier. Each of these was marked by a copper bolt in top with cross lines.

Five boundary marks established by Von Schmidt in 1873 were recovered, all in good condition:

- (1) The granite monument on the shore of the lake, called "Lake shore stone" in the records, marked "210 miles 76 chains" on the northwest face, "1873" (changed from 1863) on the southeast face, "NEV." on the northeast, and "CAL." on the southwest face. This monument was in loose sand and leaning somewhat. A crib work of logs was placed around it after the stone was made vertical.
- (2) A square wooden post set in the marsh to mark 211 miles.
- (3) Granite monument on the southeast side of the road in front of Lakeside Tavern, marked "211 miles 30 chains," counting from Oregon, date changed from 1863 to 1873, and with "CALIFORNIA" and "NEVADA" on their respective sides. (See illustrations Nos. 15 and 16.)
- (4) Wooden post to mark 212 miles, on the foothills.
- (5) Tree marked "212 miles 53 chains," to preserve the site of Von Schmidt's observatory on the southeast shore of the lake.

The field notes of Von Schmidt state that this point (5) was marked by an "iron monument." I failed to find anything but a pine tree 8 inches diameter, marked "212 m. 53 ch. 21 lks.," "1873," "CAL.," and "NEV." The iron monument could not have been carried to that place except in sections, on account of the steep grade and rough mountain side. It was never set in place.

No search was made for Von Schmidt's line marks southeast of this point, as they were too far from our base of operations. This line (Von Schmidt) is blazed through the woods very clearly, and may be traced without any difficulty.

While executing the topography the line of 1863 was identified by means of a fence running along it and trees with blazes cut on them and traced nearly to the mountain summit. No marks were near the lake, but a wooden post without marks about 10 by 10 inches, 6 feet long, was found in the fence line just west of the Placerville road. The post was badly decayed at the ground and ready to fall. I learned afterwards that the two granite monuments now on the Von Schmidt line of 1873 were formerly on this line. The date 1863 was changed to 1873, as is clearly shown by inspecting the figures. These granite monuments are 6 feet long, 2 feet rough cut with base dimensions about 12 by 12 inches, and 4 feet dressed, being 10½ inches at the bottom and 8½ inches at top, and terminating in a flat pyramid.

Near the triangulation point, "Upper Truckee," three-eighths mile west of the mouth of the Upper Truckee River, two wooden blocks were found that had evidently been sawed off from a large tree about 2½ feet in diameter and used as instrument supports, presumably by Von Schmidt in 1873. These blocks were in the last stages of decay, and were nearly obliterated by a storm in September, 1893. The most westerly

block was in the water, the lake having encroached upon the south shore. Two good photographs were obtained of these blocks.

The post set by Grunsky and Minto in 1889 to mark their boundary near the shore of the lake was found lying on the ground and photographed without disturbing it.

A second post set by them "4 073'3 ft." due east of the "Lake Shore Stone" of Von Schmidt was also found and determined on the topographic sheet No. 2151, scale 1:10 000. No other marks set by these engineers were looked for.

Several of the section trees of the land survey were included in the topography.

A number of the triangulation points along the lake shore toward Bijou and Rowland's were permanently marked with stones having drill holes in the tops.

A block of granite with a copper bolt and cross lines on top and with "120°" cut on its north face, was set on the low, narrow, grassy rim of firm land separating the marsh of the Upper Truckee River from the lake. This stone is three-eighths mile east of the mouth of the Upper Truckee River. It has about 18 inches exposed above ground.

While I was engaged at the southeast end of Lake Tahoe, Assistant W. B. Fairfield executed the triangulation necessary to connect the primary work depending on the Yolo base, with the small triangulation executed by me. He used for this purpose the line "Lola-Round Top," 91 038'53 meters in length, and gradually contracted the scheme until he finally joined my work on the line "Folsom-Lake Shore Stone," 3 017'08 meters in length, differing from my rough determination with a steel tape base only 0'3 meter, which is sufficiently close for topographic purposes.

The following comparisons show the local deflection:

	Latitude.	Longitude.
	° / //	° / //
"Lake Shore Stone" (astronomic data) determined from observed ϕ and λ 1893.....	38 57 34'854	119 57 05'125
Lake Shore Stone (geodetic data) from Yolo base triangulation	38 57 25'059	119 57 05'992
Difference or local deflection.....	9'804	0'867

On the Colorado River the difference between the latitude observed at Von Schmidt's 35° latitude post (astronomic) and the latitude brought up from the Needles (geodetic) 12 miles south by triangulation is 9''13, as shown below.

	Latitude.	Longitude.
	° / //	° / //
Von Schmidt's east latitude post, astronomic or observed.....	35 00 15'020	
The same, geodetic, from Lake Tahoe.....	35 00 14'640	114 39 31'710
	0'38	
The same, geodetic, from Needles.....	35 00 24'150	114 39 23'055
	9'51	
Difference or local deflection.....	9'13	8'655



GRANSKY AND MINTO POST OF 1899.

The country traversed by the boundary, as shown on the topographic sheet 1:10 000, has the following characteristics:

Near the shore the soil is chiefly sand from the disintegration of the granite forming the surface rock of the mountain range. The slope is gradual up to the foothills, which begin three-fourths of a mile from the shore. Beyond this the country is very much broken by hillocks and small peaks, having both sides and summits covered with masses of granite. This continues for three-fourths of a mile farther, rising at $1\frac{1}{2}$ miles from the lake to an elevation of some 600 feet above its surface, where the steep side of the mountain is reached. The rise continues to an altitude of 3 300 feet above the lake.

The sloping ground and many of the little valleys are cultivated where water can be procured for irrigation. Several small mountain streams are utilized for this purpose, but the supply is not very abundant. All of this region was covered with a splendid growth of sugar pine, pitch pine, tamarack, white fir, and white cedar. Most of the original forest has been cut and the timber used in the mines of Virginia City and the neighboring towns. This industry necessitated the building of two narrow-gauge railroads—one at Bijou, the southern end of the lake, with several branches running through the timber, and the other at Glenbrook, to carry the lumber from the lake up to the summit, whence a flume conveyed it to Carson City, the nearest point to the railroad running to Virginia City and Reno. Two steamers were employed to tow rafts of logs to the sawmills and the barges, laden with wood from Bijou and other points on the lake, to Glenbrook.

In 1898 the narrow-gauge railroads were torn up and removed to the northwest side of the lake. For years the lake has been a summer resort. Many hotels have sprung up to meet this demand. A railroad now connects Tahoe City with Truckee, and a large steamer carries the mail and excursion parties around the lake during the summer.

Mr. Frank W. Edmonds acted as telegraph operator at the Lake Tahoe astronomic station, was recorder to Professor Davidson in observing the primary azimuth, and assisted in the preliminary computations and building of signals for triangulation and the topographic work.

Mr. G. J. Kammerer aided Assistant Fairfield in his triangulation. Among the many who rendered service and showed us courtesies may be mentioned Mr. C. W. Friend, of the Carson City observatory; Bliss Brothers, representing the Virginia and Truckee Lumber Company and owners of the telephone line from Carson City to Glenbrook; also the owners of the telephone lines from Glenbrook to Bijou and Tallac Hotel. No charge was made for using this line, and free transportation on the steamers plying between Glenbrook and Bijou was given us.

The season closed about November 1, and the party returned to Carson City for the purpose of storing the outfit and putting the animals out to winter. The party reached San Francisco from Carson City on November 3, 1893, and was disbanded. Mr. Fairfield and I remained in San Francisco, working on the records, until November 26, when we started to Washington.

D. FIELD OPERATIONS OF 1894.

During the winter of 1894 the office computations of the work executed at the Colorado River and Lake Tahoe termini were made, and the party was directed to resume operations on the California and Nevada oblique boundary, beginning at Lake Tahoe and running southeast in tracing the line. The great railroad strike beginning June 28, 1894, and continuing about a month, prevented us from getting into the field by July 1.

1. INSTRUCTIONS.

The following instructions of May 16, 1894, show the general scope of the field work:

TREASURY DEPARTMENT,
UNITED STATES COAST AND GEODETIC SURVEY,
Washington, D. C., May 16, 1894.

C. H. SINCLAIR,
Assistant, Coast and Geodetic Survey, Washington, D. C.

SIR: After completing the Tacoma-Seattle longitude work and the necessary computations at San Francisco relative thereto, you will please arrange, in conference with Assistant Davidson, for the resumption, on July 1, of work on the California and Nevada boundary line.

You will begin at the Lake Tahoe end of the boundary and first observe an azimuth for the determination of its direction. This azimuth may be observed at a point 805.15 meters due north of the longitude station, which point is the intersection of the meridian of the longitude station with the oblique boundary. Calling T 0 the initial point in Lake Tahoe, and T 1, T 2, etc., the points in the line proceeding southeast, and C 0 the initial point in the Colorado River, and C 1, C 2, etc., the points in the line proceeding northeast, the azimuth—

$$T\ 0\ to\ C\ 0 = 311^{\circ}\ 14'\ 36''\cdot6$$

and the azimuth

$$T\ 1\ to\ C\ 0 = 311^{\circ}\ 16'\ 39''\cdot8,$$

hence the back azimuth

$$T\ 1\ to\ T\ 0 = 131^{\circ}\ 16'\ 39''\cdot8.$$

Having obtained the direction of the line, you will range it out with a theodolite, establishing points on the lake shore, road crossings, and summits, so that from any principal line mark two others, one forward and the other backward, may be visible. These line marks should be placed from 1 to 5 miles apart, according to the character of the country.

The distances between the principal line marks will be measured by small triangulation, continuous as far as practicable, and intermediate distances may be obtained where triangulation is impracticable by tape measures and telemeter.

Assistant W. B. Fairfield will be assigned to your party, and has already been instructed to report to you on July 1, at Lake Tahoe, after having attended to the purchase of necessary outfit.

Mr. Fairfield will execute, under your direction, the triangulation, and attend to the sketching of the topography, while you are engaged on the ranging out and marking of the line; but as your work will probably progress more rapidly than his, you will, from time to time, discontinue temporarily your line work and assist in the triangulation.

Latitude and longitude observations will be made at or near the intersection of the Carson and Colorado Railroad with the boundary, and an azimuth will be observed at said intersection. According to the railroad map the station named "Queen" is very near the boundary.

The magnetic elements should be determined at Carson City and Lake Tahoe, and the magnetic bearing of the boundary line should be observed at all monuments and triangulation stations occupied. For the latter purpose a compass declinometer may be used.

Assistant George Davidson will exercise general supervision over the work, and you will confer freely with him and keep him fully informed as to the progress of the work, but you will have control over your party funds and will submit your accounts, journals, and monthly reports directly to this office.

Your estimates for monthly expenses, etc., will be approved, but the amount of the allotment (probably \$5 000) can not be fixed until after the passage of the appropriation bill by Congress. You will be duly notified hereafter of the amount of your allotment, and on its exhaustion you will, without further instructions, disband party, make suitable provision for the care of the public property in your charge, and proceed to Washington, D. C., and report to me in person at this Office.

Mr. Fairfield will also proceed to Washington, and his traveling expenses and your own, and all necessary expenses of the work, will be covered by these instructions.

Respectfully, yours,

T. C. MENDENHALL, *Superintendent.*

2. AZIMUTH OBSERVATIONS SOUTHEAST END LAKE TAHOE.

In compliance with these instructions the party left San Francisco on July 27 for Lake Tahoe and reached the field of operations on the 31st, after getting together the animals, wagons, instruments, and other outfit stored in Carson City at the close of the preceding season. In June, Assistant W. B. Fairfield had gone to Carson Valley and purchased additional mules for our complement of team and pack animals.

From the new determination of the termini a more correct knowledge of their geographic position was obtained and a recomputation of the direction of the oblique boundary was made. The new azimuth was about five minutes less than the preliminary one used in 1893, and the new distance north of the longitude pier to reach a point on the oblique boundary was 805'15 meters instead of 790'9 meters.

The meridian was extended north of the old position of 1893 14'25 meters, and a large block about 16 inches in diameter and 7 feet long was cut from a dry pine log and planted 2½ feet in the ground as a support for the azimuth instrument (theodolite No. 82, 10-inch Gambey).

Azimuth was determined on August 3, 4, and 5 by means of ten sets on "Polaris at any hour angle." The terrestrial mark was placed at Folsoms Knob, distant 2½ miles. After computing the azimuth, the angle of the line was laid off and a point was located on the shore of the lake 460'7 meters distant and called "Initial 1894." The azimuth station itself was called "T 1." Another point, T 2, was set from the azimuth station 377'9 meters southeast on the road from Bijou to Glenbrook and Carson City (from Placerville to Carson Valley). These two points were marked with stones having copper bolts in top, moved from the preliminary points set in 1893. The theodolite was then transferred to the point on the shore of the lake, "Initial 1894," and a point was located on the mountain, T 3, 3 946'4 meters distant.

The theodolite was after this moved up on the mountain, where a camp was established. The stations T 3, T 4, T 5, T 6, and T 7 were successively occupied, the distances between them being as follows: T 3 to T 4, 263'4 meters; T 4 to T 5, 988'6 meters; T 5 to T 6, 652 meters; T 6 to T 7, 602 meters. Thus, in ranging out 4 miles, it was necessary to set up the theodolite five times in order to get over the summit of the mountain, which rises to 9 517 feet above the sea, or nearly 3 300 feet above the lake.

3. RANGING OUT THE LINE—ORGANIZATION OF PARTY.

The party was now divided into three sections. One under Mr. Fairfield, who had charge of the triangulation for determining the length of the line, the magnetic observations, and topographic sketching. The other two sections were the ranging-out section with the theodolite, under my immediate charge, and the forward section, which cooperated with me, under Mr. A. W. Cuddeback, who went ahead to locate points in

line by means of a pocket heliotrope. Two heliotropes were used to get in line, one at the theodolite and one with the forward party, both parties being provided with a code of signals. The length of sight was limited only by the topographic features.

4. CARSON VALLEY—ANTELOPE MOUNTAINS—SWEETWATER MOUNTAINS.

From T 7 a number of points were located in Carson Valley, and as far away as T 22, on the summit of the Antelope range, a distance of 20.4 miles. The theodolite was then moved back to T 6 because it was higher, and T 32 was lined in on the east slope of the "Middle Sister," in the Sweetwater Mountains, 43.7 miles from the instrument. This was a very long sight, the longest recorded, to my knowledge, up to that time, of lining in a point, but it was exceeded by the next sight from T 32 to T 60 on the White Mountains.

The theodolite was moved from T 6 to T 32, and a number of points put in on the back line to the northwest as far as T 23 on the southeast slope of the Antelope Mountains.

It required three days to move from Lake Tahoe to the Sweetwater Mountains. The camp outfit and instruments were carried up on pack animals to a spring on the northwest side of the "Middle Sister," about a mile from the station.

5. WHITE MOUNTAINS.

From T 32 the White Mountains loomed up conspicuously, and as the season for stormy weather was approaching I sent the forward section directly to this distant place, and succeeded in getting a point located in 1 hour 40 minutes from the time the heliotrope was first seen. This long sight of 68.8 miles was made on a small pocket Steinheil heliotrope, with a mirror $1\frac{1}{4}$ inches by 1 inch, and the signals were clearly interpreted at that distance. This point was T 60, the southeast limit of our work for the season, 116.2 miles from the shore of Lake Tahoe.

The forward section returned after this to T 42, working back toward the theodolite station T 32. This point T 42 was nearly 27 miles from T 32 and almost 42 miles this side of the White Mountains. Points were located on all of the important intervening ridges back to T 32. The theodolite was afterwards moved to T 42, and points were placed on the ridges and roads to T 49, 16.5 miles southeast.

In order to reach T 49 it was necessary to cross the desert, a distance of 30 miles, without water. The route was from Aurora by Spring Peak across the desert to Adobe Meadows, at the east end of which is a large spring, making an excellent camping place. The instrument was set up at T 49, and points were lined in as far as T 53. The latter was then occupied and T 54 put in, so point by point until T 59 was reached, which marks the crossing of the Carson and Colorado Railroad, about 110 miles from the shore of Lake Tahoe.

Assistant W. B. Fairfield had charge of the triangulation, as before stated. It was decided at the beginning of the season to carry a scheme of triangulation along the line, with sides from 1 to 5 miles in length, to get the distances and control the work. The base for this purpose was obtained by contracting the primary work from "Round Top"—"Lola" to the requisite dimensions near Lake Tahoe. As the line could be ranged out more rapidly than the triangulation could be executed, I stopped the ranging from time to time and assisted in the triangulation, reconnaissance, and signal building.

The angular measures were made with a 6-inch Gambey reading to 5", a 10-inch Gambey reading to 5", and a 7-inch Buff and Burger theodolite reading to 10". The party consisted of 11 men, all told; 23 animals, of which 5 were saddle horses and 18 were mules; 2 large wagons and 1 thoroughbred, with a pair of mules. The party during this season was able to subsist on the country, at the ranches and small hotels. Provender, such as hay and grain, was generally procured in the immediate neighborhood of the work. Owing to frequent moves, the field operations were more in the nature of a reconnaissance than regular triangulation. During the season 60 points were established on the random line and 35 additional triangulation points were fixed.

Upon the completion of the triangulation the entire outfit was taken back to Carson City, the instruments and wagons stored, and the animals quartered for the winter. While this was being done, the magnetic elements were determined on three days with theodolite magnetometer No. 17 and dip circles No. 23 at Carson City, in the grounds of the "Pavilion," and in the meridian of the transit of Mr. C. W. Friend's observatory, one square south. The station was marked by a stone with a drill hole in the top. The magnetic elements were also determined on three days at the Lakeside Tavern, southeast end of Lake Tahoe, at a point 25 meters due south of the longitude pier of 1893, with the same instruments, just after the station at Carson City was completed.

The season closed and the party was disbanded on November 27, and Mr. Fairfield and I started to Washington on December 8, after getting the records in shape at the suboffice in San Francisco.

E. FIELD OPERATIONS, 1895.

I. INSTRUCTIONS.

TREASURY DEPARTMENT,
OFFICE OF THE COAST AND GEODETIC SURVEY,
Washington, D. C., May 15, 1895.

C. H. SINCLAIR,

Assistant, Coast and Geodetic Survey, Washington, D. C.

SIR: You will please make your arrangements to resume the survey of the California and Nevada oblique boundary, beginning at the point where operations were suspended last season.

The plan of operations will be the same as that of last season, except that it is not considered necessary at this time to determine longitude, latitude, and azimuth at the railroad crossing, since it is not required for the successful prosecution of the survey. A tape-line base, however, is to be measured at the railroad crossing and connected with the triangulation.

Assistant W. B. Fairfield will be associated with you in this work, and will execute the triangulation, topography, and magnetics, as he did last season.

Both you and Assistant Fairfield are authorized to purchase round-trip tickets to San Francisco, as thereby considerable expense will be saved.

At the close of the season both of you will report to me in person at Washington.

These instructions cover all necessary expenses of travel, transportation, and field operations incurred in their execution.

If necessary, an additional Aid will be sent you later.

Respectfully, yours,

W. W. DUFFIELD, *Superintendent.*

P. S.—In place of the additional Aid mentioned above, Mr. A. L. Baldwin, Assistant, will be assigned to your party.

Before leaving Washington for the West in 1895 I had written to Professor Davidson, who was in charge of the suboffice at San Francisco, and requested him to secure for me a few trustworthy men; consequently we were not long detained in San Francisco, but on June 3 proceeded to Carson City, Nev., where the outfit was stored and the animals had been left for the winter.

A few days were spent in shoeing the animals, repairing wagons, harness, and making other preparations for the season's work, and then the party started for Bertrand's ranch, near Benton, Cal., at the crossing of the Carson and Colorado Railroad, near the end of the 1894 work, about 160 miles distant. As the animals were fresh from the pasture the journey was made by easy stages to prevent making the shoulders of the mules sore and in order that the teams might be in good working condition upon reaching the scene of operations. About a week was consumed in making the drive. Our outfit comprised two 6-mule wagons, one thoroughbrace drawn by two mules; and two double buckboards, five saddle and pack animals in addition, making twenty-three animals and twelve persons in the party. Three other mules were purchased during the season. The buckboards proved to be a most serviceable addition to the outfit. With them, by using the large wagons as the bases of supply, camps were made in difficult places for a short time, and the pack animals were employed where the buckboards could not travel.

2. BASE AND AZIMUTH, WHITE MOUNTAINS.

The party reached the starting point on June 13. Next day preparations were made for measuring a base with a steel tape and an azimuth for the triangulation. Azimuth was measured at T 59, on Polaris, June 14 and 15 with theodolite No. 82, 10-inch Gambey, time being determined with the same instrument and with theodolite No. 159, a 7-inch Buff and Berger. On Sunday night, June 16, the base was measured twice with 100-meter steel tape No. 153, using a straight reach of the railroad and laying the tape along the rails. This base was 1 080.14 meters in length; the temperature was noted by two thermometers laid on the rail.

The base was connected with the triangulation by Assistant Fairfield, who occupied several points to the northwest for this purpose.

The organization of the party was in three sections similar to that of last season. The triangulation, topographic sketching, and magnetic observations were placed in charge of Assistant W. B. Fairfield. The forward section, for ranging out the line, was under Assistant A. L. Baldwin, who cooperated with me directly by going ahead and selecting the location of points on ridges or at the proper distances in the valleys. The direct ranging out and interpolating points was under my charge.

3. CROSSING THE WHITE MOUNTAINS, FISH LAKE VALLEY, SYLVANIA MOUNTAINS, GRAPE VINE MOUNTAINS.

The first station occupied by me for ranging out the line was T 60 (see illustration No. 42), the most southeastern point located during the preceding season on the bold north front of the White Mountains, which stand across the line as a formidable barrier about 13 000 feet above sea level. It is an exceedingly difficult station to reach, owing to its altitude and precipitous sides. The footing is very insecure in many places, on account of loose sand, and the difficulties were increased by the

rarefied atmosphere. On Monday, June 17, a start was made for the summit, and camp was pitched at night at the highest water that could be found, in a little spot made green by the melting snow. Next morning we moved upward, slowly, as far as the animals could be induced to go, then, dividing the load between three of us, we reached the station after five hours arduous climbing, where it was necessary to shovel away the snow in order to get a forward sight. Patiently we waited for the heliotrope to flash from the forward party, and at last when it came they were on the wrong mountain, about 3 miles too close. It was too late for them to climb the next mountain that day, so there was nothing left us but to descend to our camp and repeat the trip.

When the ascent was made the next day the forward party was seen to be on the right mountain about 9.7 miles southeast in an air line, but as this station was 9 286 feet above the sea and the climb above the valley was about 4 000 feet, it was slow work for them and they were not in place until the afternoon, when a point was lined in at T 64 and two of us packed to the animals the observing tent and theodolite before dark and spent the night at our improvised camp. Next day the pack animals were brought over from the Queen mine and all of the effects were moved back to Bertrand's ranch, where the large wagon had been left.

By getting an early start and driving late the team was able to move in one day as far as McNett's ranch, nearly 40 miles, and not very far from T 64. Next day we went to a running stream for camp and carried the theodolite up to T 64, and a point was lined in back at T 61, about 6.6 miles to the northwest. This was on June 22, and from this time until July 4, points were lined in from T 64 back to the northwest and all across the Fish Lake Valley as far as T 79 in the Sylvania Mountains, nearly 37 miles to the southeast.

When the outfit was moved from T 64, we went to Piper's upper ranch, Oasis, Cal., near the south end of Fish Lake Valley, where the forward section was waiting for us. Beyond the Sylvania Mountains is a region difficult to operate in on account of the scarcity of water and provender. After due consultation, Mr. Baldwin started on an exploring expedition through this region on July 7, and I moved up to T 79 with the theodolite so as to be ready for the forward ranging. Mr. Baldwin flashed a heliotrope from the highest point of the Grape Vine Mountains on the 11th, 40 miles distant, but it was too late in the day to get a point, and one could not be located until the 15th, near T 89, owing to scarcity of water and long distances from his base of supplies. In the meantime I was able to line in points near by and to make reconnaissance and erect signals for the triangulation.

The forward party, after putting in two intermediate points, returned from their expedition on the 19th, and it was then decided to bring up the triangulation and get the entire party together before advancing through the region to the southeast. Mr. Fairfield was carrying the triangulation over the White Mountains, and, while I worked from T 79 to the northwest, Mr. Baldwin operated about 20 miles northwest of me and formed a junction with Mr. Fairfield. We were thus able to put three triangulation parties in the field.

Arrangements were also made for sending hay and grain to the southeast, a very necessary precaution, as it had to be hauled from Fish Lake Valley. An extra 6-horse team was hired for this purpose, because our own teams were utilized in distributing

provender to the different mountain stations and hauling supplies from the railroad at Bishop.

By August 10 the triangulation had been brought up, provender sent to the southeast, and the parties moved in the same direction. Points having been lined in at T 85 and T 86, I moved forward to the Grape Vine Mountains, passing through the head of Death Valley via Sand Spring, where Mr. Fairfield was engaged in triangulation and putting in a few line stations. The only tree at Sand Spring was a sickly mesquite that made no shade, and the extremely high temperature was most trying to the members of the party as well as to the animals, which were exposed to the broiling sun. The first water beyond Sand Spring is at Staininger's ranch. A second ranch owned by the same man is nearer the Grape Vine Mountains closer to the boundary line. There was a small supply of alfalfa hay at this place, making it a good base from which the work could be conducted. The party remained there until all of the back triangulation was brought up and a forward point lined in for advancing across the Grape Vine Mountains. Although the next spring in the Grape Vine Mountains was less than a day's travel by trail from Staininger's, it required three days to get the teams around, and a distance of 65 miles was traversed. The route was from Staininger's to Thorp's mill, 18 miles; thence to Oasis, Nev., or Beatty's, 28 miles; thence to Big Springs about 19 miles, up in a cañon just at the east foot of the sharp summit called "Nye" in our triangulation, the next to the highest in the Grape Vine Mountains. Grain and hay were sent in advance to this spring, the party reaching there on September 5, moving up from Beatty's ranch with buckboards and pack animals, so as to leave the big teams available for hauling supplies.

From here the ranging was advanced to the southeast end of the Great Amargosa Desert, T 90 having been put in from T 89, T 91 from T 90, and T 92 from T 91. T 92 was a very commanding station. From it points were lined in all across the desert as far west as T 105, about 60 miles distant, the farthest point reached during the season, being on the mountain range dividing Ash Meadows from Pahrump Valley, called by Von Schmidt Chung-up, or Waterless Mountains.

Upon leaving Big Spring the party moved to Oasis, Nev. (Beatty's ranch), and then 8 miles to the next running water. From there it was 40 miles to a water hole, near Franklin Well, dug in the old bed of the Amargosa River, which comes out in Death Valley. Most of this distance is through deep sand, making it a trying trip for the mules with a heavy wagon. Mr. Baldwin had preceded the main party to the water hole and cleaned it out as well as dug it deeper so as to get an abundance of water. While waiting for me to come up he made a reconnaissance, erected signals, and selected a base for checking the triangulation.

Upon reaching this place it was decided to close the season's operations after bringing up the triangulation and measuring a base and azimuth, because it would have required more than a month to complete another reach of the line, and funds were not sufficient for that purpose. Accordingly, while Mr. Fairfield was bringing the triangulation through the Grape Vine Mountains and the Little Amargosa Desert, Mr. Baldwin undertook the central portion and I executed the triangulation at the southeast end as far as T 105 high, the farthest point in the scheme to the southeast, nearly 275 miles from the shore of Lake Tahoe.

4. BASE AND AZIMUTH, GREAT AMARGOSA DESERT.

On October 4, with the assistance of Mr. Baldwin, a base of 1 494.9 meters in length was measured twice, at night, with 100-meter steel tape No. 153, over rolling ground near the southeast end of the Great Amargosa Desert.

I also measured an azimuth at T 101 east, on October 8 and 9, using "Polaris at any hour angle," with Buff and Berger theodolite No. 159.

All of the triangulation was completed by October 10, and arrangements made for starting toward the railroad at Bishop, Cal., by October 14. The route was from Franklin Well (or rather a water hole southeast of it) to Oasis, Nev., "lower water," 40 miles; thence to the "upper water," 8 miles, where one day was spent in getting our effects loaded. From there to Thorp's mill, 28 miles. The water at this well was very bad at that time, but since then the mill has been repaired, the well cleaned out and found to contain excellent water, but no provender is to be had there. The next stopping place was Lida, 35 miles, where there is good well water, but a very uncertain supply of provender. A small store at this place keeps a few supplies for miners. The next move was to Fish Lake Valley, Oasis, Cal., or Piper's ranch, 24 miles, where all kinds of supplies may be procured; provisions in small quantities, hay in abundance, and generally grain. From Thorp's mill a light team may proceed over the mountain grade by State Line Mills, near Oriental post-office, to Tule Cañon, Pigeon Springs, and Palmetto to Piper's ranch. From Piper's it is 40 miles to Big Pine and 15 miles farther to Bishop. Good water is found at Gilbert's, 12 miles from Piper's, and, also, at the tollgate on the pass 10 miles from Big Pine. We reached Bishop, 190 miles from Franklin Well, on Sunday, October 20. Here the animals were put out for the winter, the wagons stored, and the rest of the outfit was taken to Carson City by rail to be overhauled. We were in Carson City on the night of October 23. As many of the men as could be spared were discharged; the others were set to work overhauling, repairing, and oiling the harness, saddles, etc., and making out the inventory.

5. MAGNETICS AT LAKE TAHOE AND CARSON CITY.

As Mr. Fairfield found it necessary to reoccupy some of the triangulation points on Lake Tahoe, I made use of this opportunity to redetermine the magnetic elements at the magnetic station established in 1894 near Lake Side Tavern, southeast end of Lake Tahoe, 25 meters due south of the longitude pier. This magnetic station was marked by a block of granite standing 10 inches above ground with cross lines cut on top. All of the magnetic elements were determined on three days with theodolite magnetometer No. 20 and dip circle No. 21.

After this the magnetic elements were determined on three days in the "Pavilion" grounds, Carson City, at a new station established about 50 meters east of the 1894 station, so as to be free from the influence of the railroad track. Azimuth was observed at this station on one night, and a meridian line marked with two cut granite blocks, 8 by 8 by 30 inches, with a deep cross on top, in the Pavilion grounds, which is county property, and therefore may be preserved.

By the time this work was done, Mr. Fairfield had completed his observations on Lake Tahoe, and after duplicating the records the final start was made on the night of November 12, and I proceeded to Washington and reported to the superintendent.

The work done by Assistants Fairfield and Baldwin can not be commended too highly. They were practically in charge of their sections, dependent upon their own good management and intelligence for subsisting their men and animals and executing the work, which was done in most satisfactory manner. Their cooperation in the work was always cordial and effective.

F. FIELD OPERATIONS OF 1898-99.

There were several reasons for not resuming work on the boundary line until 1898, the chief of which was the small amount of money available for this survey. Owing to the intense heat during the summer along the southern part of the line, it was considered more advantageous to execute the work during the fall, winter, and spring. After running the random line and triangulating it to obtain the length, it was necessary to correct the line back to Lake Tahoe on the supposition that the random would not strike the terminal post at the southeast end near the Colorado River. It was, therefore, not advisable to undertake the survey until the funds were sufficient to do all of this. Under any circumstances it was necessary to take the outfit back over the line as far as Bishop to winter the stock, so it would have been bad management to return and, not work back. This working back or correcting the line made it necessary that the party should be provided with not less than \$10,000, and until 1898 that sum was not available.

I. INSTRUCTIONS.

A copy of instructions is here inserted:

TREASURY DEPARTMENT,
OFFICE OF THE COAST AND GEODETIC SURVEY,
Washington, D. C., October 1, 1898.

C. H. SINCLAIR,

Assistant, Coast and Geodetic Survey, San Francisco, Cal.

SIR: In conformity with my telegram of October 1, you will please submit estimates for the continuation of the survey and temporary marking of the California and Nevada boundary. Mr. Walter B. Fairfield, assistant, and Mr. F. W. Edmonds, will be directed to report to you for duty.

You are hereby authorized to make the necessary preparations and to put your party in the field without awaiting notice of the formal approval of your estimates.

The general scheme outlined in your statement of April 19, 1898, which contemplates the use of cut stone when practicable for marking the boundary, is approved, and the details of marking the boundary in the most permanent manner possible within the appropriation are left to your own judgment.

The appropriation for this work is as follows: "For surveying and temporarily marking that portion of the eastern boundary of the State of California, commencing at and running southeastward from the intersection of the thirty-ninth degree of north latitude with the one hundred and twentieth degree of longitude west from Greenwich, ten thousand dollars."

These instructions cover all necessary expenses of travel and transportation incurred in their execution.

Respectfully, yours,

HENRY S. PRITCHETT,
Superintendent.

2. ORGANIZATION OF PARTY AND TRAVELING TO THE FIELD.

As a preliminary step toward the resumption of the California and Nevada oblique boundary survey, I went to San Francisco on October 1, from Utah, and after the end of my leave of absence, October 15, was engaged in making preparations for field work. Assistant W. B. Fairfield, who had been engaged in primary triangulation in southeastern California, found me in San Francisco. Mr. Frank W. Edmonds, who was made an assistant in July, 1899, was also added to the party. A few trustworthy men of long experience in our survey work were engaged in San Francisco, and on October 20 the party left for Carson City, Nev.

Reaching Carson City the next day, the work of overhauling the outfit, selecting and shipping it from the storeroom, occupied us until the 22d. On Sunday, the 23d, the party went by rail to Bishop, Cal., where the animals were in pasture and the wagons had been stored in 1895. We reached Bishop October 24, and were employed until the 30th in shoeing the animals, repairing the wagons, getting supplies, and perfecting arrangements for taking a large party through 210 miles of country, for the most part desert, uninhabited, and with but few watering places.

The start on the long journey was finally made on October 31. The party consisted of 11 persons, 2 6-mule wagons, 1 thoroughbred and 2 double buckboards, besides 5 saddle horses and 3 extra pack mules, a total of 26 animals. There were two additions to the party later on, making 13 persons in all. The experience gained in former seasons was of use in making this trip. As the animals were fresh from pasture they could not be driven hard at first for fear of making their shoulders sore and breaking them down. Moreover, the distances traveled were, to a great extent, regulated by the watering places. Once only 8 miles were traveled; another day it was necessary to make 35 miles; after several hard days in succession the teams were allowed to rest an extra day, so it was not until the morning of November 12 that the party reached the scene of operations, after a journey of nearly 210 miles from Bishop.

The organization of the party was similar to that of the preceding season, viz, the ranging section under my immediate charge, the forward section under Mr. Frank W. Edmonds, and the triangulation under Assistant W. B. Fairfield. All three sections assisted in this last work according to the need of bringing it up with the ranging of the line.

3. ASH MEADOWS, STEWART VALLEY, PAHRUMP VALLEY.

The first working camp was at Mound Spring, near the southeast end of Ash Meadows, on the road to Pahrump Valley, and 6 miles north of the last station located in 1895, called T 105, which was the first to be occupied this season as a ranging station. Arrangements were made to have hay and grain hauled to this spring from Manse, a ranch in Pahrump Valley, 24 miles southeast. This ranch supplied the party with hay and grain for 100 miles, and without it we would have incurred heavy expense in hauling supplies from the railroad and from Fish Lake Valley by team.

On Sunday, November 14, with one member of the party I went over the line to the northwest, putting up signals for back ranges at T 103 and T 101, the latter nearly 16 miles from T 105. On the 14th the theodolite was moved to T 105 and mounted for ranging in line points to the southeast. The same day the forward section went over the mountain to Stewart Valley to get a point. The distance driven was very great and

the mountains exceedingly rough, so it was not until late in the afternoon that the heliotrope was seen about 3 miles away along the mountain top. Unfortunately the sun was cut off by a near mountain before the position could be obtained, and the forward section had to drive until 11 o'clock that night before reaching a stopping place. Next morning the forward party gave two points in line to the southeast, T 107 and T 108, 7 and 10 miles away.

4. MESQUITE VALLEY, STATE LINE MOUNTAINS, IVANPAH VALLEY.

In the meantime Assistant Fairfield, who had gone forward to reconnoiter and erect signals for triangulation, was lined in at T 106, 3 miles distant on a very rough mountain, using a pole for that purpose. Point after point was ranged in up to T 116, 34.5 miles distant, on a small ridge at the south end of Pahrump Valley. The ridge cut off all view across Mesquite Valley, but did not obscure the State Line Mountains, nearly 61 miles distant. To this place the forward section was sent, and on November 22 a point was located by heliotrope at T 123 from T 105. This was the second longest sight on the entire line.

The theodolite was next moved ahead to T 123, passing the ranch at Manse, where Mr. Flynn joined the party and went with us to Sandy and to Bullock's Well, 6 miles from the station on State Line Mountains, where supplies had been sent. The day after leaving Sandy the instrument was taken up to State Line Mountains at T 123, and next day Mr. Edmonds began working back to the northwest, giving me a point in line near Sandy post-office, about 14 miles distant. Mr. Edmonds himself first went to T 116, 26 miles away, to enlarge the signal and to show a heliotrope in line, so as to make sure of an object to point on for the back ranging. By November 30 all of this portion of the line had been completed back to T 117, after which Mr. Edmonds went to the southeast in Ivanpah Valley.

On December 2 and 3 four points were lined in to the southeast—T 125, T 126, T 127, T 128. On December 5 it was cloudy, and no ranging could be done without sunshine, but angular measures were made for triangulation at T 123, and Mr. Flynn was engaged in erecting signals and observing angles to the northwest. On December 7 T 130, 26 miles distant, was located on the New York range of mountains near Vanderbilt, the limit of seeing to the southeast.

For three days, December 8, 9, and 10, snow storms and heavy rains prevailed so that but little could be accomplished; the party not having provided stoves, suffered severely at night during this period. On December 11, 12, and 13 the thermometer stood at 10°, 12°, and 14° in the early morning, temperatures rarely experienced in that southern country, according to the statement of miners.

5. DRY LAKE WELL, NEW YORK MOUNTAINS, MANVEL, CASTLE MOUNTAINS.

Before moving forward to the New York Mountains two quadrilaterals to the northwest of State Line Mountains and one to the southeast were completed by my section, to help along the triangulation. On December 20 the party moved ahead to Manvel, via Dry Lake Well, the only water on the road. On December 22 we reached Malpais Springs, on the southeast slope of the New York Mountains, and the nearest water to T 130. On the 23d the theodolite was moved to T 130 and T 131 put in. The same day from T 131 a point was located at T 132, on the lofty cliff or butte in the

Castle Mountains, 5 miles distant. On the 24th No. 132 was occupied by the theodolite and No. 133, 4 miles distant, was lined in.

In order to move forward from this place to the southeast at Piute Springs it was necessary to haul hay and grain there from Manvel, and while this was being done by Mr. Edmonds, Mr. Flynn and I erected signals and observed angles in the triangulation scheme. Mr. Edmonds was ready to resume the lining in by December 30. On that date a point was lined in at T 134, and next day T 135, T 136, T 137, and T 138 were set from T 132, the last being 23 miles distant. The weather continued very cold and windy all of this time.

6. MALPAIS SPRINGS, PIUTE SPRINGS.

While Mr. Flynn was left to complete some of the triangulation near Malpais Springs, and to bring forward the big team, I moved ahead in the buckboard on the east side of the Lewis range of mountains to join Mr. Edmonds with the forward section at Piute Springs, January 2, 1899. He had traveled by the western route from Manvel and it was necessary to cut away the bushes and repair the road in the defile to the eastward at Piute Springs in order to get his team through. This was completed on the 3d, and next day while Mr. Edmonds traveled over to the Colorado River with the thoroughbrace and buckboard by the old government road, I went to the Needles on a saddle horse by the great Piute wash, and sent up hay and grain to the camp near Von Schmidt's east 35° latitude post. On Friday, January 6, the big team that had been left at Malpais Springs crossed the grade and reached the camp on the Colorado River. On January 9 I went to the summit at T 138, overlooking the Colorado River Valley, and lined in T 139 and T 140. Next day, January 10, the last two points, T 141 and T 142, were lined in from T 139, and the work of ranging out the random line was completed.

Six years before a post had been placed by us to mark a point on the oblique boundary nearest to the river crossing of the thirty-fifth degree of latitude. It was with some feeling of interest that this point toward which the theodolite had been directed in 1894 from a similarly placed point in the oblique boundary near Lake Tahoe, about 400 miles distant, was approached. From the lining station, T 139, it could not be seen how near the random line came to this post; but, when returning to camp, a detour was made on horseback to see what the distance was. Gradually, while drawing near, both points came into view, and upon reaching the place it was found that we had come within 150.5 meters of striking the point.

The line passed over altitudes varying from about 500 feet at the Colorado River to nearly 13,000 feet at the White Mountains. It was shown by the observations that the local deflections at the Colorado River end amount to about 9'' 19, 283 meters in latitude, and at the Lake Tahoe end to a greater amount. The uncertainty in azimuth at different points on the line may be great; but if so, the errors due to local deflection must have very closely balanced, as proved by the small error at the end of the line—a line ranged out and triangulated for nearly 400 miles.

In 1893 Assistant W. B. Fairfield measured a base with a steel tape at the Needles, and executed a scheme of triangulation to connect the latitude and longitude stations at that point with the latitude station at Von Schmidt's thirty-fifth degree east-latitude post. In order to connect the triangulation brought down from Lake Tahoe with this

work a reconnaissance was made, signals were erected, and horizontal angles were observed until a junction was made with Assistant Fairfield, who was working toward the Colorado River from the northwest. This work was completed by January 24, and two days later Mr. Fairfield's section reached the Colorado River camp.

Mr. Flynn took charge of the computations from the time of his arrival, and under his direction were placed those members of the party who could assist him, and such good progress was made that all of the adjusting was completed by February 16, about five weeks after he first reached the Colorado River. During a part of this time I was engaged in sketching the topography of the river from Fort Mohave to the Needles on a scale of $\frac{1}{40000}$, using the stations established in 1893 and a small mountain plane table.

Upon completing the computations a comparison of the work brought down from Lake Tahoe could be made with that brought up from the Needles, the line of junction being "Peak—Von Schmidt's East Lat. Post"—3 180'34 meters in length.

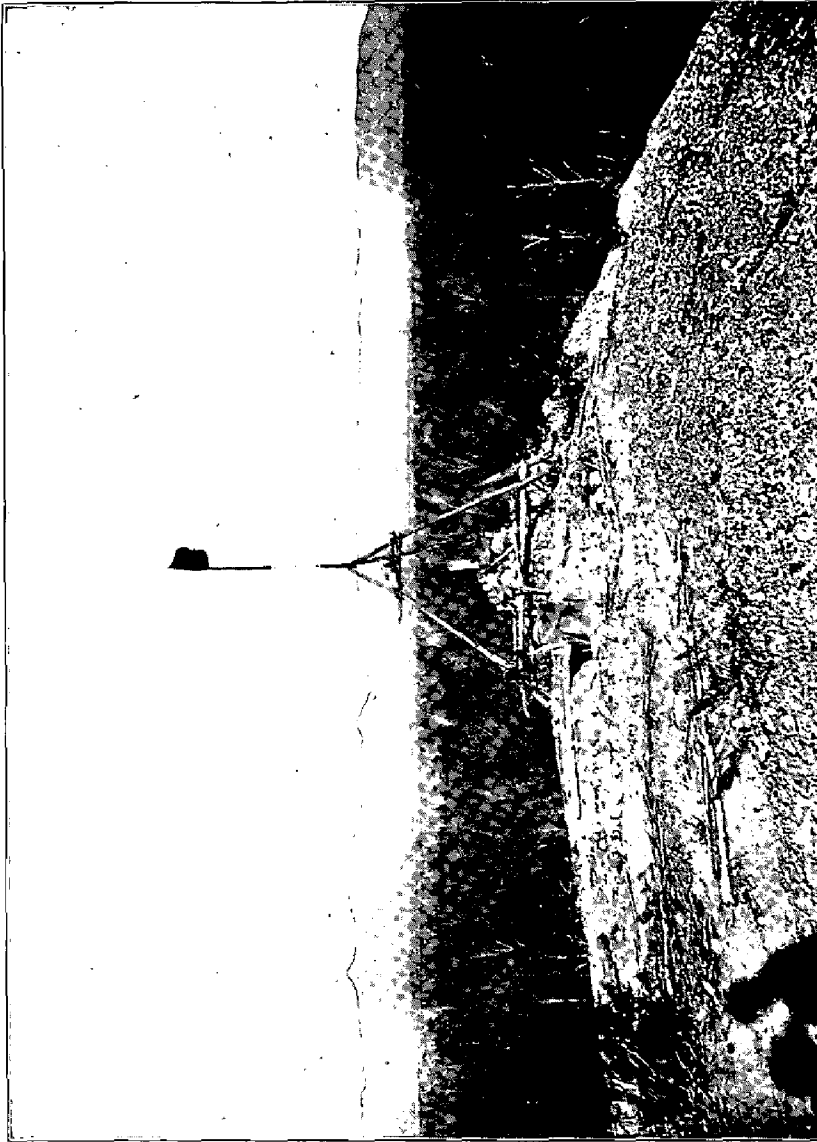
7. COMPARISON OF RESULTS.

The following comparisons will prove interesting:

Length of the line "Peak-Von Schmidt East Lat. Post" from the Needles base, meters..	3 180'34
Length of the line "Peak-Von Schmidt East Lat. Post" from Lake Tahoe triangulation.....meters..	3 180'05
Difference.....do....	0'29
Azimuth of the line "Peak-Von Schmidt East Lat. Post" from that observed at Von Schmidt post.....	91°26'07''9
Azimuth of the line "Peak-Von Schmidt East Lat. Post" from Lake Tahoe triangulation.....	91°25'57''8
Difference.....	10'1
Latitude of Von Schmidt's East Lat. Post, observed in 1893.....	35°00'15''020
Latitude of Von Schmidt's East Lat. Post, from Lake Tahoe triangulation.....	35°00'14''641
Difference.....	0'379
Longitude of Von Schmidt's East Lat. Post, from Needles, 13 miles south, 1889, by telegraph.....	114°39'23''055
Longitude of Von Schmidt's East Lat. Post, from Lake Tahoe triangulation.....	114°39'31''708
Difference.....	8'653
The random line ranged out from Lake Tahoe, 400 miles distant, passed southwest of the Colorado River terminal post (error of ranging or closure).....meters..	150'5
Length of the oblique boundary, To-Co, computed from astronomic data.....do....	652 020
Length of the oblique boundary, To-Co, measured by triangulation.....do....	651 676'4
Difference.....do....	343'6

When it is considered that the scheme of triangulation along the line was inferior in character, the sides of the triangles varying from less than a mile to 10 miles in length, the angles measured with theodolites having circles 6, 7, and 10 inches in diameter, using 12 repetitions chiefly, upon signals of poor quality, not waiting for favorable conditions, but observing at any hour of the day, the agreement in length (0'29 meter) and in azimuth (10''1) may be regarded as highly satisfactory.

Quadrilaterals and central figures were carried from one end of the line to the other, and in no instance was a distance in the main scheme left unchecked; but in a



LATITUDE AND AZIMUTH STATION, 1893. VON SCHMIDT 35° LATITUDE POST (EAST POST). LOOKING EAST.

few cases it was found necessary to depend on concluded angles, on account of having mistaken other objects for signals during the observations, when it would have delayed the work too much to go back for a reoccupation of the stations.

8. BASE LINES.

Two intermediate bases were measured as checks upon the triangulation, which therefore depends upon four bases—the Yolo, a primary, from which, through the primary line “Lola-Round Top” (91 038'53 meters in length) was determined the first line in the scheme.

Base.	Length.
	<i>Meters.</i>
Lake shore stone-Folsoms Knob, on Lake Tahoe.....	3 017'2
The White Mountain base, 109 miles from the first.....	1 080'14
The Amargosa base, 154 miles from the White Mountains	1 464'93
The Needles base, 152 miles from the Amargosa base.....	1 709'33

These bases give a fair distribution of checks.

Two intermediate azimuths were observed, one at the White Mountain base and one near the Amargosa base, but the entire line, as ranged out by back and fore sights, depended upon the initial azimuth measured on Lake Tahoe at “Turning point, 1894,” where the tracing of the line was started in August, 1894.

G. THE CORRECTED LINE.

The first operation after completing the adjustment and computations of the triangulation was to set the terminal post, located approximately in 1893 from the field computations, in the corrected position. This was done by setting up the theodolite at “S. E. line post of 1893” and laying off the angle to the south from the triangulation, then measuring due south 12'42 meters with a steel tape. The theodolite was then set over this corrected position, and the second point northwest nearly abreast of “N. W. line post of 1893” was lined in by laying off the azimuth of the line as determined by the office computation.

1. TERMINAL MARK AT THE COLORADO RIVER, 35° LAT. POSTS.

The terminal mark on the Colorado River is a mass of concrete 17 by 17 by 18 inches, being a portion of the old latitude pier used at the “Von Schmidt E. Lat. post” in 1893. This was sunk in the ground and has a drill hole in the top to mark the station. On top of this was placed a redwood post 6 inches by 6 inches by 6 feet long, marked “S. E. LINE POST.” It is the old post used in 1893. Around the post was built a cairn 10 feet in diameter and 6 feet high. An outer circular wall of stone nearly 20 feet in diameter and 1 foot high surrounded the cairn. Four stones with drill holes were set in the ground just outside of the outer wall, two being in the direction of the line and two at right angles. From the center it is—

	<i>Meters.</i>
To the northwest stone	3'14
To the southeast stone.....	3'22
To the northeast stone.....	2'86
To the southwest stone	3'11

This terminal is called No. 142, counting from Lake Tahoe. The second station, called No. 141, about 2 250 meters northwest from No. 142, is marked by a drill hole in a stone set in the ground. On top of this is a redwood post 6 inches by 6 inches by 6 feet, marked "N.W. LINE POST," being the old post used in 1893. A cairn 5 feet in diameter and 4 feet high was built around this post.

The two posts set to mark the approximate thirty-fifth degree of latitude in 1893 were moved to their correct positions also, which was 19 feet due north of the old position of 1893. The marks on these posts were not changed, but under each post was placed a stone with a drill hole in it, and a large cairn was built around each. The west post has a circular trench about 10 feet in diameter dug around it, in addition to the cairn.

2. RETURN OVER THE LINE. REDUCTION OF PARTY.

Having set all of the marks that could be conveniently reached from the camp on the Colorado River, the party began its return over the line to correct it and set the final boundary marks, on Friday, February 17. There were but few places in the first 75 miles where the offsets could be directly laid off with a steel tape. A slight move at right angles to the line often meant changing to a different hill, sometimes nearer and sometimes farther ahead than the station on the random line. When the ground was very rough or mountainous the new points were lined in and the corrected position of the point was located generally by angular measurements.

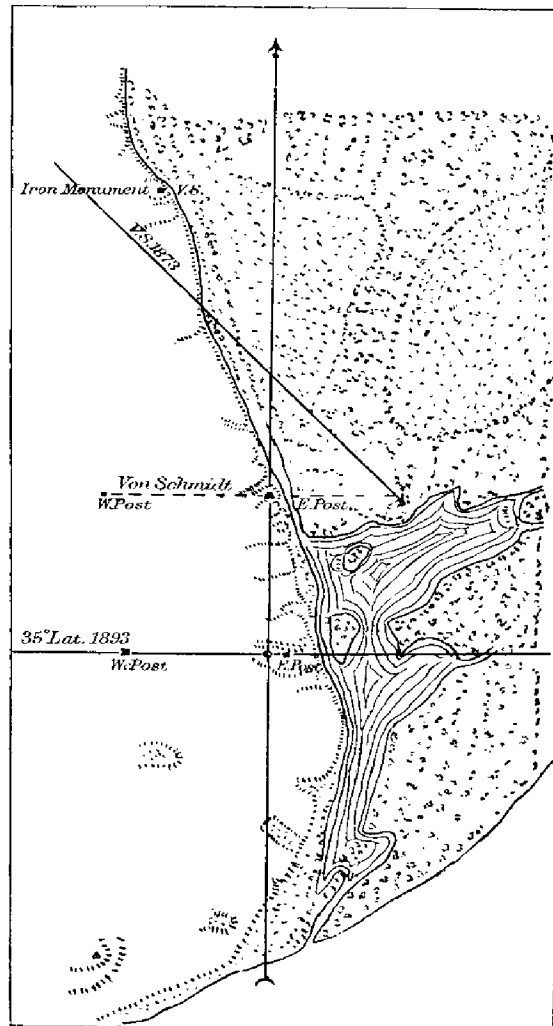
By the end of February the party had reached Manvel on its return. It was found advisable to reduce the party at this time in order to lessen expenses so as to leave money enough to complete the correction of the line. Mr. Flynn was, therefore, directed to take charge of the men and outfit that could be spared, cross the desert to Bishop, Cal., about 300 miles distant, sell 11 animals, one large wagon, and the thoroughbrace, store the rest of the outfit in the Federal building at Carson City, and report to the Superintendent in Washington. By this reduction the monthly expenses were changed from an average of \$1 237.22 to \$709.86, with 7 men and 14 animals. Such portions of the outfit as were not required in the field were shipped by rail from the Needles and Manvel to the suboffice in San Francisco.

The party made rapid progress in correcting the line for the first 140 miles, because the triangulation signals were all standing and the weather was favorable. To the northwest of this, after striking the Grape Vine Mountains, bad weather prevailed. Snowstorms were frequent and the line had to be reached from springs a long distance off. Where the signals were standing, the muslin, put on three and one-half years before, had disappeared. When the party reached Fish Lake Valley and were working across the White Mountains, snow interfered very materially with the progress, although it was late in April. Early in May the party crossed to the north side of the White Mountains, where the altitudes were not so great and snowstorms were less frequent.

3. TERMINAL MONUMENT, LAKE TAHOE.

By gradual stages the work advanced until Lake Tahoe was reached, and there, on June 12, the stone that marked the beginning of the line on the lake shore was set in concrete, which completed the field operations.

Most of the boundary positions were marked by a post—redwood, cedar, or pine—with a cairn from 3 to 5 feet high around the post. If the point fell in the desert with



35° Latitude Posts



SMALL LAKE AT COLORADO RIVER CAMP. LOOKING SOUTHWEST.



SETTING TERMINAL MONUMENT, LAKE TAHOE.



MONUMENT NO. 1, LAKE TAHOE. LOOKING NORTHWEST.



TEAMS AT LAKESIDE TAVERN, END OF SEASON.

no stones near, a single stone with drill hole in it was used as a ground mark, and a mound of earth or sand was heaped around the post, with a circular trench outside. Eight of the points, Nos. 1, 2, 11, 12, 13, 14, 24, and 27, were marked with granite monuments 6 feet long, 6 inches at top, dressed down 4 feet from the top to 12 inches, and rough cut for 2 feet to set in the ground, weighing about 850 pounds; the top terminated in a flat pyramid. These monuments were quarried near Carson City and dressed in one of the Carson City stone yards. The boundary posts were marked with the letters "C" and "N" on their respective sides, with the number on the northwest. The letters were made with wire nails $1\frac{1}{2}$ inches long driven into the posts. On the stone monuments the letters "C" and "N" were cut, but the numbers were painted. When the line is permanently marked the distances may be cut or cast according to the nature of the material. The present system of numbering the marks is simply for the purpose of identification.

On June 13 the party moved from Lake Tahoe to Carson City, and until the 20th was engaged in making the inventory, packing and shipping the instruments and other outfit to San Francisco, and completing the duplicate records. On June 20 the animals and wagons were sold at public auction, and the same day I went to San Francisco with the remaining members of the party, where they were discharged. I then started for Washington and reported to the Superintendent on June 30.

In former years I have had occasion to refer to the cordial and cheerful cooperation between the different members of the party, without which progress would be slow and success doubtful in work of this kind. Assistant W. B. Fairfield was in charge of the triangulation and he always showed most commendable zeal and interest in executing the work. Mr. Edmonds, who was in charge of the forward section of the line work, proved equal to every emergency that arose. His work required good judgment, foresight, and many sacrifices of personal comfort to get his party through a region sparsely settled. Mr. Flynn joined the party after the work was started, and displayed great energy in taking hold of the reconnaissance, signal building, and triangulation. His principal work was in adjusting the triangulation of the last 130 miles of the line, and this he did with marked success and in a short time, considering the great mass of work involved in abstracting angles, adjusting and computing the triangle sides and geographic positions for the entire season.

In 1893, topographic surveys were made at the Lake Tahoe and Colorado River termini, on a scale of $\frac{1}{100,000}$. Only a limited area was embraced in these sheets. In 1899, to show roughly the topography, 14 sheets were used, on a scale of $\frac{1}{100,000}$. The work was done chiefly with a small mountain plane table, which was set up on the line and oriented by means of some of the triangulation points. The sketching was executed partly by me and partly by Mr. Edmonds. The altitudes on the sheets were obtained by vertical measures with the theodolite. No elevations on the sheets were obtained with the plane table. Many photographs were taken along the line in 1899, but most of them were injured by a crack in the camera, due to the lofty elevation and dry atmosphere. Magnetics with compass declinometer No. 741 were observed all along the random line.

H. CHANGE OF AREAS.

By comparison with the Von Schmidt line the State of Nevada gains about 321 square miles; California gains about 65 square miles; making a net gain for Nevada of about 256 square miles.

Owing to the barren character of the country traversed, the change of area does not mean a material gain of taxable wealth to either State in arable land. As to the value of mineral wealth involved, that will depend upon future discoveries: at present there are no indications of important changes.

I. MAPS.

The following maps accompany the report (see end of volume):

1. The California and Nevada Oblique Boundary in 7 sections. Scale, 1:120000.
2. Index map showing arrangement of topographic sheets, triangulation, and profile of the random line. Scale, 1:533333.

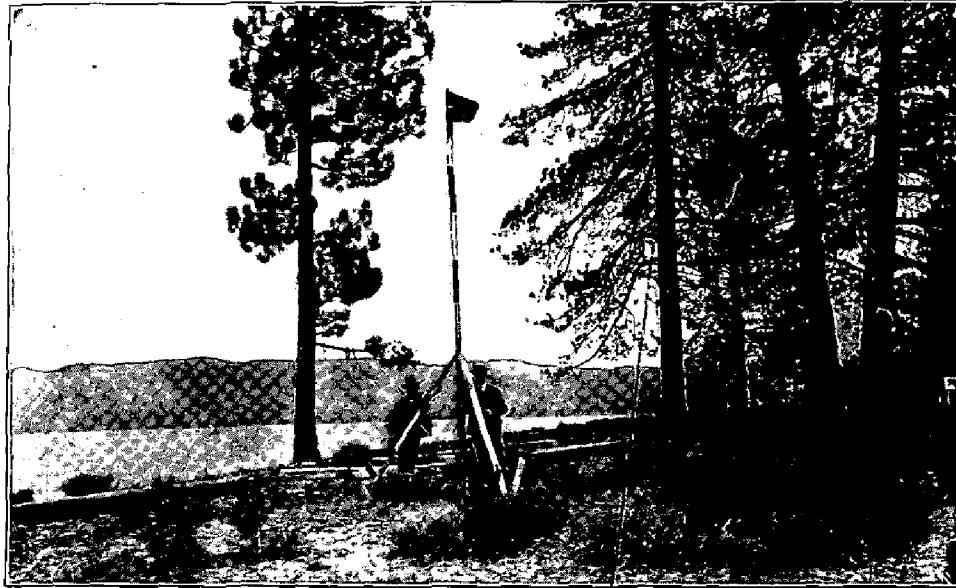
J. STATISTICS, CALIFORNIA-NEVADA BOUNDARY.

	1893.	1894.	1895.	1898-99.	Total.
Number of signals erected	50	93	114	86	343
Triangulation stations occupied	35	65	90	70	261
Trigonometric points determined	71	106	122	96	395
Horizontal angles measured	532	992	1 179	870	3 573
Horizontal angles, repetitions	7 163	11 769	14 023	9 273	42 228
Vertical angles measured		133	329	619	1 081
Vertical angle measurements		266	658	1 238	2 162
Magnetic stations, compass declinometer		60	38	36	134
Magnetic stations, magnetometer		2	2		4
Stations located on the random line		60	47	38	145
Boundary marks on the corrected line					137
Von Schmidt, 1873, marks recovered					50
Telegraphic longitude, determined	1				1
Latitudes determined, zenith telescope	2				2
Azimuths measured, theodolite	2	1	2		5
Base lines measured, steel tape	3		2		5
Topographic sheets, 1:10000	2				2
Topographic sheets, 1:40000, sketched				14	14
Approximate area sketched square miles					850
Approximate area triangulated do					1 660
Monuments to be placed at 5, 6, 50, and 90					
Average distance of boundary marks, 141 in number, in miles					2.83

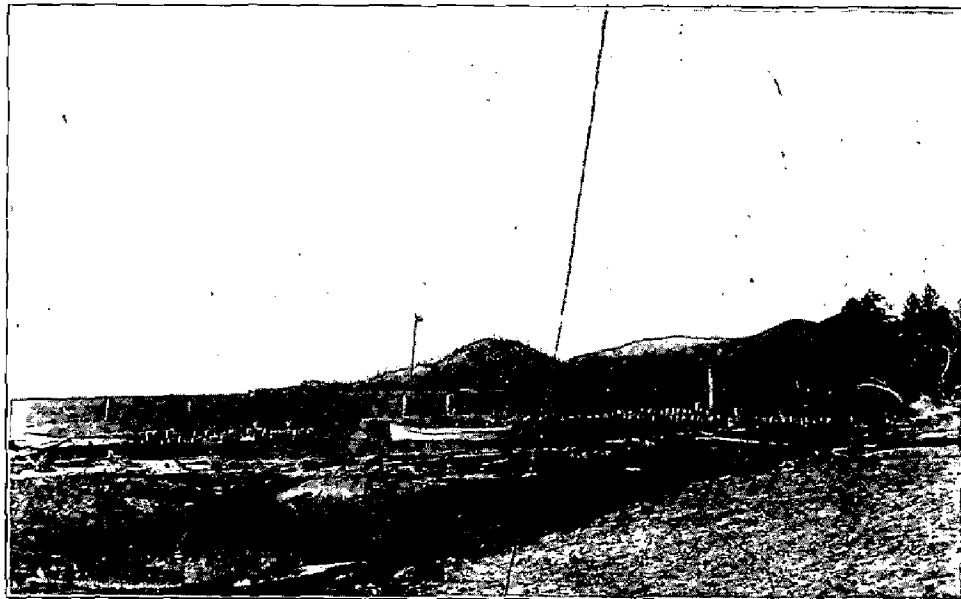
K. APPROPRIATIONS, COST, ETC.

The act making appropriations for sundry civil expenses of the Government for the fiscal year ending June 30, 1893, and for other purposes, approved August 2, 1892, contains the following on page 9:

For furnishing points to State surveys, to be applied, as far as practicable, in States where points have not been furnished, and for surveying and distinctly designating with permanent monuments that portion of the eastern boundary of the State of California commencing at and running southeastward from the intersection of the thirty-ninth degree of north latitude with the one hundred and twentieth degree of longitude west from Greenwich, fifteen thousand six hundred dollars.



ROWLANDS TRIANGULATION STATION. LOOKING WEST.



Folsoms Knob.
LAPHAMS WHARF, LAKE TAHOE.

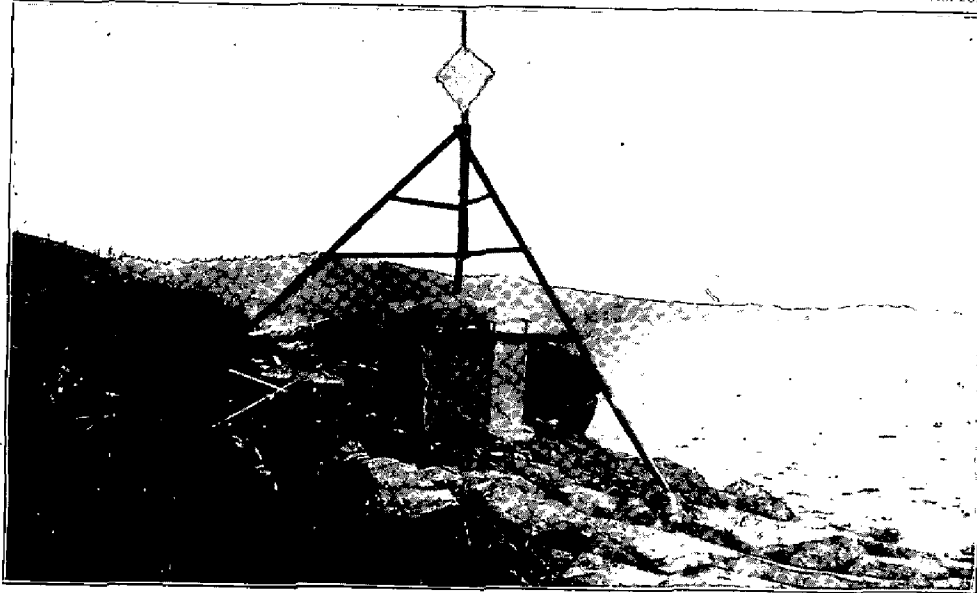


Folsom's Knob.

SOUTHEAST SHORE LAKE TAHOE. LOOKING NORTH.



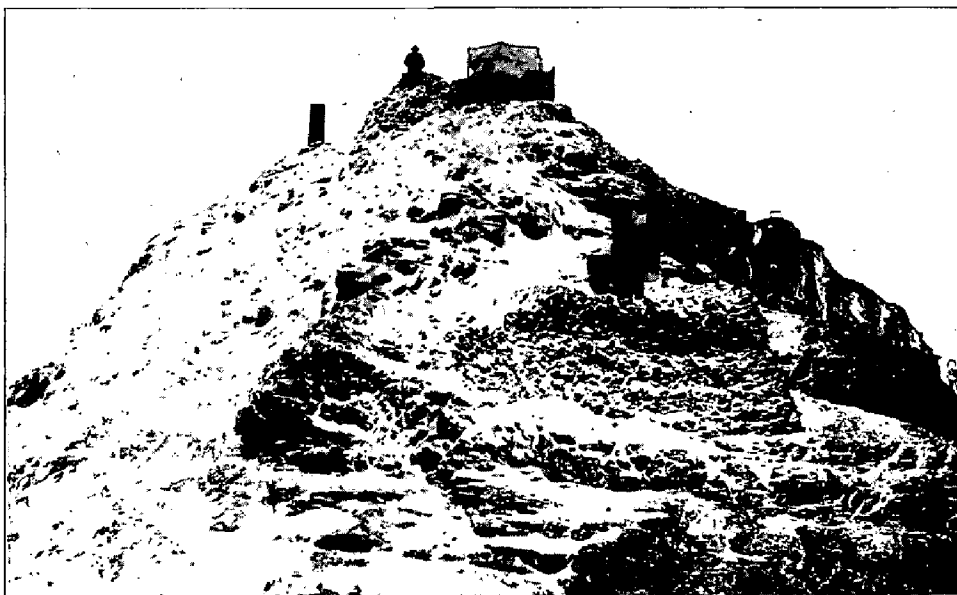
DEADMAN POINT TRIANGULATION STATION.



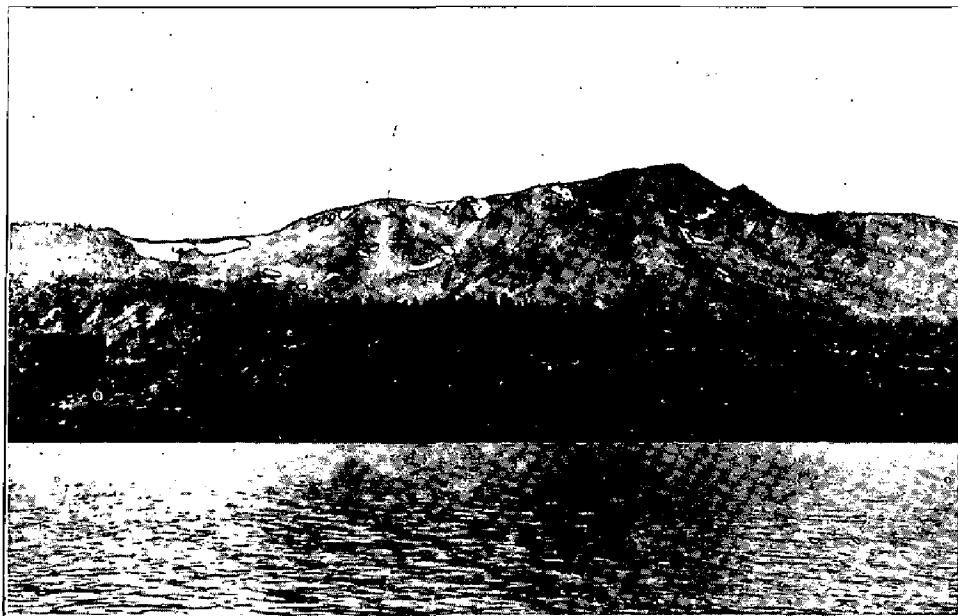
RUBICON POINT TRIANGULATION STATION. LOOKING NORTH.



NORTH OF RUBICON POINT, LAKE TAHOE. LOOKING EAST.



ROUND TOP TRIANGULATION STATION.



TALLAC PEAK. LOOKING WEST.

Of this sum \$5 000 was allotted to the California boundary by the Superintendent.

For the years 1894, 1895, 1896, 1897, and 1898 the bill was substantially the same, except as to the sums allotted.

For 1899 the clause was slightly different, providing—

For surveying and *temporarily* marking that portion of the eastern boundary of the State of California commencing at and running southeastward from the intersection of the thirty-ninth degree of north latitude and the one hundred and twentieth degree of longitude, etc., ten thousand dollars. Approved July 1, 1898.

The temporary character of the boundary marks was made necessary by the fact that the true points could not be located until the line had been traced through to the Colorado River and corrected back along its entire length to Lake Tahoe, and by that time not only was the fiscal year nearly ended, but the appropriation was almost exhausted.

COST.

The cost of the California-Nevada oblique boundary survey, excluding the salaries of the Coast and Geodetic Survey officers engaged upon it, was as follows:

Fiscal year.	Expended.
1893.....	\$4 966'99
1894.....	4 741'00
1895.....	5 927'43
1896.....	5 815'01
1897 (keep of animals, no field work).....	421'20
1898 (keep of animals, no field work).....	421'20
1899.....	9 822'97
Total.....	32 115'80
Equipment sold after completing survey.....	—1 255'50
Total cost, without permanent monuments.....	30 860'30

A number of the animals were supplied by the Coast and Geodetic Survey, as they were already on hand, and these were sold at the close of the work in 1899 with the others purchased for the boundary work; but it is proper to state that some of the tents were paid for out of the boundary allotment, which partly offsets the animals sold.

The total length of the line from the beginning in Lake Tahoe to the Colorado River terminus is very close to 405 statute miles, and the cost per linear mile was \$76'20. This cost would have been very materially reduced if the appropriation had been sufficient to execute the work with one organization of the party and with no necessity for keeping the animals between seasons. The party was organized and put in the field four separate times, entailing considerable expense for traveling, expressage, and freight. Each time the men had to be trained for their duties and the animals broken in afresh with new drivers, which caused much delay in executing the work.

L. DESCRIPTION OF THE CALIFORNIA AND NEVADA OBLIQUE BOUNDARY.

Lake Tahoe lies in the heart of the Sierra Nevada Mountains at an altitude of nearly 6 224 feet, surrounded by summits that rise from a few hundred feet to about 5 000 feet above the lake surface, or approximately 11 000 feet above the sea. The

loftier summits are usually snow-capped until midsummer, but there are sheltered spots where the snow remains during the entire year. From the lake shore the ground rises gradually, or is nearly level for a short distance, except where the bold cliffs come down to the water's edge. Some of this ground is cultivated where sufficient water is furnished by the mountain streams for irrigation.

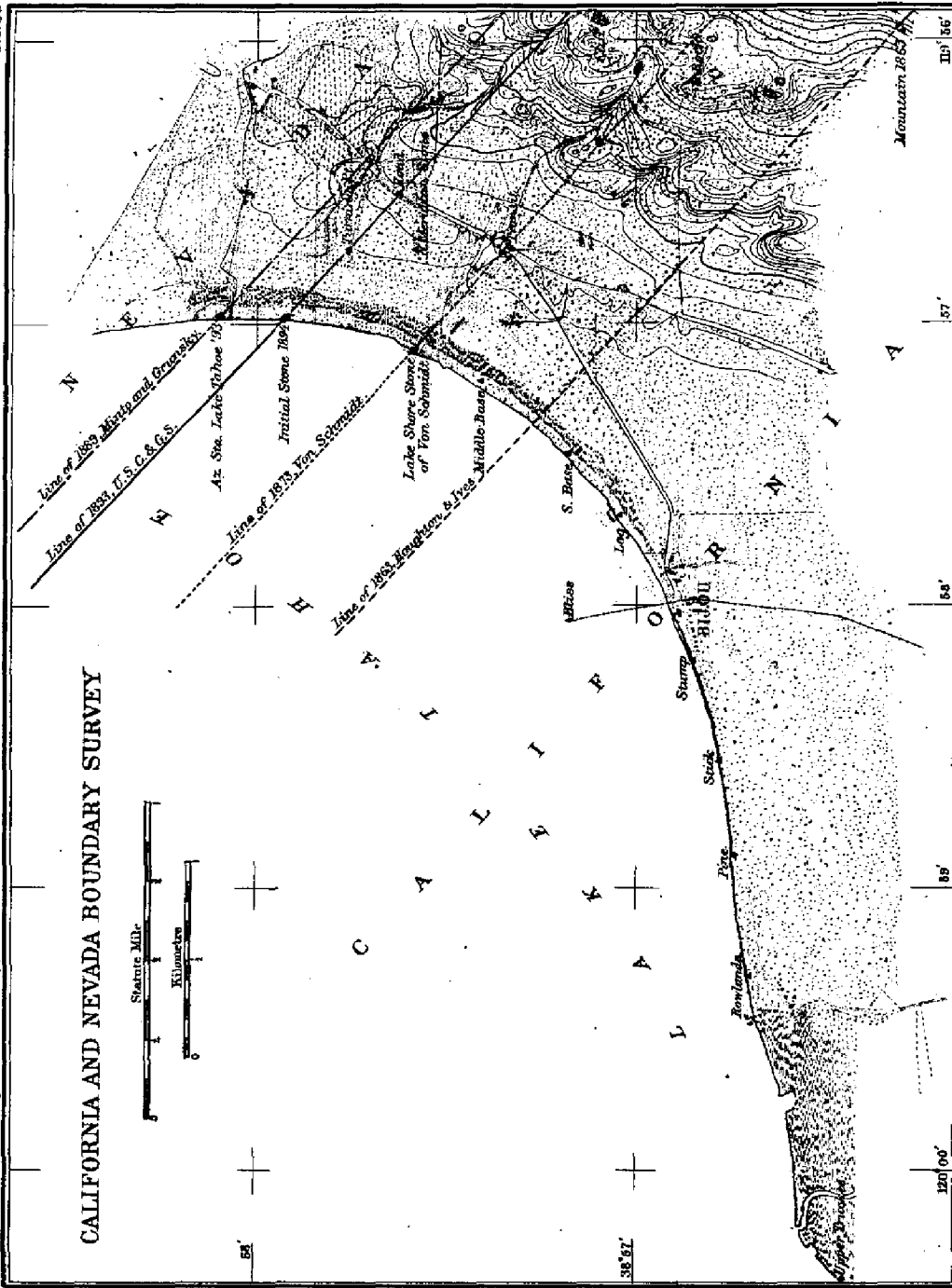
A luxurious growth of pine, fir, tamarack, and cedar covered nearly all of this region thirty years ago, but the greater part of this has been cut to supply the mines at Virginia City and other places with timber, and for general building purposes. Many of the mountains were entirely denuded and the lower lands have left on them little that is valuable for timber. The lake is about 20 miles north and south and 12 miles from east to west. About $3\frac{1}{2}$ miles from the south shore of Lake Tahoe, a little east of the upper Truckee River, and 2 miles from the east shore, between Zephyr Point and "Folsoms Knob," or "Round Mound," the one hundred and twentieth meridian west from Greenwich intersects the thirty-ninth parallel of north latitude, and this intersection marks the beginning of the oblique boundary. The water reaches a depth of something like 1 300 feet at this place. (See ill. No. 3, diagram of depths.)

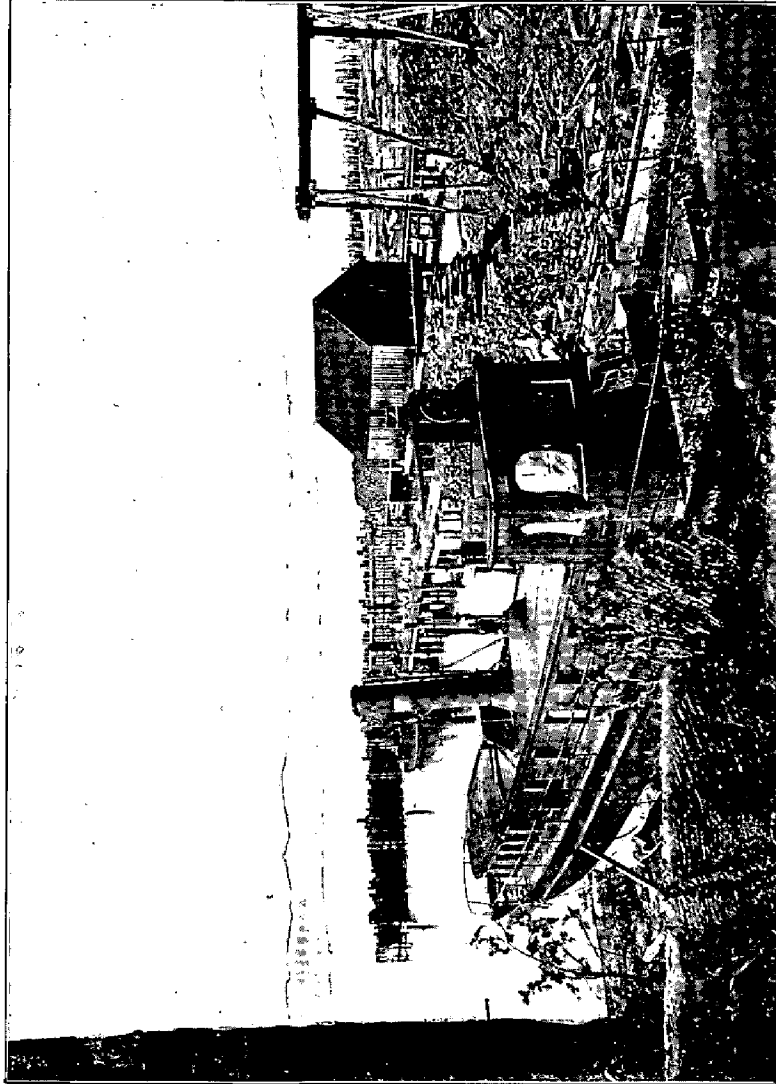
Running to the southeast from the starting point on an azimuth of $311^{\circ} 14' 36''$, the line strikes the shore after traversing the water for a distance of 3.6 miles. The first stone, called No. 1 (distance 3.6 miles from the one hundred and twentieth degree of longitude and the thirty-ninth degree of latitude, altitude 6 230 feet), is a granite monument 6 feet high, of which 2 feet are in the ground near the shore of the lake on a firm strip of sandy soil about 5 feet above the surface of the water. This strip is from 20 to 60 meters wide, running parallel to the shore, covered with thin grass and a few forest pines. Beyond this is a narrow belt of pines and tamaracks, then a marshy place covered with good grass, then a second narrow belt of pines and tamaracks, followed by a sandy reach, gently rolling, with a few bushes and sage brush upon it, up to the azimuth station of 1894, 460.7 meters distant from No. 1, which is still marked, as it was then, by a block of granite projecting about a foot above ground with a copper bolt in the top. Three distinct shore lines are found northwest of the azimuth station.

From this point to No. 2, which is located on the west side of the road between Bijou and Hobart, the soil is sandy and covered with large timber, partly cut out. No. 2 is a granite monument like No. 1, distant 838.6 meters from it. Crossing the road the line traverses ground from which the first growth of trees was cut, but there are small ones left; then continues over gently rising ground broken by granite-covered hillocks until, at a distance of $1\frac{1}{2}$ miles from the lake and about 600 feet altitude above the lake, the abrupt sides of the steep mountains are reached. From here to No. 3—distance, 1.9 miles, altitude, 9 019 feet on the west top of the mountain—the original forest has not been cut.

Between No. 3 and No. 4 it is only 263.4 meters. The line is still in timber, rising over rough boulders. No. 3 and No. 4 are marked by pine posts, with cairns. From No. 4 to No. 5 (not corrected on account of deep snow; it should be moved 1.11 meters northeast) the distance is 988.6 meters. The line crosses a level reach thinly covered with trees, then rises at No. 5 to 9 517 feet. From No. 5 the line crosses a hollow, then ascends to an altitude of 9 475 feet to No. 6—distance, 652 meters. (No. 6 not corrected on account of deep snow; it should go 1.26 meters northeast.) From No. 6 the line crosses another deep hollow to No. 7, 604 meters distant, altitude, 9 340 feet.

CALIFORNIA AND NEVADA BOUNDARY SURVEY





Steamer Meteor.
WHARF AT GLENBROOK, LAKE TAHOE. LOOKING NORTHWEST.

Boundary Surveys
Calif-Nev-

Sheets. 2397
2410
2473

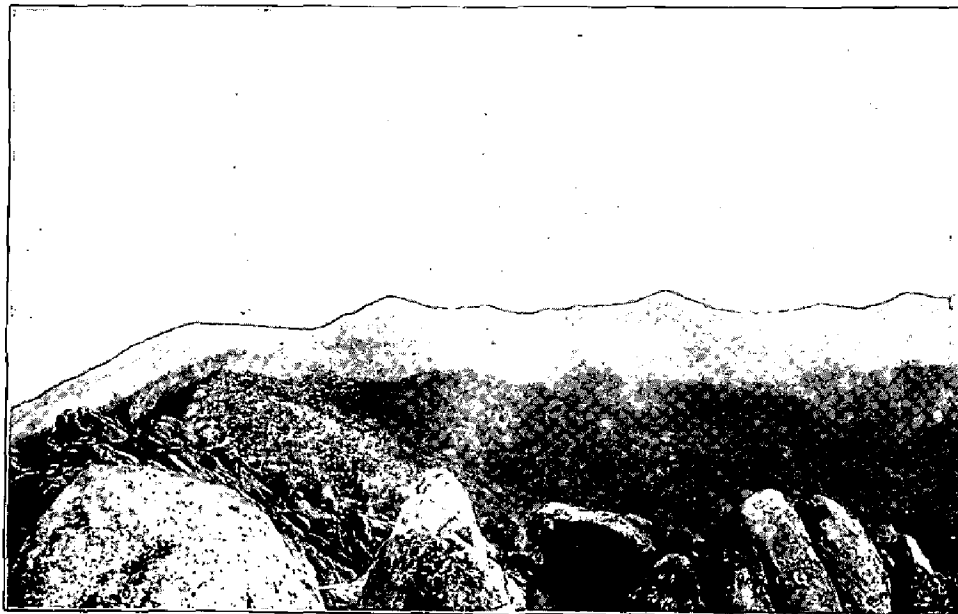
Don Perry
3/22/00



EAST PEAK FROM MONUMENT PEAK.



MONUMENT PEAK FROM EAST PEAK.



Jobs Peak. Jobs Sister. Freels Peak.
LOOKING SOUTH FROM MONUMENT PEAK.

No. 7 is on a large rock just at the foot and on the northeast side of a cliff on the backbone leading up to Monument Peak. The line then descends obliquely across the mountain to Carson Valley along the rough, wooded mountain side to No. 8, 4.6 miles; altitude, 5 214 feet. This point is 4 303 feet below the high summit at No. 5, which is only 5.4 miles northwest. Near No. 8 the timber is thin and small. Beyond No. 8 the line crosses a ravine with running water in it to sandy soil covered with sagebrush, gradually rolling and sloping to the east to No. 9, distant 1.1 miles; altitude, 4 834 feet. Fay's red barn is nearly east. From No. 9 it is still in sagebrush, soil sandy and covered with bowlders to No. 10, 0.9 mile distant, 4 866 feet altitude. Fay's red barn is nearly north; the schoolhouse is northeast. Leaving No. 10 the line crosses stony and sandy soil covered with sagebrush for 0.87 mile to No. 11, 4 801 feet altitude. This point is in the forks of the road and a short distance south of Baldwin's house. A cut-granite monument with broken top, held in place by means of hoop iron, and a cairn around it, marks the point. From here the line crosses sagebrush for a short distance, then enters the pasture land and, continuing in it for $1\frac{1}{4}$ miles, passing a short distance west of H. Godecke's ranch in the valley to No. 12, distant 1.4 miles; altitude, 4 847 feet. Deluchi's barn is east. No. 12 is a cut-granite monument like No. 1, nearly in the east fence line of the road that runs north and south.

From No. 12 it is 0.35 mile across sandy soil covered with sagebrush to No. 13, also a cut-granite monument like No. 1 on the west bank of the west fork of the Carson River. The altitude is 4 848 feet. Deluchi's barn is nearly north.

Crossing the river the line traverses a pasture field, then up a sagebrush ridge to No. 14; altitude, 4 980 feet; distance, 0.6 mile. This is also a cut-granite monument like No. 1, and between two roads in the valleys northwest and southeast.

Still traversing sagebrush the line crosses a road in a small valley, rises over a hill, crosses another valley, then ascends to No. 15 on the west slope of a thickly-wooded hill covered with sagebrush to No. 16, 1.64 miles distant, altitude 5 460 feet, marked by a post with a cairn around it. From No. 15 the line descends into the valley of a creek called the Middle Fork of the Carson, crossing a road, to No. 16, marked by a post and cairn on the southeast side of the stream in meadow land, 0.45 mile distant, about one-half mile north of Gallanar's house. Leaving No. 16 the line crosses a fence with a road alongside at the foot of a hill, and ascends through scattered pines to No. 17, 1.06 miles distant, and 5 815 feet altitude.

From No. 17 it passes through scattered pines, descending, crossing a road, and after going down a steep declivity strikes the East Fork of the Carson River at No. 18 on the southeast side in the fence line of Kelley's ranch on the southwest side of the road, 1.2 miles distant, and 5 104 feet altitude. The mark is a post within a cairn not far from the bank of the river.

After crossing the road leading to Kelley's house near by, the line rises rapidly through dense pines to No. 19, a bold rocky summit, 0.72 mile distant, altitude 6 027 feet, marked by a post in a pile of stone. Following along the edge of the mountains over very stony ground covered with sagebrush and a few pines, on the west slope of a reddish, rocky bluff is No. 20, distant 0.71 mile, marked by a post in a pile of stone.

From this place there is a steep descent to Bryant Creek, passing O'Reilley's ranch on the northeast side of the house; then up the mountain halfway to the top on the southwest slope is No. 21, 1.77 miles distant, and 6 323 feet altitude.

Following the mountain side for half a mile the line first crosses a deep ravine, then rises over a ridge covered densely with pine, crosses a second ravine, another ridge, bare except for sagebrush, then descending and again ascending for more than a mile, at a distance of 2.86 miles it reaches No. 22, altitude 7 613 feet, on the west slope of the high east and west ridge overlooking the narrow valley of Mountaineer Creek. It is marked by a post of mountain mahogany set in a large cairn.

Crossing an irregular plateau covered with sagebrush, a few scattered cottonwoods and pines, for 2.6 miles, altitude 7 523 feet, No. 23 is found on the east slope of a bold mountain mass overlooking Alkali Lake, Antelope Valley, and Holbrook. It is marked by a pine post in a large cairn northeast of a thick growth of mountain mahogany.

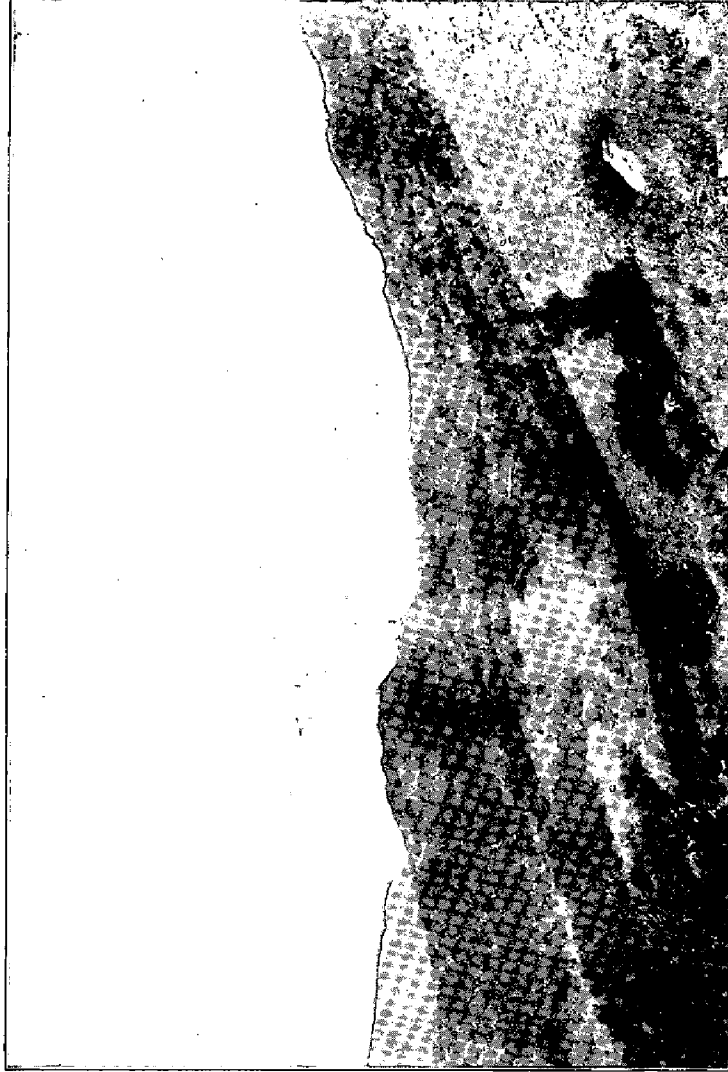
From this point the descent is very precipitous, being more than 2 000 feet, to the cut-granite monument marking No. 24, 1.9 miles distant on the northwest side of the stage road from Coleville to Holbrook, and about one-fourth mile northwest of Alkali Lake.

Just across the lake on a bold hill without timber and very conspicuous from all points, at a distance of 1.45 miles, and 5 304 feet altitude, is the large cairn with a post in it marking No. 25. Following the sage brush-covered hills for nearly a mile, the line crosses the road from Coleville to Wellington, then enters the meadow land, which is marshy for the first half mile and firm beyond, to No. 27, where a cut-granite monument was placed on the west bank of the West Walker River, 2.32 miles distant, and 4 936 feet in altitude. This is the last cut-stone monument; the other marks are posts in cairns or mounds. The stream makes a sharp bend, running north and south, here, and there is a small island that divides the waters. A mound of earth was built around the stone, outside of which was dug a deep circular trench. About one-fourth mile southwest is the fence of Thomas Rickey, the great cattle owner, who controls nearly all of the land in Antelope Valley, cultivating alfalfa and sometimes harvesting 5 000 tons of hay. None of the land in Antelope Valley crossed by the line is under cultivation. No. 26 was only a temporary station, not marked.

From No. 27 the line crosses bottom land for a considerable distance, then rises through sagebrush to No. 28, 2.32 miles distant; altitude, 5 112 feet.

No. 28½ is to mark the crossing of the Wellington and Topaz road, 494.5 meters distant, and through sagebrush. The line rises over the sagebrush slope to the foothills of the Sweetwater mountains and strikes a wooded ridge covered with nut pine at No. 29, distant 4.66 miles from No. 28½; altitude, 7 480 feet. At an altitude of 7 963 feet, and a distance of 2.32 miles, the line reaches No. 30, on a bare ridge, except sagebrush. It then crosses a wooded ridge, a second valley, then ascends to an altitude of 8 643 feet at No. 31, 1.25 miles distant.

From this point the line descends into the rough ravine of Desert Creek, three-fourths of a mile distant, crosses a low ridge into a small valley, which it traverses for 2 miles, and then begins the steep ascent of the "Middle Sister," in the Sweetwater mountains, crossing on the east slope over very rough, loose stone until it reaches No. 32, distant 3.85 miles, and at an altitude of 10 556 feet. The northwest slope has a belt of pine trees, but the summit is loose stone. Von Schmidt placed a small flag pole farther up the backbone to the southwest, which was in good condition after twenty years' exposure to the weather. A large cairn is also on the summit nearly 10 feet high, built of flat stone carefully laid. This is about one-fourth of a mile southwest of No. 32. The undergrowth on the summit is Manzanita.



No. 7. No. 21.

AT NO. 22. LOOKING NORTHWEST.



No. 22.

AT NO. 23. LOOKING NORTHWEST.



West Sister. Middle Sister. No. 32. East Sister.

AT T. 34. LOOKING NORTHWEST.

From No. 32 the line descends rapidly, crosses a ravine, then rises over a rough ridge about a mile southeast, then strikes the northeast slope of a bold spur, from which it descends into the Sweetwater Valley and follows across it through sagebrush to No. 33, at an altitude of 6 986 feet and 5.26 miles distant. This station is at a fence corner. Two miles northwest of this, or 54.3 miles from the intersection of 120° and 39° in Lake Tahoe, is the crossing of the Von Schmidt line of 1873, which runs on the northeast side for 277 miles before the second crossing in Mesquite Valley southeast of Sandy post-office.

About $1\frac{1}{4}$ miles southeast of No. 33 is a faint road along a fence, running to the old Clinton mines. Nearly one-half mile beyond it crosses Sweetwater Creek, and soon afterwards begins to rise to No. 34, which is on the ridge with a few scattered pines 3.3 miles distant; altitude, 6 530 feet.

From No. 34 the line ascends to No. 35, on a wooded ridge 0.38 mile distant, and 6 444 feet altitude. This point is less than half a mile distant from the Bridgeport road running on the southwest side of the East Walker River. Crossing this stream the line rises over a broken country to No. 36, 3.46 miles distant, altitude 7 259 feet, on a ridge densely covered with a small growth of nut pine. A Von Schmidt cairn is a short distance northeast.

The line next crosses several valleys and ridges to No. 37, 2.6 miles distant, altitude 8 010 feet, nut pine and cedars abounding. Between this and the next point the country is very rough, rising to an altitude of 8 348 feet at No. 38, 1.6 miles distant.

It is 3.07 miles to No. 39 and the country is very rough over the mountains, crossing a creek three-fourths of a mile southeast of No. 39, where the altitude is 8 009 feet. About 200 meters northeast of No. 39 is an old Von Schmidt post marked 278 miles.

From No. 39 the line descends into a valley, crosses a ridge and also Rough Creek 2 miles distant, then rises up over the bold bluff and at No. 40 reaches an altitude of 8 954 feet, 3.5 miles distant, on Beauty Peak, which is bare of trees, but covered with stones and sagebrush. The old triangulation station is north of this point about 200 meters.

From No. 40 the line descends for 1.29 miles over rough ground and stones through sagebrush to No. 41 on the slope.

Seven-eighths of a mile beyond this is the edge of a steep bluff on the northwest side of the road from Bodie to Hawthorne near "Sunshine" or Davidson Ranch, an old stage station. This bluff is a part of the cañon of Bodie Creek which narrows down rapidly toward Aurora, leaving scarcely enough room for a road and forming highly picturesque scenery. The southeast side is not so precipitous, but rises gradually to the west slope of Mount Brawley, one of the roughest climbs on the line, being a bold uplift of rock very dark and rounding up from the west to the northeast, where the sides are precipitous. This is at an altitude of 9 247 feet at No. 42, and distant 2.31 miles. The line here is about one-eighth of a mile southwest of the Von Schmidt line of 1873. The highest summit of West Brawley, less than one-fourth of a mile northeast, is 9 506 feet. This station is 2.8 miles southeast of Aurora and 5 miles northeast of Bodie.

The line descends from Mount Brawley over very rough ground and across a faint road about a mile distant, then going over rough hills reaches No. 43 on the northwest side of the road between Bodie and Aurora, 1.65 miles distant.

From No. 43 the line continues to descend to the valley or desert covered with sagebrush, crosses and climbs an isolated mountain, bare except sagebrush, to No. 44 on the east slope nearly 1.79 miles distant, and 8 521 feet altitude. Then the line descends to the valley, passes the edge of a small lake bed and climbs a wooded mountain with double top, crossing a very deep, rocky ravine on the mountain before reaching No. 45, 2.76 miles distant, and 8 179 feet altitude; the timber is piñon and juniper.

From this station the hills covered with scattered nut pine continue for more than 2 miles before reaching the desert; then the line crosses a sandy reach with some nut pine and juniper for about 2 miles and strikes No. 46, 4.57 miles distant, which is about 50 meters southeast of the desert road from Aurora to Adobe Meadows and Benton, in the midst of juniper and nut pine; sandy soil.

There is a gradual rise through the woods and across the hills and hollows to No. 47, altitude 7 878 feet and 2.29 miles distant, on a rocky, wooded ridge. It is on the east slope about 65 meters from the highest part.

The next station, No. 48, 2.74 miles distant, is on a high table-land very stony on the west edge of a lava knoll. To reach it the line crosses some very rough hills and defiles, through sagebrush and a few scattered pines and scrub junipers.

The line continues over very rough and gradually ascending table-land for 0.68 mile to No. 49, which is on the northeast slope of a hump of lava. There are three of these humps close together on the ridge. The station, T 49, on the random line was on the west side of the center hump, and No. 49 is on the east side.

The line descends for nearly 4 miles to the bottom of a ravine draining to the eastward into Hontoun Valley, then ascends for 2 miles over hills, all the way through nut pine and cedar to No. 51, 6.8 miles distant, on a nut-pine covered knoll. The old station, T 50, on the random line was not corrected. It should go northeast 35.69 meters. It is located on a small hill southeast of the ravine in the bottom. At the time of correcting the line it was impracticable to delay the party for the purpose of reaching this place. A dry camp would have been necessary, and the region is almost without value, being nearly inaccessible under present conditions, except for pack animals. The old point, T 50, is 4.18 miles from No. 49 and 2.6 miles from No. 51.

Between 51 and 52 the distance is only 0.5 mile through nut pine. Both of these stations are on the east slope of wooded ridges. From the latter point the line descends into a valley, crosses a wooded ridge into another valley, then up the sides of a densely wooded ridge to No. 53 on the west slope, 2.22 miles distant and 7 942 feet altitude. From this place it crosses hills and hollows through scattered nut pine, stones, and sagebrush to No. 54, 3.8 miles distant and 7 802 feet altitude. This station is on the east slope of a narrow bluff ridge very stony and with a few nut pines.

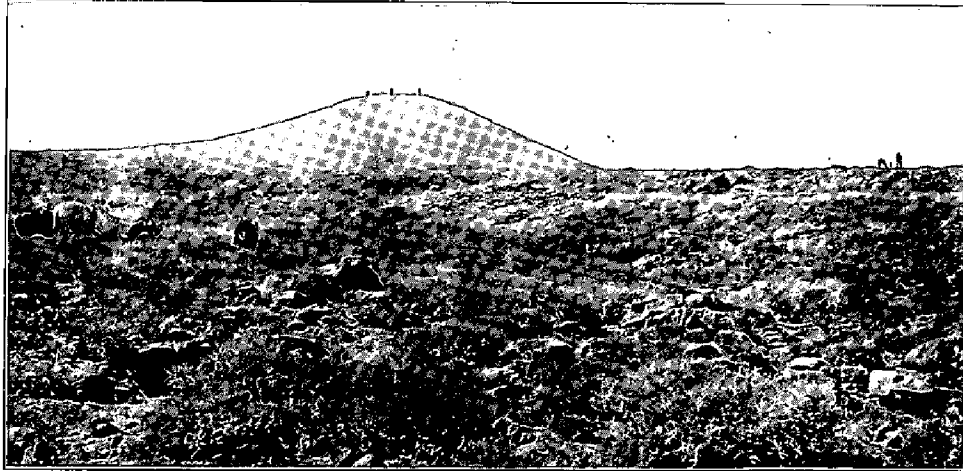
The next point, No. 55, is only 0.46 mile distant and 7 789 feet altitude, on the west slope of a ridge covered with sagebrush:

The next point, No. 56, is 0.66 mile distant, on the east slope of a ridge.

No. 57 is only 0.28 mile distant, also on the east slope of a hill.

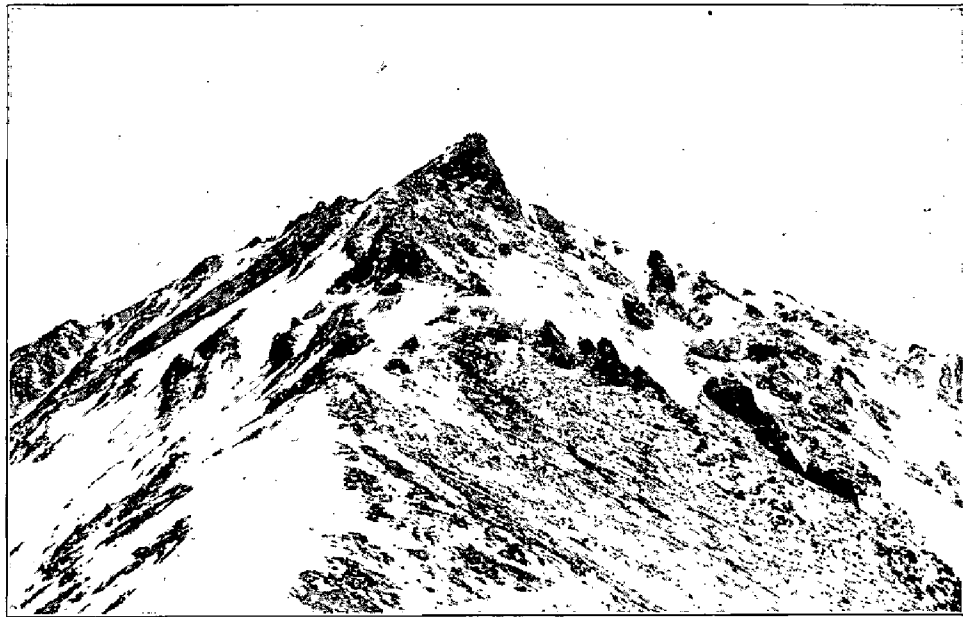
The line now ascends to a rough plateau, then rises to No. 58 among large stones and a few scattered nut pines 1.47 miles distant and 7 092 feet altitude.

The descent onward from this point is quite precipitous for a mile to the valley, then the line crosses the valley to the Carson and Colorado Railway, 2.98 miles distant, to No. 59, altitude 5 951 feet, which is on the northwest side and 21 meters from the rail-



T. 40. No. 40.

BEAUTY PEAK TRIANGULATION STATION FROM NO. 41.



NORTH PEAK (MONTGOMERY PEAK), WHITE MOUNTAINS, FROM NO. 60. ALTITUDE, 13,465 FEET.



ROCKY RIDGE, NORTHWEST SLOPE OF WHITE MOUNTAIN PEAK.



HIGHEST POINT ON THE LINE (NO. 60), WHITE MOUNTAINS—12,937 FEET.

road track. The road from Bertrand's Ranch to Queen Mine is about one-fourth mile to the northwest of this mark. All the stations from No. 47 to 58 are in the Excelsior Mountains.

Rising gradually from No. 59 through sage brush for 1.9 miles, the line goes to No. 59½, 6 618 feet altitude; then, in a little more than a mile, it strikes the steep ascent of the White Mountains, reaching the highest altitude along the line, about 12 930 feet, at No. 60, 4.61 miles distant. Here it crosses in a sag between the two highest summits, a little nearer the northeast summit. The southwest summit, about three-eighths mile from the line, is the highest, being 13 465 feet. The mountain is very difficult of ascent; it is formed of light-colored granite, which is rapidly disintegrating. There is no vegetation on top; only huge masses of rock and sand.

The line descends the steep southeast side of the mountain, then rises to T 61, 3.13 miles distant, and 11 323 feet altitude. This point was not corrected, being snow-covered and very difficult of access. It should go northeast 44.90 meters. It falls on the southeast slope of a very high summit.

The next point is 3.35 miles distant, and 9 653 feet in altitude, falling on the east side of the mountain. T 62 High is only about 250 meters southwest of this point and should not be confounded with it. A Von Schmidt post, marked "333^m. 26th," is one-half mile northeast of this station.

The line continues on the rough mountain side to No. 63, distant 2.3 miles and 9 077 feet altitude.

No. 64 is on a narrow, rocky ridge nearly a mile southeast and 9 286 feet altitude. There is a deep cañon northwest with running water in it, and another southeast of this station.

There is a deep ravine about halfway to the next point, No. 65, which is 1.36 miles distant and 8 585 feet altitude. This point falls on the southeast slope.

From here there is a descent into a deep ravine with water; then a rise to a ridge on which No. 66 is located, on the northeast slope, distant 2.43 miles and 7 972 feet in altitude.

The line continues obliquely along the northeast slope of the mountain for 4.1 miles to No. 67, on the last spur of the main White Mountain Range, 6 771 feet altitude.

After a sharp descent the sandy soil of Fish Lake Valley, covered with sagebrush, is reached, and the first valley mark is No. 67½, distant 4.4 miles and 4 986 feet altitude. About 1½ miles northwest of this is the McBride post of 1865.

No. 68 is in the valley, 2.1 miles distant and 4 994 feet altitude. About three-fourths of a mile north, at the road crossing, is a Von Schmidt post.

No. 69 is 1.8 miles distant and 5 088 feet altitude.

No. 70 is 0.71 mile distant and 5 056 feet altitude.

No. 71 is 0.71 mile distant and 5 002 feet in altitude. Here was located a bench mark of the United States Geological Survey, marked "5 070 feet." The road to Leidy's ranch crosses just northwest of here.

No. 72 is 2.82 miles distant and 4 982 feet in altitude. Soil still sandy and covered with sagebrush.

No. 73 is 3.36 miles distant. Piper's ranch, Oasis, Cal., is 1½ miles southwest.

No. 74 is 1.74 miles at the road crossing going to Silver Peak, altitude 5 053 feet.

A bench mark of the United States Geological Survey, marked "5 121 feet," was located here. One mile east of this, on the northeast slope of a hill, is a Von Schmidt post, marked "363 miles." Oasis, Cal., is 2 miles west.

The next mark, No. 75, is 2.57 miles distant.

No. 76, 0.73 mile distant and 5 255 feet in altitude, just southwest of the road to Palmetto.

No. 77, distant 1.22 miles, is the last point in Fish Lake Valley. All of the soil is sandy and covered with sagebrush. There are some ranches in the valley which are very productive where water can be procured for irrigation. Grain is grown to a limited extent also, but alfalfa is the principal crop. In 1895 nearly all of our provender was hauled from this valley to the southeast, as far as Oasis, Nev.

The next point, No. 78, is on the first high ridge limiting the southeast end of the valley; the Sylvania Range, 3.36 miles distant and 6 774 feet in altitude; it is on the southwest slope. The line crosses a rough, mountainous region, high hills and deep ravines for a distance of 3.21 miles to No. 79, 7 927 feet in altitude, in a sag of the ridge, with some nut pines growing on it. The old Sylvania mining camp, now abandoned, is a mile north. There are a few springs through this region known to the ranchers and miners.

Less than three-fourths of a mile southeast is a wash or cañon, probably 1 000 feet deep and half a mile wide, which leads up to the northeast about half a mile beyond the line. Crossing this, the line goes over rough country, partly wooded, to No. 80, 4.87 miles distant and 6 894 feet in altitude. The drainage from here is into Death Valley.

The country is still very rough, but descends to No. 81, which is on the west end of a range of hills, 6.83 miles distant and 4 270 feet in altitude.

No. 82 is just southeast of a big wash and the road from Tule Cañon, 2.8 miles distant and 3 763 feet altitude. This country is much cut up by washes from the mountains on the northeast.

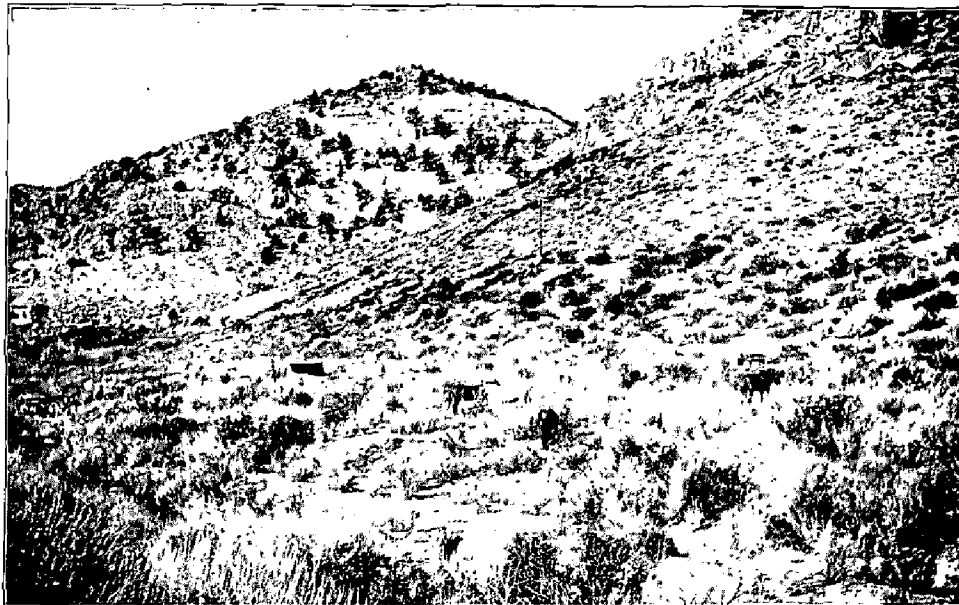
No. 83 is just southeast of a large wash, 4.41 miles distant and 4 216 feet in altitude.

The next point, No. 84, is on a high hill, west slope, 4 766 feet in altitude and 2.14 miles distant. The terrene is extremely rough between the next two points, No. 85 being on a hill, 5 197 feet altitude, 1.23 mile distant. Continuing on the same rough mountains, No. 86 is on the east side of the summit of a symmetrical hill, 5 698 feet altitude and 4.25 miles distant.

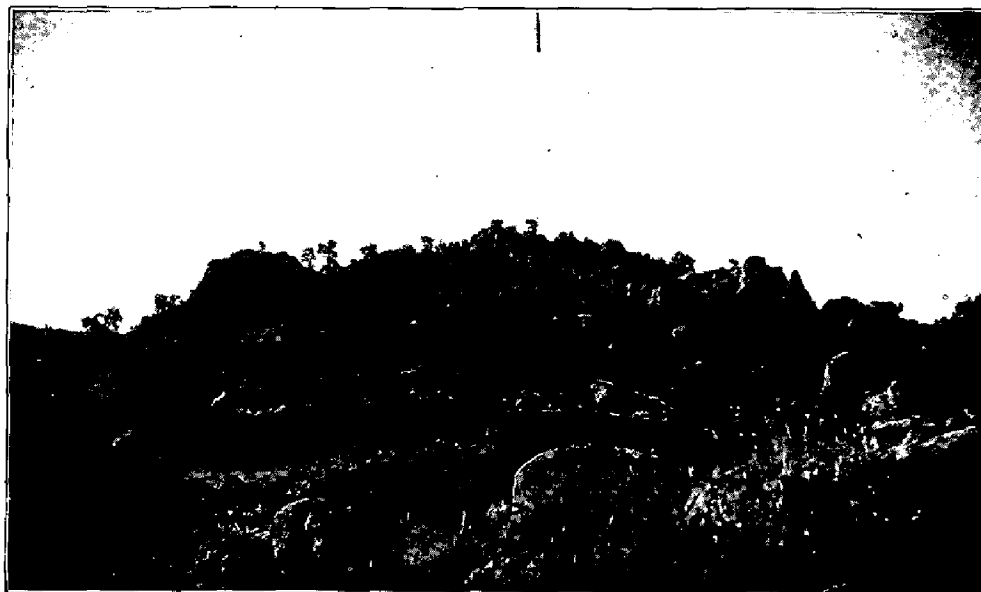
Crossing a valley and going up a steep slope, No. 87 is found on the east side of a hill covered with yucca, 1.13 mile distant and 5 444 feet in altitude.

The line goes over rough hills and ravines and washes to No. 88, 5.47 miles distant and 4 260 feet in altitude, on the rocky hill southeast of the road from Staininger's to Thorp's mill.

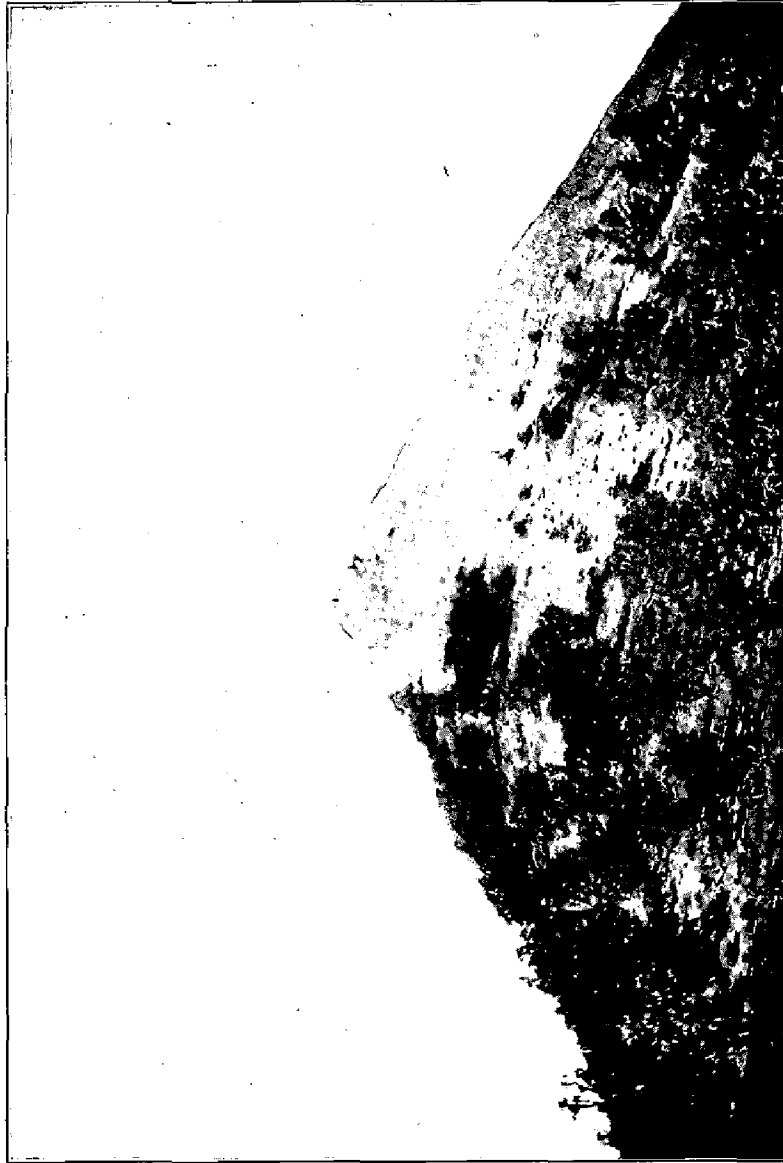
In order to reach the region from No. 81 to No. 84, Sand Spring was used as a water and supply place. The water at Sand Spring, running through grass, has a taste of the roots and is not very wholesome without being boiled. Staininger's ranch, about 20 miles southeast of this place, was the base for reaching all the stations between No. 85 and No. 89, inclusive. There is an abundance of water of good quality, though warm when it emerges from the ground, and a few acres of good ground have been placed under cultivation. Alfalfa grows luxuriously, but one can not depend on finding



CAMP AT BIG SPRINGS, GRAPE VINE MOUNTAINS.



BIG SPRINGS, GRAPE VINE MOUNTAINS. LOOKING SOUTH.



NYE TRIANGULATION STATION (8,558 FEET), GRAPE VINE MOUNTAINS.

provender at this place except during the summer and early fall when the hay is being harvested. It is not practicable to reach the stations in this region, except No. 82, with teams; only saddle and pack animals can be utilized. The foot of the hill below No. 88 being close to the road, the station is accessible.

Between No. 88 and No. 89 the line crosses a very rough region for 5.64 miles over ravines, washes, and cañons, the foothills of the lofty Grape Vine Mountains. The altitude of No. 89 is approximately 7 000 feet, it is located on a precipice fully 1 000 feet above the gorge to the northeast. The boundary mark is about 300 feet lower than the random line point, T 89.

The point called T 90 on the random line is 4 miles from No. 89. It falls on the west slope of the main peak of the Grape Vines on top of a cliff about 80 feet above the valley or ravine below. It was not changed, but should go northeast 77.70 meters to bring it on the boundary. It will be necessary to go to the northwest a short distance and climb the steep sides of the mountain. The altitude of T 90 is 7 800 feet; that of the main peak is 8 771 feet.

Continuing across narrow valleys, rough hills, and deep gorges for 4.85 miles the line climbs to No. 91, 7 871 feet altitude, on the crest of a ridge running north and south. On the west of this place is a deep cañon extending toward Death Valley. On the north, then extending southeast and south, is a great cañon, one of the roughest on the line; it divides the mountain range and winds around into Death Valley. Beyond this cañon the line crosses a rough mountainous region traversed by gorges before reaching No. 92, on the west slope near the top of a smooth mountain covered with sagebrush, distant 3.4 miles and 7 034 feet altitude. This point commands the Little Amargosa and Great Amargosa deserts for 60 miles.

For Nos. 90, 91, and 92 the Big Springs of the Grape Vine Mountains, at the east foot of the sharpest and next to the highest peak, was used as a base; only pack and saddle animals can be used. The Big Springs are reached from Staininger's by Thorp's mill, where there is a fine well of water, then to Oasis, Nev., and then doubling back west into the mountains about 65 miles from Staininger's.

Between No. 92 and No. 93, 9.52 miles distant, the line crosses to the northeast slope of the Grape Vines, over a region without value, very mountainous, and with no water.

Near No. 93, to the west, up the cañon, are Daylight Springs. The distance from No. 93 to No. 94 is 5.68 miles, and the line descends to 3 853 feet, crossing washes and sagebrush.

From No. 94 the line crosses a rough, rolling country on the east slope of the Funeral Mountains to No. 95, distant 1.89 miles, altitude 3 899 feet. There is a considerable descent from here across a valley covered with sagebrush to No. 96, 3.57 miles distant, altitude 3 614 feet.

Between No. 96 and No. 97 the country is of the same general character and the distance 6.17 miles.

It is about 2.5 miles to No. 98, and nearly a mile farther to No. 98½, both on the northeast slope of the Funeral Mountains. Between these two points and to the southeast on the main slope are T 98, 2 927 feet altitude; and one-half mile southwest, T 98 High, 3 677 feet altitude. To the southeast of No. 98½ is a wash, then a ridge with several summits. There are many washes, some of considerable extent, leading

from the mountains on the southwest side of the line. No. 98½ is the last point northwest of the great Amargosa Desert.

The next point, No. 99, is 5.16 miles distant and 2 349 feet in altitude, after passing through a flat sandy region covered with sagebrush and greasewood.

Nearly north of No. 99 about 8 miles distant, rising sheer out of the desert, is a mass of great white sand hills several hundred feet high without vegetation, a marked feature in the landscape.

No. 100 is in a saddle between two low hills, the west one a dark lava formation and the east one light colored. The distance from No. 99 is 5.16 miles, the altitude 2 358 feet. The mountains are several miles to the west of the line. Sand and sagebrush are crossed with a descending slope for 4.45 miles to No. 101, altitude 2 271 feet. About a mile south of this in the old bed of the Amargosa River, among the mesquites, is the water hole, not far from what was called Franklin well. The water is whitish in appearance, but not disagreeable to the taste; it may be found in abundance by digging from 6 to 8 feet.

Still descending, the line crosses sand, gravel, and through sagebrush and greasewood for 4.24 miles to No. 102, altitude 2 176 feet. To the south and 1 464.9 meters distant is the south base, T 102 being the north end of the base. On the northeast, about 2 miles distant, the sand hills, covered with small mesquite, begin. These extend to the west rim of the Ash Meadows.

The line continues to descend to No. 103, which is the lowest monument in the Great Amargosa Desert, being 3.83 miles distant and 2 119 feet altitude, located in a soft bed of brownish red soil, in which the animals sink from 6 to 10 inches. Half a mile to the northwest is an old stream bed covered with coarse grass, and a short distance southeast is another, draining from the eastward.

The region called Ash Meadows, from the ash trees growing along the streams, lies on the southeast side of the Great Amargosa Desert. There are a number of warm springs in the meadows, of great volume, sufficient to irrigate a large area, but the amount of alkali in the soil is prejudicial to the cultivation of hay to any great extent. The grass is sufficient to support a goodly number of cattle.

No. 104 is 2.66 miles distant from No. 103, at the west end of the second range of bold hills rising out of the valley.

No. 105 is on the high ridge forming the eastern slope of the Chung Up or waterless mountains, at a distance of 5.11 miles and an altitude of 3 860 feet. The station is on the east side of a sag and not far from the top of the ridge, among large, flat stones. Care must be taken not to confound the three points on this top; T 105 is nearest to the sag, No. 105 up the slope to the northeast, and T 105 High still farther to the northeast and at an altitude of 3 937 feet. It is very rough, rising from the valley to No. 105. The main summit is one-half mile west.

The line runs over the rough mountains for 3 miles to No. 106, 3 358 feet altitude, located on the east slope of a very precipitous black, rocky ridge, rising in sheer cliffs nearly 900 feet above Stewart Valley.

Beyond No. 106 the line descends rapidly to Stewart Valley and traverses sandy soil covered with sagebrush to the old bed of a lake covered with soft, brownish soil, then along sandy soil to No. 107, 4.18 miles distant and 2 423 feet in altitude.

The next mark is No. 108, 3 miles distant. The monument is on the southwest end

of a small range of mountains that bound Stewart Valley on the east. It stands up boldly on a rocky point at least 50 feet higher and 200 meters north of T 108, which is 2 484 feet in altitude. A short distance southeast the line crosses two roads running from Resting Springs to Pahrump and Manse ranches, not much used now. The line is now in Pahrump Valley, traversing sand and sagebrush for 5 miles to No. 109, 2 494 feet altitude. Pahrump Valley is lowest on the southwest side near the western mountains. It rises gradually toward the eastward in the direction of Charleston Peak, a very high summit, about 11 000 feet in altitude, covered with some pine and with large timber pines in the ravines. A sawmill supplies lumber to the mines and the ranches in the valley. There are two ranches near the northeast end of Pahrump Valley, the one farthest north giving name to the region, and 6 miles southeast is Manse. The water supply comes from warm springs, the quantity at Pahrump ranch being sufficient to irrigate about 500 acres of land and the two large springs at Manse a like quantity. These springs have a uniform temperature of 72° and an unvarying flow the year round. There are no other important springs to the northwest until Ash Meadows are reached, 24 miles. Fourteen miles south of Manse there is a small quantity of water at Stump Spring of good quality, but no more until Sandy is reached, 30 miles south of Manse. Stump Spring is on the old immigrant route from Las Vegas to California.

Leaving No. 109 the line traverses sand and sagebrush to No. 110, 3'54 miles distant, and 2 516 feet altitude. The same character of country is found to No. 111, 3'93 miles distant, and 2 527 feet altitude.

No. 112 is 3'41 miles distant, with an altitude of 2 586 feet, and from here the line runs a short mile to No. 113, altitude 2 610 feet.

No. 114 is 2'17 miles distant, altitude 2 647 feet, and No. 115, 2'0 miles distant, with an altitude of 2 689 feet. The character of the country is the same—sand and sagebrush. Stump Spring is 2 miles north and a little east; an old adobe hut without a roof is still standing just northeast of the spring.

Leaving No. 115 there is a gradual descent, partly through sagebrush and some bunch grass, a few sand hills and washes, to the foot of the ridge on which No. 116 is located, then a rise through thick bunch grass up the stone and gravel slope to No. 116, 3'3 miles distant, altitude 3 089 feet. This last point is on the northeast slope of a low ridge running across the valley, dividing it from Mesquite Valley. The low hills near No. 116 turn nearly parallel to the line and extend for nearly 4 miles to the southeast, until they connect with the high, rocky butte near the center of the valley, almost 6 miles from No. 116. A little over one-half mile east of this is the Von Schmidt 521 milepost.

Crossing over the ridge into Mesquite Valley the line traverses sandy and gravelly soil covered with sagebrush and Spanish bayonet. No. 117 is on the west end of a black, rocky ridge about 3'75 miles from No. 116, and about 0'8 mile northwest of T 117 and T 117 High, which are on a brown hill covered with a mass of loose stone. The altitudes of these latter are 2 921 and 2 924 feet, respectively. No. 117 is somewhat higher, from 50 to 60 feet. Half a mile north of this is Von Schmidt 524 milepost.

Leaving No. 117 the line crosses a depression for over half a mile, then a narrow ridge, and near by the stony hill on which the random line points were located, then descends again into Mesquite Valley and continues through gravel, sand, sagebrush, and Spanish bayonet to No. 118, 5'49 miles distant and 2 631 feet altitude, and

one-fourth mile southwest of the main road between Pahrump and Sandy. On the northeast side of this road is a region of sand hills, a few of them covered with mesquite. There are a few sand hills about a mile north of the station also; Von Schmidt 531 milepost is one-half mile east.

Southeast of No. 118 the line traverses sandy soil and sagebrush to No. 119, 2.66 miles distant, altitude 2 591 feet. Von Schmidt 533 milepost is one-fourth mile north, and Von Schmidt 534 milepost is a little more than three-fourths mile southeast.

The line continues through sand and sagebrush to No. 120, distant 2.13 miles, altitude 2 556 feet, on the northeast side of the road running southwest from Sandy to the mountains. Sandy post-office is $1\frac{3}{8}$ miles northeast among the sand hills. A large quartz mill, the Keystone, was erected there years ago, which is not in use now; but there are copper mines in operation a few miles northeast of Sandy. The water here is good, being raised from a well by means of a windmill, though the quantity is limited. Von Schmidt's 535 milepost is one-fourth mile north of No. 120. The road to Manvel is about 200 meters northeast.

About $1\frac{1}{2}$ miles southeast the line crosses the Manvel road and about three-fourths of a mile farther a road branching from it to Sandy. A mass of sand hills is encountered about one-half of a mile northeast of No. 121, which is 3.32 miles distant and 2 584 feet altitude on a sand hill. About 1.25 miles southeast of No. 121 the Von Schmidt line is crossed a second time. The second crossing is 331.31 miles from the intersection of 120° of longitude and 39° of latitude in Lake Tahoe, and 277 miles from the first crossing in the Sweetwater Valley between No. 32 and No. 33.

The line crosses the west slope of high ground on the northeast, full of washes and stones, and also across the upper road between Sandy and Bullock's well, less than a mile northwest of No. 122, about 3.33 miles distant and 2 551 feet altitude. Bullock's well, with alkali water fit only for stock, is $1\frac{1}{2}$ miles south of No. 122. There is no shelter at this place, but a good growth of mesquite, which may be used for firewood, covers the numerous sand hills. The well is at the southeast end of the sand hills.

The line continues on the west slope of the mountains across washes and stony ground covered with sagebrush, greasewood, and some Spanish bayonet, rising over the foothills, and finally crosses the main ridge of the State Line Mountains on the northeast side of the pass, above the precipitous ledges, on the southwest slope of the main ridge in a very commanding position, to No. 123; distant from No. 122, 3.91 miles. The random-line point T 123 has an altitude of 4 342 feet. The boundary monument No. 123 is about 150 feet higher. The State Line Mountains are very striking in appearance. Some of the mass is unstratified, but most of the mountain is formed of horizontal strata from 1 foot to 50 feet thick, greatly eroded by weathering. Some of the strata are fossil bearing; a few of the summits pyramidal in shape, with irregular, receding steps.

The line continues well on the edge of the mountain down the southeast side, striking the southwest edge of the terminal hills in Dry Lake, until it reaches No. 125, 5.75 miles distant and 2 588 feet in altitude. On the corrected line No. 124 was not necessary, and was therefore omitted. No. 125 is on the alkali flat, forming the north end of Dry Lake about a mile east of the old well (no water) where the road to Sandy, going over the divide, strikes the sagebrush at the foot of the ascent. The road crossing the State Line pass is in very good condition, but the grade on the northwest side is steep



DRY CAMP, LITTLE AMARGOSA DESERT.



No. 123.

FROM ROAD ON STATE LINE PASS. LOOKING NORTHEAST.



IVANPAH VALLEY FROM STATE LINE PASS.

in places. It is about 10 miles across from foot to foot. About one-fourth mile southeast of No. 125 the line crosses the road from Manvel to Good Springs, a mining camp in active operation at this time (1899). The ground is sandy for a short distance and then is covered with stone and large boulders, sloping upward to No. 126, 3.6 miles and 2 981 feet altitude. The land rises up to the northeastward.

The line continues on the slope through stones and sagebrush for 4.46 miles to No. 127, which is on the southwest side of a high rocky ridge above the general level. The ridge is of black lava and very precipitous. The point on the random line T 127 has an altitude of 3 387 feet, and No. 127 is about 100 feet higher and north one-eighth mile.

For a mile the line continues in the mountains on the west slope, then strikes the sloping mesa, rocky and covered with sagebrush, crossing washes and sandy soil to No. 128, 6.42 miles distant, on the west slope of the mountains. This point is nearly one-fourth mile due east of T 128 on the random, 4 075 feet altitude. T 128 High is just southwest of this, and 4 092 feet altitude. The line crosses the west slope of the mountains over washes, stony and sandy soil, with sagebrush, for 1.72 miles to No. 129, on the northeast slope of a ridge. The random line point T 129, a short distance west, is somewhat higher, being 4 483 feet in altitude.

The line continues on the west slope of the mesa over stones and sand through Spanish bayonet and a forest of yucca to the New York Mountains until No. 130 is reached, 4 miles distant and 5 182 feet altitude. The water for operating from No. 125 to No. 129 may be procured at Dry Lake well, of good quality, on the road from Manvel. To reach No. 130 it is advisable to go to Manvel, then to Malpais Springs, nearly two days' drive from Dry Lake well.

There are three other points near No. 130, T 130 and T 131 on the random line, and T 130 High about one-fourth mile northeast. Malpais Springs are 2.5 miles south of No. 130, in a cañon, with a large stock corral and watering troughs.

The line descends through the large yucca forest, Spanish bayonet, and sagebrush, across the sloping mesa for 5.13 miles to No. 132 on a conspicuous flat-top summit in the Castle Mountains, 4 983 feet altitude. There are two of these summits close together, the line falling on the north one. The Castle Mountains have a number of peculiar rock-capped peaks like cauliflower blooms, the boldest and highest being southwest of the line. The road from Manvel to Searchlight Mines passes about a mile north. The gorge at Malpais Springs drains into the Great Piute Wash that runs into the Colorado River a few miles north of Needles via Ibex Station on the Atlantic and Pacific Railroad.

The line traverses a rough region, hills and valleys, for 4 miles, to No. 133, on the northeast slope of a high rocky mountain. The random line point T 133 is 4 096 feet in altitude, and the line point is about 100 feet lower. For 3.5 miles beyond this the line is in the hills and then comes down into the desert, traversing it to No. 134, 9 miles distant and 2 303 feet in altitude. This point is about a mile northeast of four small buttes in the valley. Von Schmidt's 592 milepost is about 1 mile west, alongside the road to Piute Springs.

Between No. 134 and No. 135 the line rises on the southwest slope, through sand and sagebrush. No. 135 is 5.88 miles distant on the south end of a mass of small summits. The old station on the random line is 2 631 feet in altitude; No. 135 is lower, in a sag among the hillocks. Correcting the line threw T 136 off of the hillside into

the lowlands, and it was omitted. The line rises obliquely across the slope and ridges through sagebrush, stones, and sand to No. 137, distant 4 miles from No. 135, altitude 2 671 feet.

No. 138 is only one-fourth mile from No. 137, owing to a rolling table-land. It is in a ledge of large rocks, falling in the space between two of them. The crossing of the road from Piute Springs to Fort Mohave is one-fourth mile southeast of this. No. 138½ is 0.80 mile from No. 138. The soil is sandy, covered with granite boulders, sagebrush, and a variety of cactus.

The line crosses a number of small granite hills for nearly three-fourths mile to No. 139 on a rocky granite ridge running east and west. T 140 on the random line, altitude 2 168 feet, falls on lower ground in the corrected line and was omitted, as the next, No. 141, is visible, distant 6.25 miles.

Leaving No. 139 the line passes over ground covered with granite boulders and hills with sagebrush and cactus growth. Three miles to the southeast is a spring in a gorge of the white granite formation. The vertical cliff is covered with Indian hieroglyphics near the spring; the quantity of water is small, and it runs dry some seasons. Just below the spring a broad wash is reached and then a low mesa sloping off toward the river. A quarter of a mile northwest of No. 141, altitude 821 feet, a higher mesa land is reached, formed of sand and gravel. The line from No. 141 crosses the granite hills, covered with sagebrush, to a lower mesa of stone, gravel, and sand, to No. 142, the terminal monument (distant 1.45 miles and altitude 517 feet), which is about 100 meters from the edge of the trees in the river bottom.

When tracing the line Malpais Springs was used as a base for Nos. 130, 132, 133; then Piute Springs for Nos. 134, 135, 136. From the Colorado River by hauling water and making a dry camp the rest of the points, Nos. 137, 138, 139, 140, 141, and 142 were placed in position.

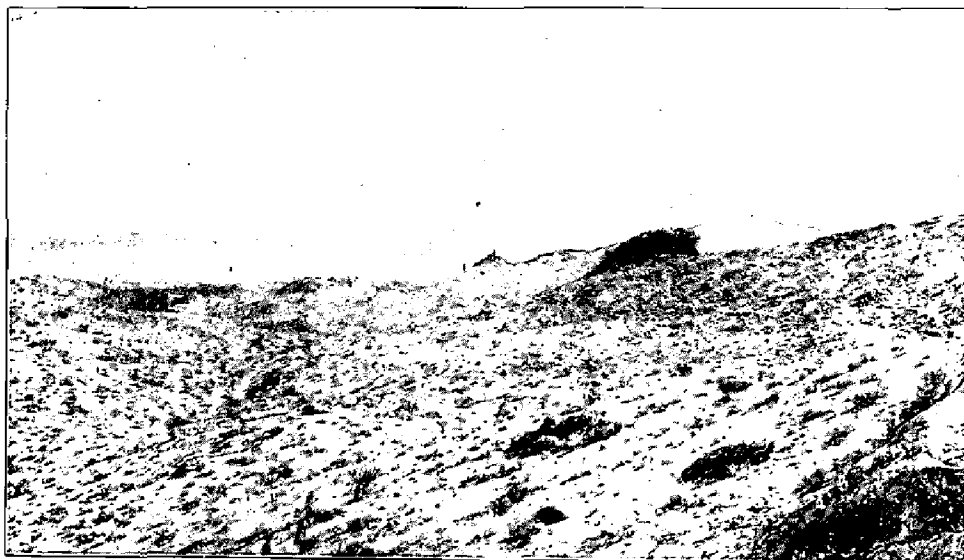
The line descends from an altitude of about 2 670 feet at the summit of the divide leading up from the Colorado River to 517 feet at No. 142 on the Colorado River in a distance of .9½ miles. The old Government road between Fort Mohave and Piute Springs is very badly washed between Piute Springs and Manvel; crossing the pass it is very steep and rough. Manvel is the best supply point for Piute Springs, and the Needles for the Colorado River camp near the thirty-fifth degree of latitude. In reality the food supplies for the men were brought from Manvel as far northwest as Pahrump Valley, 75 miles distant. To the southeast of No. 142 the line enters the bottom land of the Colorado River, passing through mesquites, willows, and some cottonwoods over a sandy loam for 2.67 miles to the central point between the bluff banks at the crossing of the thirty-fifth degree of latitude, the terminus of the oblique boundary between California and Nevada.

From Fort Mohave to the Needles the Colorado River has bottom lands from 1 to 3 miles wide, edged by bold bluffs of sand and gravel, which may be considered permanent, so little are they subject to change, except superficially through the agency of cloudbursts in the mountains, that send down the water in torrents, tearing gulches and gorges through the mesa.

The river wanders from side to side through its alluvial bottom in the most capricious manner during high water, at which time most of the low land is submerged and receives a rich deposit of fertilizing material. There are a number of Mohave Indians



AT T. 139. LOOKING NORTHWEST.



T. 140. T. 140 high.

AT T. 139. LOOKING SOUTHEAST.



CALIFORNIA AND NEVADA BOUNDARY SURVEY

THE NORTH PACIFIC COAST, WASHINGTON, D. C.

who derive a precarious living by cultivating small patches of soil in the low grounds. During high water they move to the bluffs for safety. A few ranches are owned by whites, who raise wheat and hay in addition to herds of cattle and horses.

M. ALTITUDES.

The altitudes were obtained by observing vertical angles on Mount Grant, a primary station in the transcontinental triangulation, and on the North (Montgomery) Peak, White Mountains, the height of which was determined in the transcontinental triangulation from the primary stations—Mount Grant, Lone Mountain, and Toiyabe Dome. Neither of these stations was occupied to determine heights along the California-Nevada oblique boundary, but verticals were observed on them from different points which agreed closely. The altitudes from Lake Tahoe to T 47 and Sag depend on Mount Grant, and the altitudes from T 53 to the Colorado River and the Needles depend on the North Peak, White Mountains. The altitudes of these two stations can not be called final, but rather relative, as the data in hand is not sufficient to warrant a complete adjustment.

In carrying the altitudes depending on Mount Grant (3 428 meters, 11 247 feet, Coast and Geodetic Survey register) to the northwest from T 47, the height of Lake Tahoe was found to be 6 224 feet, or 1 foot less than that given on the United States Geological Survey chart (6 225 feet).

There is a break in the heights depending on Mount Grant toward the southeast, about 30 miles northwest of the White Mountains, and, in order to carry the heights southeast of this break, the North (Montgomery) Peak, White Mountains (4 104 meters, 13 465 feet, Coast and Geodetic Survey register), was used.

At T 74, on the random line, a Geological Survey bench mark was found with the altitude (Carson and Colorado Railroad data) 5 121 feet; carrying the levels over the White Mountains, a distance of 41.7 miles by vertical angles from Queen Station, this bench mark is 5 119 feet; differing from the United States Geological Survey levels only 2 feet. Queen Station, on the Carson and Colorado Railroad, is given by the railroad levels, based on the San Francisco datum, as 6 254 feet; Queen Station, by vertical angles from North Peak, White Mountains, is 6 188 feet; making a difference of 66 feet. Transferring the railroad levels from Queen Station by vertical angles along the random line to the Needles, Atlantic and Pacific Railroad, a distance of nearly 300 miles, the altitude is 532 feet; Needles, by railroad levels from San Francisco along the Atlantic and Pacific Railroad, 480 feet; difference, 52 feet. Using North Peak, White Mountains, the altitude of the Needles (by trigonometric levels) is 466 feet; difference, 14 feet.*

INSTRUMENTS.

In 1894 the vertical measures were made with the 4-inch vertical circles (reading to 1 minute) attached to two theodolites, with 4-inch horizontal circles, by Fauth & Co. and by Buff & Berger. In 1895 and 1899 the altitudes were determined with

*Mr. R. D. Laws, assistant superintendent and chief engineer of the Carson and Colorado Railroad, on January 28, 1896, Hawthorne, Nev., gave the height of Queen Station above mean high water, San Francisco, Cal., 6 254 feet. The Atlantic and Pacific Railroad authorities gave the height of Needles Station (rail in front of station) above mean low low water, Fort Point, San Francisco, Cal., 479.85 feet. The plane of reference for the trigonometric levels is the mean sea level. The

the 5-inch vertical circles (reading to 1 minute) attached to the 7-inch Buff & Berger theodolites. Five of these theodolites were used on the boundary triangulation. (See illustration, No. 58.)

On the random line the stations are designated by T 1, T 2, T 3, etc., counting from Lake Tahoe, while on the corrected line the boundary marks are designated by No. 1, No. 2, No. 3, etc.

IV. TABLES, ETC., SHOWING THE RESULTS IN DETAIL.

A. DISTANCE AND ALTITUDES ON THE RANDOM LINE.

Stations.	Distance between stations.	Total distance from T 1.	Offset to corrected line.	Altitude.	Remarks.
	<i>Meters.</i>	<i>Meters.</i>	<i>Meters.</i>	<i>Feet.</i>	
T 1.....	0'0	0'0	0'00	6 249'3	T 1 was the azimuth station of 1894.
T 2.....	377'9	377'9	'89	.....	On road, southwest side.
T 3.....	3 107'8	3 485'7	'82	9 019'4	West side of the mountain top.
T 4.....	263'4	3 749'1	'88	9 160'7	Do.
T 5.....	988'6	4 737'7	1'11	9 517'2	Not corrected on account of deep snow.
T 6.....	652'0	5 389'7	1'26	9 475'3	Do.
T 7.....	604'1	5 993'8	1'41	9 340'0	East side of the mountain top.
T 8.....	7 438'1	13 431'9	3'15	5 213'6	Carson Valley, west side.
T 9.....	1 777'2	15 209'1	3'57	4 833'8	Do.
T 10.....	1 448'9	16 658'0	3'91	4 865'6	Do.
T 11.....	1 395'9	18 053'9	4'23	4 800'6	Carson Valley, fork of roads.
T 12.....	2 276'6	20 330'5	4'77	4 847'1	Carson Valley, in road.
T 13.....	564'8	20 895'3	4'90	4 848'4	Carson Valley, West Fork Carson River.
T 14.....	1 040'0	21 935'3	5'14	4 980'2	Carson Valley.
T 15.....	2 639'5	24 574'8	5'76	5 459'8	Carson Valley, rolling hills.
T 16.....	727'7	25 302'5	5'94	.....	Middle Fork of Carson River.
T 17.....	1 700'4	27 002'9	6'33	5 815'3	Rolling hills.
T 18.....	1 940'1	28 943'0	6'79	5 103'9	East Fork Carson River, Kelly's ranch.
T 19.....	1 256'3	30 199'3	7'08	6 027'4	Wooded mountain, southeast of Kelly's ranch.
T 20.....	1 141'2	31 340'5	7'35	.....	West slope of cliff.
T 21.....	2 853'1	34 193'6	8'02	6 322'7	West slope, half way to top.

Footnote—Continued.

plane of mean high water is 1'845 feet above mean sea level; and the plane of mean low low water, or, as usually designated, mean lower low water, is 3'182 feet below mean sea level; so that the difference between the above reference planes at Fort Point is 5'027 feet.

The following letter is authority for this statement:

TREASURY DEPARTMENT,
OFFICE OF THE COAST AND GEODETIC SURVEY,
Washington, D. C., January 10, 1901.

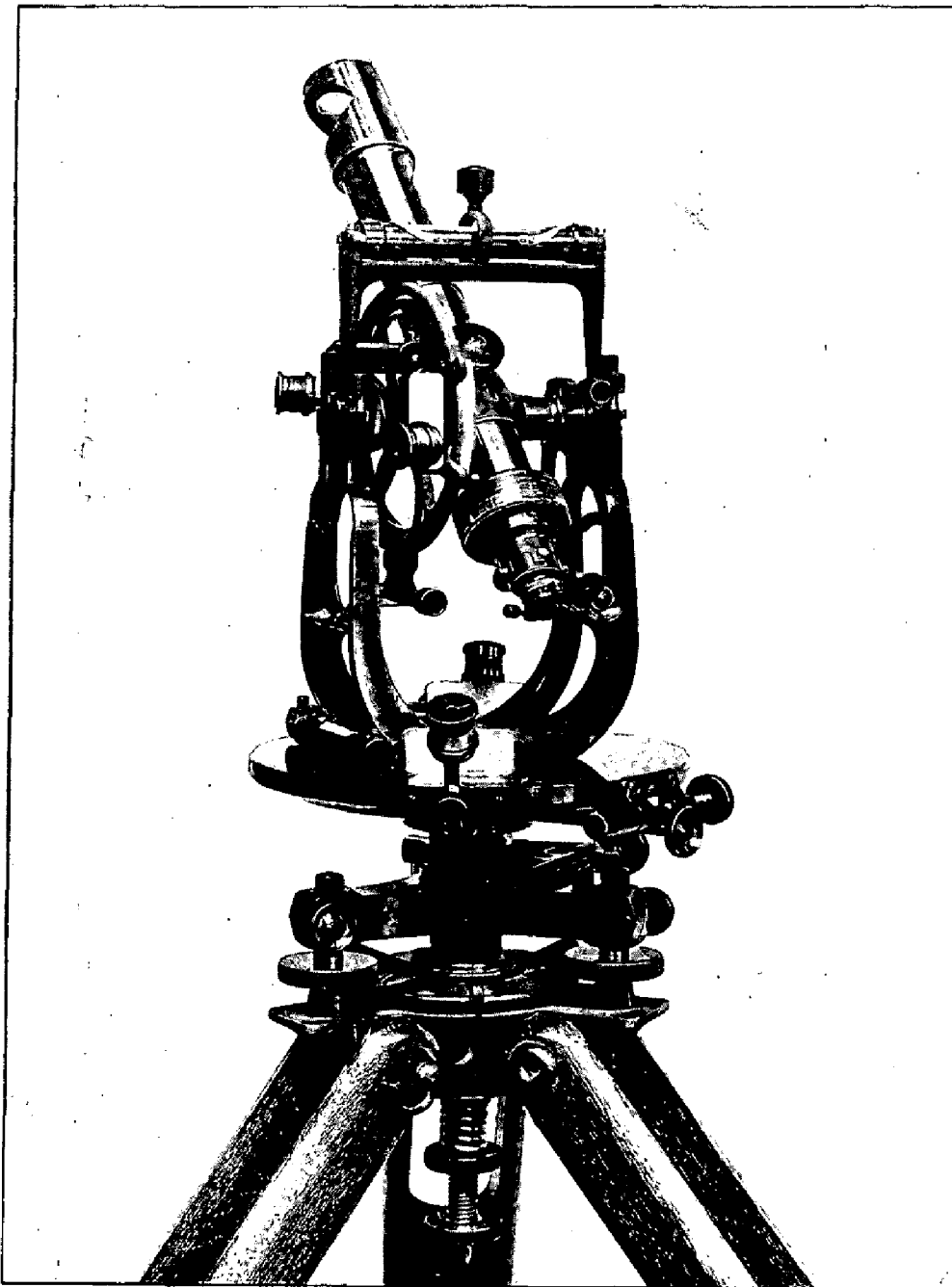
Mr. C. H. SINCLAIR,

Assistant, Coast and Geodetic Survey, Washington, D. C.

SIR: In reply to your inquiry of the 9th instant in relation to the difference between mean high water and mean low water at Fort Point, San Francisco Bay, California, I have to state that the difference is 5'027 feet. The plane of mean high water is 1'845 feet above mean sea level; and the plane of mean low low water, or, as usually designated, mean lower low water, is 3'182 feet below mean sea level.

Respectfully, yours,

ANDREW BRAID,
Assistant in charge of the Office.



BUFF & BERGER 7-INCH THEODOLITE.

A. DISTANCE AND ALTITUDES ON THE RANDOM LINE—Continued.

Stations.	Distance between stations.	Total distance from T 1.	Offset to corrected line.	Altitude.	Remarks.
	<i>Meters.</i>	<i>Meters.</i>	<i>Meters.</i>	<i>Feet.</i>	
T 22.....	4 597.3	38 790.9	9.10	7 612.6	Highest ridge, west slope.
T 23.....	4 179.1	42 970.0	10.07	7 522.9	Southeast slope.
T 24.....	3 040.0	46 010.0	10.79	.....	Carson & Coleville road, north side.
T 25.....	2 336.9	48 346.9	11.34	5 303.9	Southeast of Alkali Lake, high hill.
T 26.....	.....	.....	.....	.....	Temporary station.
T 27.....	3 735.4	52 082.3	12.21	4 936.4	Northwest side of W. Walker River.
T 28.....	3 737.9	55 820.2	13.09	5 111.9	Antelope Valley.
T 29.....	7 996.7	63 816.9	14.97	7 480.1	Wooded hill.
T 30.....	3 733.8	67 550.7	15.84	7 962.8	Bare ridge.
T 31.....	2 010.5	69 561.2	16.31	8 643.4	Bare ridge.
T 32.....	6 195.4	75 756.6	17.77	10 556.2	Summit of Sweetwater Mountains.
T 33.....	8 457.7	84 214.3	19.75	6 985.9	Sweetwater Valley.
T 34.....	5 307.4	89 521.7	20.99	6 529.6	Do.
T 35.....	621.9	90 143.6	21.14	6 444.0	Do.
T 36.....	5 573.3	95 716.9	22.45	7 258.8	On Red Hill.
T 37.....	4 169.9	99 886.8	23.43	8 009.6	Do.
T 38.....	2 588.4	102 475.2	24.03	8 347.6	On Rocky Knob.
T 39.....	4 941.7	107 416.9	25.19	8 009.2	On table-land.
T 40.....	5 677.3	113 094.2	26.52	8 954.0	On Beauty Peak.
T 41.....	2 167.8	115 262.0	27.03	.....	North of Aurora and Bodie Road.
T 42.....	3 714.2	118 976.2	27.90	9 246.8	Summit of West Brawley Mountain.
T 43.....	2 661.3	121 637.5	28.53	.....	North of Aurora and Bodie (old) road.
T 44.....	2 877.1	124 514.6	29.20	8 521.2	Round bare hill—isolated mountain.
T 45.....	4 449.9	128 964.5	30.24	8 178.7	Wooded peak—double-top mountain, southeast one.
T 46.....	7 347.0	136 311.5	31.97	.....	Aurora and Benton road; desert.
T 47.....	3 681.5	139 993.0	32.83	7 878.2	On wooded hill.
T 48.....	4 403.5	144 396.5	33.86	.....	On table-land.
T 49.....	1 043.7	145 440.2	34.11	.....	Lava ridge, east side of small knob.
T 50.....	6 730.2	152 170.4	35.69	.....	Hontoun Valley, bottom of defile.
T 51.....	4 203.3	156 373.7	36.67	.....	Excelsior Mountains, east slope wooded mountain.
T 52.....	812.1	157 185.8	36.86	.....	Do.
T 53.....	3 581.9	160 767.7	37.70	7 942.0	Excelsior Mountains, west slope wooded mountain.
T 54.....	6 102.7	166 870.4	39.13	7 802.0	Excelsior Mountains, east slope bare ridge.
T 55.....	746.3	167 616.7	39.31	7 789.0	Excelsior Mountains.
T 56.....	1 057.0	168 673.7	39.55	.....	Do.
T 57.....	452.7	169 126.4	39.66	.....	Do.
T 58.....	2 365.4	171 491.8	40.22	7 092.0	Excelsior Mountains, wooded.
T 59.....	4 793.6	176 285.4	41.34	5 951.0	Carson and Colorado R. R., north-west side.
T 59½.....	3 059.6	179 345.0	42.06	6 618.0	Foot of White Mountains, on mesa.
T 60.....	7 094.9	186 439.9	43.72	12 887.0	Summit of White Mountains.
T 61.....	5 039.3	191 479.2	44.90	11 323.0	White Mountains, sharp, bare ridge.
T 62.....	5 390.9	196 870.1	46.17	9 653.0	White Mountains.
T 63.....	3 693.9	200 564.0	47.03	9 077.0	Do.
T 64.....	1 519.5	202 083.5	47.39	9 286.0	Do.
T 65.....	2 194.4	204 277.9	47.91	8 585.0	Do.
T 66.....	3 915.5	208 193.4	48.82	7 972.0	Do.
T 67.....	6 568.2	214 761.6	50.36	6 771.0	Do.
T 67½.....	7 024.1	221 785.7	52.01	4 986.0	Fish Lake Valley.
T 68.....	3 355.5	225 141.2	52.80	4 994.0	Do.
T 69.....	2 973.0	228 114.2	53.50	5 038.0	Do.
T 70.....	1 318.0	229 432.2	53.80	5 056.0	Do.
T 71.....	1 343.5	230 775.7	54.12	.....	Do.
T 72.....	4 539.7	235 315.4	55.18	.....	Do.
T 73.....	5 409.2	240 724.6	56.45	.....	Do.
T 74.....	2 796.8	243 521.4	57.11	5 053.0	Do.

A. DISTANCE AND ALTITUDES ON THE RANDOM LINE—Continued.

Stations.	Distance between stations.	Total distance from T 1.	Offset to corrected line.	Altitude.	Remarks.
	<i>Meters.</i>	<i>Meters.</i>	<i>Meters.</i>	<i>Feet.</i>	
T 75	4 145.1	247 666.5	58.08	.....	Fish Lake Valley.
T 76	1 180.6	248 847.1	58.36	.....	Fish Lake Valley, southeast of road.
T 77	1 968.7	250 815.8	58.82	.....	Fish Lake Valley.
T 78	5 409.4	256 225.2	60.09	6 774.0	Foothills of Sylvania Mountains, west slope.
T 79	5 165.2	261 390.4	61.29	7 927.0	Summit of Sylvania Mountains.
T 80	7 844.1	269 234.5	63.14	6 894.0	Sylvania Mountains.
T 81	10 996.6	280 231.1	65.72	4 270.0	Wash from Tule Cañon.
T 82	4 499.0	284 730.1	66.77	3 763.0	Head of Death Valley.
T 83	7 101.6	291 831.7	68.44	4 255.0	Do.
T 84	3 446.5	295 278.2	69.25	4 766.0	Head of Death Valley, rolling hills.
T 85	2 975.4	298 253.6	69.94	5 197.0	Do.
T 86	6 840.5	305 094.1	71.55	5 635.0	Round bare hill.
T 87	1 822.9	306 917.0	71.98	5 444.0	Lava ridge.
T 88	8 810.3	315 727.3	74.04	4 260.0	Lava ridge, very stony.
T 89	9 082.4	324 809.7	76.17	7 688.0	North face of precipice, Grape Vine Mountains.
T 90	6 511.1	331 320.8	77.70	7 800.0	Grape Vine Mountains.
T 91	7 801.7	339 122.5	79.53	7 587.0	Do.
T 92	5 463.6	344 586.1	81.00	7 034.0	Bare summit Grape Vine Mountains.
T 93	15 314.2	359 900.3	84.40	4 974.0	Rocky summit, Funeral Mountains.
T 94	9 149.5	369 049.8	86.55	3 903.5	Little Amargosa Desert.
T 95	3 045.3	372 095.1	87.26	3 899.0	Do.
T 96	5 748.7	377 843.8	88.61	3 614.0	Little Amargosa Desert, bare hill east slope.
T 97	9 928.9	387 772.7	90.94	.....	Little Amargosa Desert, big wash.
T 98	4 698.5	392 471.2	92.04	2 927.0	Northeast end of Funeral Mountains.
T 99	9 102.5	401 573.7	94.17	2 549.0	Great Amargosa Desert.
T 100	7 589.2	409 162.9	95.95	2 358.0	Do.
T 101	7 162.6	416 325.5	97.63	2 271.0	Do.
T 102	6 822.3	423 147.8	99.23	2 176.0	Do.
T 103	6 157.0	429 304.8	100.68	2 118.9	Do.
T 104	4 277.9	433 582.7	101.68	.....	Do.
T 105	8 226.4	441 809.1	103.61	3 859.7	Northeast end of Chung Up Mountains.
T 106	4 859.2	446 668.3	104.40	3 357.5	Northeast end of Chung Up Mountains, precipice.
T 107	6 728.5	453 396.8	105.59	2 423.1	Stewart Valley.
T 108	4 925.5	458 322.3	106.50	2 484.4	Do.
T 109	8 036.0	466 358.3	108.35	2 494.4	Pahrump Valley.
T 110	5 695.0	472 053.3	110.37	2 515.7	Do.
T 111	6 315.3	478 368.6	111.09	2 526.9	Do.
T 112	5 483.3	483 851.9	113.58	2 585.9	Do.
T 113	1 552.8	485 404.7	111.22	2 609.6	Do.
T 114	3 486.4	488 891.1	113.57	2 646.6	Do.
T 115	3 179.7	492 070.8	112.40	2 689.4	Do.
T 116	5 307.2	497 378.0	116.64	3 089.0	On ridge between Mesquite and Pahrump valleys.
T 117	7 417.8	504 795.8	118.38	2 921.1	On round hill, Mesquite Valley.
T 118	7 624.5	512 420.3	120.17	2 630.9	Mesquite Valley.
T 119	4 285.9	516 706.2	121.17	2 590.5	Do.
T 120	3 526.0	520 232.2	122.07	2 555.6	Mesquite Valley, southwest of Sandy Post-Office.
T 121	5 351.5	525 583.7	123.26	2 583.9	Mesquite Valley, on Sand Hill.
T 122	6 328.3	531 912.0	124.74	2 651.1	Mesquite Valley, east side.
T 123	7 759.4	539 671.4	126.56	4 342.3	Summit of State Line Mountains.
T 124	906.2	540 577.6	126.77	4 270.1	Do.
T 125	8 356.0	548 933.6	128.73	2 588.1	Dry Lake, Ivanpah Valley, northeast end.
T 126	5 798.5	554 732.1	130.09	2 920.8	East side Ivanpah Valley.

A. DISTANCE AND ALTITUDES ON THE RANDOM LINE—Continued.

Stations.	Distance between stations.	Total distance from T 1.	Offset to corrected line.	Altitude.	Remarks.
	<i>Meters.</i>	<i>Meters.</i>	<i>Meters.</i>	<i>Feet.</i>	
T 127.....	7 182.8	561 914.9	131.77	3 387.0	East side Ivanpah Valley.
T 128.....	10 325.2	572 240.1	134.19	4 074.8	Do.
T 129.....	2 769.1	575 009.2	134.84	4 483.3	Do.
T 130.....	6 338.8	581 348.0	136.34	5 181.9	New York Mountains.
T 131.....	237.0	581 585.0	136.40	5 193.9	Do.
T 132.....	8 146.6	589 731.6	138.31	4 983.0	Castle Mountains, flat top.
T 133.....	6 470.8	596 202.4	139.82	4 095.7	Lewis Range, east slope.
T 134.....	14 403.0	610 605.4	143.19	2 303.0	Piute Wash, Piute Valley.
T 135.....	9 361.9	619 967.3	145.39	2 630.7	East side Piute Valley.
T 136.....	3 938.8	623 906.1	146.31	2 648.7	Do.
T 137.....	2 640.7	626 546.8	146.93	2 671.3	Do.
T 138.....	798.0	627 344.8	147.12	2 649.9	Divide between Piute Valley and Colorado River.
T 139.....	2 022.6	629 367.4	147.59	.....	Southeast slope to the Colorado River.
T 140.....	1 635.8	631 003.2	147.97	2 168.1	Do.
T 141.....	8 421.2	639 424.4	149.93	820.7	Do.
T 142.....	2 334.2	641 758.6	150.48	517.4	West bank of Colorado River, 100 meters from trees.
Center of river, 35° latitude.	3 646.1	645 404.7	.....	.....	Middle of Colorado River and 35° latitude.

NOTE.—Points on the random line are designated by T 1, T 2, T 3, etc.; points on the corrected line are designated by No. 1, No. 2, No. 3, etc.

B. DISTANCES ON THE CORRECTED LINE.

No.	Distance between monuments.		Total distance from 120° longitude and 39° latitude.		Remarks.
	<i>Meters.</i>	<i>Miles.</i>	<i>Meters.</i>	<i>Miles.</i>	
0.....	0.0	0.0	0.0	0.0	At intersection of 120° longitude and 39° latitude.
1.....	5 811.0	3.61	5 811.0	3.61	On lake shore, same as "Initial, 1894."
2.....	838.6	0.52	6 649.6	4.13	On road, same as T 2 on random line.
3.....	3 107.8	1.93	9 757.4	6.06	West side of the mountain top.
4.....	263.4	0.16	10 020.8	6.22	Do.
5.....	988.6	0.61	11 009.4	6.83	Do.
6.....	652.0	0.40	11 661.4	7.23	Summit of the Sierras.
7.....	604.1	0.38	12 265.5	7.62	East of summit.
8.....	7 438.1	4.62	19 703.6	12.24	Carson Valley, west side.
9.....	1 777.2	1.10	21 480.8	13.35	Do.
10.....	1 448.9	0.90	22 929.7	14.25	Do.
11.....	1 395.9	0.87	24 325.6	15.12	Carson Valley, forks of roads.
12.....	2 273.2	1.41	26 598.8	16.53	Carson Valley, in the road.
13.....	568.2	0.35	27 167.0	16.88	Carson Valley, Carson River, west bank.
14.....	1 040.0	0.65	28 207.0	17.53	Carson Valley.
15.....	2 639.5	1.64	30 846.5	19.17	Carson Valley, rolling hills.
16.....	727.7	0.45	31 574.2	19.62	Middle fork of Carson River.
17.....	1 700.4	1.06	33 274.6	20.68	Wooded hill.
18.....	1 940.1	1.21	35 214.7	21.88	East fork of Carson River, Kelly's ranch.
19.....	1 256.3	0.78	36 471.0	22.66	Wooded Mountain, southeast side of Kelly's ranch.
20.....	1 141.2	0.71	37 612.2	23.37	West slope of cliff.
21.....	2 853.1	1.77	40 465.3	25.14	West slope, halfway to top.

B. DISTANCES ON THE CORRECTED LINE—Continued.

No.	Distance between monuments.		Total distance from 120° longitude and 39° latitude.		Remarks.
	Meters.	Miles.	Meters.	Miles.	
22.....	4 597'3	2'86	45 062'6	28'00	Highest ridge, west slope.
23.....	4 179'1	2'60	49 241'7	30'60	Southeast slope.
24.....	3 040'0	1'89	52 281'7	32'49	Carson and Coleville road, north side.
25.....	2 336'9	1'45	54 618'6	33'94	Southeast of Alkali Lake, high hill.
26.....		Omitted.			
27.....	3 696'0	2'30	58 314'6	36'24	Antelope Valley, West Walker River, northwest side.
28.....	3 777'3	2'35	62 091'9	38'58	Antelope Valley.
28½.....	494'5	0'31	62 586'4	38'89	Do.
29.....	7 496'8	4'66	70 083'2	43'54	
30.....	3 745'5	2'33	73 828'7	45'88	Bare Ridge.
31.....	2 000'4	1'24	75 829'1	47'12	Do.
32.....	6 207'0	3'86	82 036'1	50'98	Summit of the Sweetwater Mountains.
33.....	8 464'3	5'26	90 500'4	56'23	Sweetwater Valley.
34.....	5 306'7	3'30	95 807'1	59'53	Do.
35.....	599'6	0'37	96 406'7	59'90	Do.
36.....	5 593'3	3'48	102 000'0	63'38	On red hill.
37.....	4 160'5	2'59	106 160'5	65'97	Do.
38.....	2 593'0	1'61	108 753'5	67'58	On rocky knob.
39.....	4 935'1	3'07	113 688'6	70'65	On table-land.
40.....	5 659'3	3'52	119 347'9	74'17	Beauty Peak.
41.....	2 095'8	1'30	121 443'7	75'47	North of Aurora and Bodie road.
42.....	3 795'4	2'36	125 239'1	77'83	Summit of the West Brawley Mountains.
43.....	2 670'1	1'66	127 909'2	79'49	North of Aurora and Bodie (old) road.
44.....	2 877'1	1'79	130 786'3	81'28	Isolated Mountain, east slope.
45.....	4 429'5	2'75	135 215'8	84'03	Wooded Mountain, double top, south-east one.
46.....	7 367'4	4'58	142 583'2	88'61	Aurora and Benton road, Aurora Desert.
47.....	3 712'5	2'31	146 295'7	90'92	Wooded hill.
48.....	4 363'9	2'71	150 659'6	93'63	Table-land.
49.....	1 051'6	0'65	151 711'2	94'28	Lava ridge, east side of small knob.
50.....		Omitted.			
51.....	10 934'1	6'79	162 645'3	101'07	East slope wooded hill, Excelsior Mountains.
52.....	812'1	0'50	163 457'4	101'57	Do.
53.....	3 576'0	2'22	167 033'4	103'79	West slope wooded hill, Excelsior Mountains.
54.....	6 097'2	3'79	173 130'6	107'58	East slope bare hill, Excelsior Mountains.
55.....	757'7	0'47	173 888'3	108'05	Excelsior Mountains.
56.....	1 057'0	0'66	174 945'3	108'71	Do.
57.....	523'1	0'33	175 468'4	109'04	Do.
58.....	2 167'4	1'35	177 635'8	110'39	Do.
59.....	4 908'3	3'05	182 544'1	113'43	Carson and Colorado Railroad, north-west side.
59½.....	3 072'5	1'91	185 616'7	115'34	Northwest foot of White Mountains.
60.....	7 082'4	4'40	192 699'1	119'74	Summit of the White Mountains.
61.....		Omitted.			
62.....	10 433'7	6'48	203 132'8	126'22	White Mountains.
63.....	3 702'9	2'30	206 835'7	128'52	Do.
64.....	1 501'4	0'93	208 337'1	129'45	Do.
65.....	2 228'1	1'38	210 565'2	130'84	Do.
66.....	3 896'6	2'42	214 461'8	133'26	Do.
67.....	6 558'0	4'08	221 019'8	137'34	Do.
67½.....	7 037'6	4'37	228 057'4	141'71	Fish Lake Valley.
68.....	3 357'9	2'09	231 415'3	143'79	Do.
69.....	2 970'6	1'85	234 385'9	145'64	Do.
70.....	1 330'3	0'83	235 716'2	146'47	Do.
71.....	1 331'2	0'83	237 047'4	147'30	Do.

B. DISTANCES ON THE CORRECTED LINE—Continued.

No.	Distance between monuments.		Total distance from 120° longitude and 39° latitude.		Remarks.
	Meters.	Miles.	Meters.	Miles.	
72.....	4 539.7	2.82	241 587.1	150.12	Fish Lake Valley.
73.....	5 409.2	3.36	246 996.3	153.48	Do.
74.....	2 796.8	1.74	249 793.1	155.22	Do.
75.....	4 145.1	2.58	253 938.2	157.80	Do.
76.....	1 180.6	0.73	255 118.8	158.53	Do.
77.....	1 968.7	1.22	257 087.5	159.75	Do.
78.....	5 409.4	3.36	262 496.9	163.11	Sylvania Mountains, west slope.
79.....	5 188.4	3.22	267 685.3	166.33	Summit of the Sylvania Mountains.
80.....	7 899.4	4.91	275 584.7	171.24	Sylvania Mountains.
81.....	10 899.1	6.79	286 483.8	178.03	
82.....	4 518.0	2.81	291 001.8	180.84	Head of Death Valley.
83.....	7 145.6	4.44	298 147.4	185.28	Do.
84.....	3 414.1	2.12	301 561.5	187.40	Do.
85.....	2 981.9	1.85	304 543.4	189.24	Do.
86.....	6 838.6	4.25	311 382.0	193.49	Round bare hill.
87.....	1 777.5	1.10	313 159.5	194.59	
88.....	8 839.5	5.49	321 999.0	200.08	
89.....	9 082.5	5.64	331 081.5	205.72	North face of precipice, Grape Vine Mountains.
90.....		Omitted.			
91.....	14 220.1	8.84	345 301.6	214.56	Grape Vine Mountains.
92.....	5 584.7	3.47	350 886.3	218.03	Bare summit Grape Vine Mountains.
93.....	15 302.8	9.51	366 189.1	227.54	Rocky summit Funeral Mountains.
94.....	9 137.4	5.68	375 327.0	233.22	Little Amargosa Desert.
95.....	3 059.7	1.90	378 386.7	235.12	Do.
96.....	5 748.2	3.57	384 134.9	238.69	Little Amargosa Desert, bare hill, east slope.
97.....	9 915.5	6.16	394 050.4	244.85	Little Amargosa Desert, west slope.
98.....	4 028.6	2.50	398 079.0	247.35	Funeral Mountains, east slope.
98½.....	1 447.4	0.90	399 526.4	248.25	Do.
99.....	8 319.0	5.17	407 845.4	253.42	Great Amargosa Desert.
100.....	7 589.2	4.72	415 434.6	258.14	Do.
101.....	7 162.6	4.45	422 597.2	262.59	Do.
102.....	6 822.3	4.24	429 419.5	266.83	Do.
103.....	6 157.0	3.83	435 576.5	270.66	Do.
104.....	4 227.5	2.63	439 804.0	273.29	Do.
105.....	8 279.0	5.14	448 083.0	278.43	Northeast end of Chung Up Mountains.
106.....	4 904.0	3.05	452 987.0	281.48	Chung Up Mountains, precipice.
107.....	6 681.5	4.15	459 668.5	285.63	Stewart Valley.
108.....	4 751.4	2.95	464 419.9	288.58	Do.
109.....	8 210.1	5.10	472 630.0	293.68	Pahrump Valley.
110.....	5 695.0	3.54	478 325.0	297.22	Do.
111.....	6 315.3	3.92	484 640.3	301.14	Do.
112.....	5 483.3	3.41	490 123.6	304.55	Do.
113.....	1 552.8	0.96	491 676.4	305.51	Do.
114.....	3 486.4	2.17	495 162.8	307.68	Do.
115.....	3 179.7	1.98	498 342.5	309.66	Do.
116.....	5 370.0	3.34	503 712.5	313.00	Dividing ridge, southeast end Pahrump Valley.
117.....	6 164.5	3.83	509 877.0	316.83	West slope Rocky ridge.
118.....	8 815.0	5.48	518 692.0	322.31	Mesquite Valley.
119.....	4 285.9	2.66	522 977.9	324.97	Do.
120.....	3 532.0	2.19	526 509.9	327.16	Mesquite Valley, southwest of Sandy post-office.
121.....	5 185.2	3.22	531 695.1	330.38	Mesquite Valley, on sand hill.
122.....	6 488.6	4.03	538 183.7	334.41	Mesquite Valley, east side.
123.....	7 739.4	4.81	545 923.1	339.22	Summit of State Line Mountains, east of bluffs.
124.....		Omitted.			

B. DISTANCES ON THE CORRECTED LINE—Continued.

No.	Distance between monuments.		Total distance from 120° longitude and 39° latitude.		Remarks.
	Meters.	Miles.	Meters.	Miles.	
125.....	9 282'2	5'77	555 205'3	344'99	Ivanpah Valley, dry lake, northeast end.
126.....	5 798'5	3'60	561 003'8	348'59	Ivanpah Valley, east slope.
127.....	6 964'0	4'33	567 967'8	352'92	Rocky bluff, east side of Ivanpah Valley.
128.....	10 781'0	6'70	578 748'8	359'62	Mountains, east side of Ivanpah Valley.
129.....	2 638'2	1'64	581 387'0	361'26	Do.
130.....	6 104'0	3'79	587 491'0	365'05	New York Mountains.
131.....		Omitted.			
132.....	8 310'0	5'16	595 801'0	370'21	Castle Mountains, flat top.
133.....	6 704'2	4'17	602 505'2	374'38	Lewis Mountains, east slope,
134.....	14 371'9	8'93	616 877'1	383'31	Piute Valley.
135.....	9 487'6	5'90	626 364'7	389'21	Piute Valley, southwest butte, near top.
136.....		Omitted.			
137.....	6 519'0	4'05	632 883'7	393'25	Piute Valley.
138.....	412'2	0'26	633 295'9	393'51	Divide between Piute Valley and Colorado River.
138½.....	1 323'0	0'82	634 618'9	394'33	East slope.
139.....	1 132'4	0'70	635 751'3	395'03	Rough ridge, on slope.
140.....		Omitted.			
141.....	10 018'0	6'23	645 769'3	401'26	Mesa.
142.....	2 261'0	1'40	648 030'3	402'67	West bank of Colorado River, 100 meters from trees.
Center of River, 35° lat.	3 646'1	2'27	651 676'4	404'94	Middle of Colorado River at 35° latitude.

NOTE.—Points on the random line are designated by T 1, T 2, T 3, etc. Points on the corrected line are designated by No. 1, No. 2, No. 3, etc.

C.** GEOGRAPHIC POSITIONS OF POINTS ON RANDOM AND CORRECTED LINES, 1893-1899.

Stations.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To stations.	Distance.
	° ' "	° ' "	° ' "	° ' "		Meters.
Initial 94.....	38 57 45'99	119 56 59'31	178 26 41'9	358 26 40'2	Folsom Peak.....	2 370'9
No. 1.....	45'99	59'31	303 30 40'5	123 32 15'7	East Peak.....	4 374'8
T 1 Azimuth Sta ..	38 57 36'13	119 56 44'93	311 16 45'3	131 16 54'3	No. 2.....	838'6
T 2.....	38 57 28'05	119 56 33'13	131 16 54'3	311 16 45'3	Initial 94.....	460'7
No. 2.....	28'05	33'13	171 16 23'0	351 16 12'3	Folsom Peak.....	2 705'3
T 3.....	38 56 21'54	119 54 56'17	131 17 14	311 17 07	T 1 Azimuth Sta.....	377'9
No. 3.....	21'57	56'16	220 24 31	40 25 46	Castle Rock.....	4 455'0
T 4.....	38 56 15'90	119 54 47'93	311 16 47'7	131 18 05'1	No. 3.....	3 107'8
No. 4.....	15'92	47'93	131 18 05'1	311 16 47'7	Initial 94.....	3 946'4
T 5.....	38 55 54'74	119 54 17'12	254 35 09'1	74 35 26'9	East Peak.....	707'4
No. 5.....	(*)	(*)	311 18 12'1	131 18 17'3	No. 4.....	263'4
			131 18 17'3	311 18 12'1	T 3.....	263'4
			233 13 03'3	53 13 15'9	East Peak.....	604'4
			311 17 59	131 18 43	No. 7.....	2 244'7
			131 19 00'6	311 18 41'2	T 4.....	988'6
			165 42 43'6	345 42 36'9	East Peak.....	1 046'9
			(*)	(*)	(*)	(*)

* Not corrected—deep snow.

** See note, end of table.

APPENDIX NO. 3. BOUNDARY LINE BETWEEN CALIFORNIA AND NEVADA. 337

C.** GEOGRAPHIC POSITIONS OF POINTS ON RANDOM AND CORRECTED LINES, 1893-1899—Continued.

Stations.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To stations.	Distance.
	° ' "	° ' "	° ' "	° ' "		Meters.
T 6	38 55 40.78	119 53 56.79	131 19 15.4 152 38 00.4	311 19 02.6 332 37 40.9	T 5	652.0
No. 6	(*)	(*)	(*)	(*)	East Peak.....	1 627.1
T 7	38 55 27.84	119 53 37.96	176 28 17.4 210 25 22.4	336 28 13.9 30 26 04.5	Bowlder.....	2 163.1
No. 7	27.87	37.92	311 18 52	131 21 18	Ledge.....	3 183.2
T 8	38 52 48.49	119 49 46.23	131 22 05 152 36 44	311 19 39 332 35 00	No. 8	7 438.1
No. 8	48.57	46.15	311 20 55	131 21 30	T 7	7 438.1
T 9	38 52 10.40	119 48 50.90	131 22 40 149 02 18	311 19 40 328 59 59	Ledge.....	8 626.6
No. 9	10.49	50.80	311 22 28	131 22 56	No. 9	1 777.2
T 10	38 51 39.33	119 48 05.81	131 23 08 146 53 31	311 19 39 326 50 44	T 7	9 215.3
No. 10	39.44	05.70	311 21 56	131 22 23	Ledge.....	10 303.1
T 11	38 51 09.41	119 47 22.37	131 23 35.2 145 15 35.2	311 19 39.4 325 12 21.4	No. 11	1 448.9
No. 11	09.51	22.26	311 22 50	131 23 34	T 7	10 664.2
T 12	38 50 20.58	119 46 11.56	131 24 20 143 13 25	311 19 40 323 09 27	Ledge.....	11 692.0
No. 12	20.77	11.53	311 24 44	131 24 55	No. 12	1 395.9
T 13	38 50 08.46	119 45 54.00	131 24 32 142 48 28	311 19 41 322 44 18	T 7	12 060.1
No. 13	08.58	53.87	311 23 32	131 23 52	Ledge.....	13 042.5
T 14	38 49 46.16	119 45 21.67	131 24 51 142 06 49	311 19 40 322 02 20	No. 13	2 273.2
No. 14	46.28	21.53	311 25 05	131 25 56	T 7	14 336.7
T 15	38 48 49.52	119 43 59.66	131 25 51 140 41 07	311 19 48 320 35 46	Ledge.....	15 262.7
No. 15	49.66	59.50	311 23 51	131 24 05	No. 14	588.2
T 15½	38 48 48.71	119 43 58.47	221 44 20 311 26 06	41 44 21 131 25 19	T 7	14 901.5
No. 15½	(†)	(†)	(†)	(†)	Ledge.....	15 815.8
T 16	38 48 33.91	119 43 37.04	131 25 49 311 25 35	311 25 34 131 26 08	No. 15	1 040.0
No. 16	34.05	36.88	311 26 15	131 26 53	T 7	15 941.5
T 17	38 47 57.39	119 42 44.19	131 26 48.6 197 33 44.6	311 23 54.2 17 34 21.3	Ledge.....	16 836.4
No. 17	57.55	44.02	311 26 57	131 27 21	No. 15	2 639.5
T 18	38 47 15.74	119 41 43.94	311 27 49.9 347 27 41.9	131 28 14.3 167 28 01.1	T 7	18 581.0
No. 18	15.90	43.76	311 26 57	131 27 21	Ledge.....	19 436.1
T 19	38 46 48.76	119 41 04.94	4 34 06.8 84 16 08.8	184 34 01.6 264 14 01.0	No. 16	727.7
No. 19	48.93	04.75	311 26 46	131 27 08	Northeast base	60.69
T 20	38 46 24.26	119 40 29.51	31 07 49 131 28 15	211 07 22 311 27 53	T 16	689.7
No. 20	24.44	29.31	311 27 20	131 28 15	T 15	727.7
					No. 17	1 700.4
					T 11	8 949.0
					Rock Cliff	4 675.1
					No. 18	1 940.1
					T 19	1 256.3
					Bald	3 416.5
					No. 19	1 256.3
					Bald	2 511.1
					Barber	4 950.6
					No. 20	1 141.2
					Bald	2 041.4
					T 19	1 141.2
					No. 21	2 853.1

* Not corrected—deep snow.

** See note, end of table.

† Omitted.

C.** GEOGRAPHIC POSITIONS OF POINTS ON RANDOM AND CORRECTED
LINES, 1893-1899—Continued.

Stations.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To stations.	Distance.
	° ' "	° ' "	° ' "	° ' "		Meters.
T 21	38 45 22.98	119 39 00.97	11 03 46	191 03 40	Ridge	1 291.7
No. 21	23.17	00.75	131 29 11	311 27 53	T 19	3 994.3
T 22	38 43 44.19	119 36 38.40	311 28 43	131 30 04	No. 22	4 597.3
No. 22	44.41	38.15	30 17 40.1	210 17 00.3	High Peak	3 048.3
T 23	38 42 14.38	119 34 28.85	115 44 15.1	295 42 39.5	Ridge	4 097.4
No. 23	14.62	28.58	311 28 43	131 30 04	No. 23	4 179.1
T 24	38 41 08.99	119 32 54.70	131 30 53.4	311 29 32.4	T 22	4 179.1
No. 24	09.25	54.41	139 36 43.4	319 36 12.8	Knoll	1 826.0
T 25	38 40 18.71	119 31 42.37	311 31 27	131 32 26	No. 24	3 040.0
No. 25	18.98	42.06	131 33 13	311 32 14	T 23	3 040.0
T 27	38 38 58.33	119 29 46.78	200 08 51	20 09 13	Lake	2 469.2
No. 27	59.46	47.66	311 32 48	131 33 33	No. 25	2 336.9
T 28	38 37 37.85	119 27 51.21	131 34 04	311 32 20	T 23	5 376.9
No. 28	38.16	50.85	166 56 23	346 56 00	Lake	3 971.3
No. 28½	38 37 27.66	119 27 35.70	311 32 45	131 33 56	No. 27	3 696.0
T 29	38 34 45.64	119 23 44.12	121 26 23	301 22 59	Dome	9 263.4
No. 29	46.11	43.88	149 49 43	329 48 07	Lake	7 342.6
T 30	38 33 25.17	119 21 48.87	311 34 32	131 35 45	No. 28	3 777.3
No. 30	25.41	48.25	131 36 22	311 32 13	T 23	12 850.2
T 31	38 32 41.83	119 20 46.84	143 43 07	323 40 19	Lake	10 955.2
No. 31	42.30	46.52	311 27 37	131 27 46	No. 28½	494.5
T 32	38 30 28.21	119 17 35.83	311 35 06	131 37 31	No. 29	7 496.8
No. 32	28.47	35.11	311 38 08	131 39 59	T 31	5 744.3
T 33	38 27 25.66	119 13 15.40	331 54 51	151 55 32	Mahogany	3 328.7
No. 33	25.82	14.42	311 37 37	131 38 49	No. 30	3 745.5
T 34	38 25 31.01	119 10 32.16	251 06 27	71 08 20	Don	4 647.2
No. 34	31.22	31.17	311 39 20	131 39 59	T 31	2 010.5
T 35	38 25 17.57	119 10 13.04	311 38 35	131 39 13	No. 31	2 000.4
No. 35	18.26	12.73	130 30 31.8	310 28 41.9	Flat	5 613.5
T 36	38 23 17.11	119 07 21.79	166 45 26.8	346 44 43.5	Pine nut	7 330.8
No. 36	17.40	20.83	311 39 15	113 41 14	No. 32	6 207.0
T 37	38 21 16.95	119 05 13.77	131 42 02.9	311 40 03.9	T 31	6 195.4
No. 37	47.47	13.07	156 03 03.9	346 02 19.4	Don	7 171.7
			311 41 18	131 44 00	No. 33	8 464.3
			131 44 51	311 42 09	T 32	8 457.7
			237 45 18	57 47 35	Sweetwater Ecc.	6 326.2
			311 44 11	131 45 53	No. 34	5 306.7
			191 24 28	11 25 03	Sweetwater Rec.	7 047.9
			311 46 34	131 46 46	T 35	621.9
			311 46 00	131 46 11	No. 35	599.6
			131 46 44.5	311 42 09.1	T 32	14 387.0
			187 14 32.5	7 14 56.4	Sweetwater Ecc.	7 381.9
			311 45 54	131 47 41	No. 36	5 593.3
			131 48 36	311 46 50	T 35	5 573.3
			226 56 33	46 56 35	Red	86.2
			311 47 31	131 48 50	No. 37	4 160.5
			133 00 25.5	312 59 07.6	Red	4 162.7
			191 55 29.5	11 55 54.3	West Walker	4 687.5
			311 48 19	131 49 08	No. 38	2 593.0

**See note, end of table.

C.** GEOGRAPHIC POSITIONS OF POINTS ON RANDOM AND CORRECTED LINES, 1893-1899—Continued.

Stations.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To stations.	Distance.
	° ' "	° ' "	° ' "	° ' "		Meters.
T 38	38 20 50'97	119 03 54'33	131 49 54	311 49 05	T 37	2 588'4
No. 38	51'40	53'47	211 29 35	31 30 17	Long	3 084'7
T 39	38 19 04'01	119 01 22'81	311 50 21	131 51 55	No. 39	4 935'1
No. 39	04'61	22'12	131 52 43	311 51 09	T 38	4 941'7
T 40	38 17 01'11	118 58 28'82	160 46 48	340 45 55	Long	6 278'3
No. 40	02'13	28'65	311 50 37	131 52 25	No. 40	5 659'3
T 41	38 16 14'16	118 57 22'44	157 39 01	337 38 59	Beauty Peak	183'4
No. 41	16'73	24'45	274 49 44	94 53 58	Aurora Peak	9 988'9
T 42	38 14 53'68	118 55 28'76	311 53 20	131 54 00	No. 41	2 095'8
No. 42	54'53	28'27	265 51 05	85 54 37	Aurora Peak	8 361'7
T 43	38 13 55'96	118 54 07'39	307 05 03	127 06 20	West Brawley	3 797'8
No. 43	56'64	06'61	311 53 42	131 54 54	No. 42	3 795'4
T 44	38 12 53'00	118 52 39'39	132 41 01	312 39 08	Beauty Peak	6 047'9
No. 44	54'30	38'59	145 27 53	325 26 10	Bald Peak	7 171'0
T 45	38 11 17'10	118 50 23'42	311 56 44	131 57 35	No. 43	2 670'1
No. 45	18'26	23'22	311 55 25	131 56 20	T 44	2 877'1
T 46	38 08 37'63	118 46 39'16	77 26 20	257 25 58	Lake View	883'7
No. 46	38'39	38'28	311 54 39	131 55 33	No. 44	2 877'1
T 47	38 07 17'68	118 44 46'89	135 18 27	315 16 49	West Brawley	5 478'2
No. 47	17'80	45'04	192 08 32	12 09 09	Aurora Peak	6 940'1
T 48	38 05 42'01	118 42 32'66	311 56 36	131 58 00	No. 45	4 429'5
No. 48	43'00	32'02	133 49 43'0	313 46 40'8	West Brawley	9 923'3
T 49	38 05 19'32	118 42 00'90	169 17 41'9	349 16 54'9	Aurora Peak	9 933'1
No. 49	20'15	41 59'98	311 58 25	132 00 44	No. 46	7 367'4
T 50	38 02 53'03	118 38 35'97	132 01 36	311 59 17	T 45	7 347'0
No. 50	(*)	(*)	272 01 30	92 04 04	Sag	6 068'3
T 51	38 01 21'63	118 36 28'11	312 00 36	132 01 46	No. 47	3 712'5
No. 51	22'50	27'10	135 58 23	55 59 48	Sag	4 018'8
T 52	38 01 03'96	118 36 03'41	312 02 41	132 04 23	T 49	5 447'2
No. 52	04'84	02'40	312 02 08	132 03 30	No. 48	4 363'9
T 53	37 59 46'03	118 34 14'52	132 04 08	311 59 17	T 45	15 432'0
No. 53	47'05	13'66	146 32 12	326 26 34	Aurora Peak	24 096'9
			312 03 28	132 03 48	No. 49	1 051'6
			132 04 27'3	311 59 17'0	T 45	16 475'7
			173 07 08'1	353 06 50'1	Sag	5 940'4
			312 02 57	132 06 22	No. 51	10 934'1
			132 05 52	312 03 45	T 49	6 730'2
			281 12 11	101 15 54	Top	9 017'7
			(*)	(*)	(*)	(*)
			132 07 10	312 03 45	T 49	10 933'5
			259 29 11	79 31 36	Top	5 825'9
			312 06 17	132 06 32	No. 52	812'1
			132 07 26	312 03 45	T 49	11 745'6
			252 35 06	72 37 16	Top	5 371'7
			312 06 43	132 07 50	No. 53	3 576'0
			301 52 14	121 55 07	Roach	8 072'6
			312 08 45	132 10 39	T 54	6 102'7
			312 07 55	132 09 49	No. 54	6 097'2

* Not corrected.

** See note, end of table.

C.** GEOGRAPHIC POSITIONS OF POINTS ON RANDOM AND CORRECTED LINES, 1893-1899—Continued.

Stations.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To stations.	Distance.
	° ' "	° ' "	° ' "	° ' "		Meters.
T 54	37 57 33.16	118 31 09.15	234 44 16	54 46 03	Cap.	5 180.5
No. 54	34.33	08.42	274 08 16	94 09 15	Roach	2 336.8
T 55	37 57 16.90	118 30 46.50	312 10 30	132 10 44	No. 55	757.7
No. 55	17.83	45.42	132 10 49	312 10 35	T 54	746.3
T 56	37 56 53.88	118 30 14.42	259 24 38	79 25 23	Roach	1 808.5
No. 56	54.82	13.33	312 09 59	132 10 19	No. 56	1 057.0
T 57	37 56 44.02	118 30 00.68	312 11 09	312 10 35	T 54	1 803.3
No. 57	43.45	29 57.45	223 39 58	43 40 23	Roach	1 440.4
T 58	37 55 52.49	118 28 48.91	312 06 57	132 07 07	No. 57	523.1
No. 58	36.19	51.68	206 05 29	26 05 46	Roach	1 498.7
T 59	37 54 08.03	118 26 23.56	312 11 22	132 12 06	T 58	2 365.4
No. 59	09.29	22.81	312 12 39	132 13 19	No. 58	2 167.4
T 59½	37 53 01.33	118 24 50.84	159 34 32.2	339 34 04.7	Roach	3 131.6
No. 59½	02.33	49.68	260 00 00.6	80 01 24.0	Lava	3 364.3
T 60	37 50 26.58	118 21 16.02	312 11 20	132 12 51	No. 59	4 908.3
No. 60	27.88	15.19	132 13 32.6	312 12 03.3	T 58	4 793.6
T 61	37 48 36.62	118 18 43.55	176 26 47.1	356 26 41.2	Lava	3 811.7
No. 61	(*)	(*)	312 12 23	132 13 20	No. 59½	3 072.5
T 62	37 46 38.95	118 16 00.57	132 14 26	312 13 29	T 59	3 059.6
No. 62	40.24	15 59.57	151 34 52	331 34 13	N. base	3 259.3
T 63	37 45 18.26	118 14 09.01	312 13 36	132 15 48	No. 60	7 082.4
No. 63	19.37	07.71	132 16 34.4	312 11 56.3	T 58	14 948.1
T 64	37 44 45.07	118 13 23.14	143 55 56.3	323 52 41.5	Lava	13 157.4
No. 64	46.58	22.38	312 14 46	132 17 59	No. 62	10 433.7
T 65	37 43 57.12	118 12 16.90	132 17 23	312 15 50	T 60	5 039.3
No. 65	57.92	15.10	297 07 06	117 09 50	Indian	7 337.9
T 66	37 42 31.54	118 10 18.78	(*)	(*)	(*)	(*)
No. 66	32.57	17.53	132 18 47	312 15 34	T 60	10 430.2
T 67	37 40 07.59	118 07 00.80	263 42 09	83 43 13	Indian	2 558.7
No. 67	09.37	06 59.82	312 18 44	132 19 53	No. 63	3 702.9
T 67½	37 37 34.18	118 03 29.31	132 20 06	312 15 44	T 60	14 124.1
No. 67½	35.41	27.87	163 41 26	343 40 30	Black	7 995.0
			312 20 01	132 20 29	No. 64	1 501.4
			132 20 37.6	312 15 47.8	T 60	15 643.6
			158 50 12.7	338 48 48.3	Black	9 326.0
			312 19 11	132 19 52	No. 65	2 228.1
			248 52 52	68 56 50	Sand	10 207.2
			312 21 26	132 22 38	T 66	3 915.5
			312 24 43	132 25 55	No. 66	3 896.6
			135 27 44.8	315 25 56.5	T 64 High	6 178.2
			226 24 10.6	46 26 56.4	Sand	9 155.4
			312 20 14	132 22 15	No. 67	6 558.0
			132 24 45.8	312 22 44.8	T 66	6 568.2
			189 26 07.9	9 26 52.5	Sand	10 886.8
			312 23 43	132 25 52	No. 67½	7 037.6
			132 26 41	312 24 32	T 67	7 024.1
			216 50 31	36 52 18	Slate	7 121.7
			312 25 42	132 26 44	No. 68	3 357.9

* Omitted.

** See note, end of table.

APPENDIX NO. 3. BOUNDARY LINE BETWEEN CALIFORNIA AND NEVADA. 341

C** GEOGRAPHIC POSITIONS OF POINTS ON RANDOM AND CORRECTED
LINES, 1893-1899—Continued.

Stations.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To stations.	Distance.
	° ' "	° ' "	° ' "	° ' "		Meters.
T 68	37 36 20.72	118 01 48.36	132 27 43	312 24 32	T 67	10 379.6
No. 68	21.92	46.83	192 42 44	12 43 29	Slate	8 163.6
T 69	37 35 15.60	118 00 18.96	312 27 02	132 27 57	No. 69	2 970.6
No. 69	16.86	16.48	132 28 37	312 24 32	T 67	13 352.6
T 70	37 34 45.73	117 59 39.35	177 44 09	357 43 59	Slate	9 978.4
No. 70	47.75	37.45	312 25 08	132 25 32	No. 70	1 330.3
T 71	37 34 17.30	117 58 58.98	132 29 01.3	312 24 31.8	T 67	14 670.6
No. 71	18.58	57.48	172 50 12.0	352 49 38.0	Slate	10 945.3
T 72	37 32 37.80	117 56 42.62	312 31 23	132 31 47	No. 71	1 331.2
No. 72	39.11	41.09	132 29 40	312 29 15	T 70	1 343.5
T 73	37 30 39.18	117 54 00.30	212 28 53	32 29 43	Esmeralda	3 706.2
No. 73	40.51	53 58.73	312 28 53	132 30 16	No. 72	4 539.7
T 74	37 29 37.86	117 52 36.39	132 31 02.7	312 29 15.0	T 70	5 883.2
No. 74	39.20	34.81	167 39 50.2	347 39 16.5	Esmeralda	6 339.9
T 75	37 28 06.90	117 50 32.14	312 30 39	132 32 18	No. 73	5 409.2
No. 75	08.27	30.53	132 33 02	312 31 23	T 72	5 409.2
T 76	37 27 40.99	117 49 56.77	163 31 59	343 31 22	Luck	5 236.3
No. 76	42.36	55.15	312 30 33	132 31 24	No. 74	2 796.8
T 77	37 26 57.77	117 48 57.80	132 33 20.3	312 30 50.3	T 72	8 206.0
No. 77	59.16	56.17	152 51 28.7	332 50 00.8	Luck	7 768.2
T 78	37 24 58.97	117 46 15.88	312 32 44	132 34 00	No. 75	4 145.1
No. 78	25 00.38	14.21	132 34 48	312 33 32	T 74	4 145.1
T 79	37 23 05.47	117 43 41.41	169 12 60	349 12 35	Pike	5 449.1
No. 79	06.41	39.00	312 33 58	132 34 20	No. 76	1 180.6
T 80	37 20 13.00	117 39 47.06	132 35 09.3	312 33 32.2	T 74	5 325.7
No. 80	12.78	42.94	162 56 14.2	342 55 27.4	Pike	6 435.2
T 81	37 16 11.36	117 34 18.60	312 34 30	132 35 06	No. 77	1 968.7
No. 81	13.31	17.33	132 36 03	312 35 27	T 76	1 968.7
T 82	37 14 31.92	117 32 04.98	235 24 55	55 26 00	Cab	3 187.3
No. 82	33.49	03.12	312 35 22	132 37 00	No. 78	5 409.4
T 83	37 11 55.44	117 28 33.62	132 37 43.0	312 35 28.7	T 76	7 378.0
No. 83	56.09	30.39	194 28 18.5	14 28 29.8	Dab	1 832.2
			312 36 49	132 38 23	No. 79	5 188.4
			132 39 20.1	312 37 46.3	T 78	5 165.2
			147 39 09.6	327 37 47.1	Dab	6 242.4
			312 38 14	132 40 37	No. 80	7 899.4
			53 38 45	233 38 28	T 80 High	856.0
			132 41 39	312 39 17	T 79	7 844.1
			312 36 22	132 39 39	No. 81	20 899.1
			282 15 37	102 18 21	Nig	6 821.0
			312 56 30	132 57 51	T 82	4 499.0
			312 55 36	132 56 57	No. 82	4 518.0
			163 40 18.6	343 39 31.7	Sclav	6 786.1
			244 24 32.1	64 25 54.9	Nig	3 739.4
			312 45 18	132 47 27	No. 83	7 145.6
			132 48 17	312 46 09	T 82	7 101.6
			244 09 02	64 10 45	Cone	4 641.7
			312 46 28	132 47 29	No. 84	3 414.1

** See note, end of table.

C.** GEOGRAPHIC POSITIONS OF POINTS ON RANDOM AND CORRECTED LINES, 1893-1899—Continued.

Stations.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To stations.	Distance.
	° ' "	° ' "	° ' "	° ' "		Meters.
T 84	37 10 39.51	117 26 51.10	260 39 29	80 40 44	Crystal.....	3 099.1
No. 84	40.88	48.82	317 10 29	137 11 09	T 85 High.....	2 408.9
T 85	37 09 33.88	117 25 22.68	312 49 22	132 50 16	No. 85	2 581.9
No. 85	35.13	20.19	115 14 12	295 13 59	T 85 High.....	601.6
T 86	37 07 02.96	117 21 59.50	199 08 22	19 08 44	Crystal.....	2 673.9
No. 86	04.29	57.02	312 49 26	132 51 29	No. 86	6 838.6
T 87	37 06 22.72	117 21 05.40	250 48 33	70 48 34	T 86 High.....	60.0
No. 87	25.04	04.27	312 52 28	132 53 01	T 87	1 822.9
T 88	37 03 08.16	117 16 44.17	312 53 02	132 53 34	No. 87	1 777.5
No. 88	09.89	42.10	134 34 36	314 34 05	T 86 High.....	1 795.6
T 89	36 59 47.39	117 12 15.24	178 22 46	358 22 42	Baldwin.....	5 717.4
No. 89	49.18	13.11	312 52 17	132 54 55	No. 88	8 839.5
T 90	36 57 23.36	117 09 02.68	133 12 59.3	313 09 50.5	T 86 High.....	10 604.4
No. 90	(*)	(*)	187 32 23.9	7 32 47.1	Queer.....	7 240.4
T 91	36 54 30.67	117 05 12.23	312 55 06	132 57 48	No. 89	9 082.5
No. 91	34.65	12.91	132 58 35.7	312 55 53.8	T 88	9 082.4
T 92	36 52 29.66	117 02 31.01	192 17 49.2	12 18 13.8	Helmet.....	4 745.6
No. 92	31.03	28.03	312 59 10	133 03 23	No. 91	14 220.1
T 93	36 46 50.14	116 54 59.87	297 07 44	117 09 21	Nye.....	4 494.9
No. 93	51.80	57.18	313 00 27	133 02 46	T 91	7 801.7
T 94	36 43 27.08	116 50 30.90	(*)	(*)	(*)	(*)
No. 94	29.10	28.47	137 05 58	317 03 40	Grape.....	8 340.5
T 95	36 42 19.44	116 49 01.43	152 31 06	332 30 25	Nye.....	3 689.2
No. 95	21.16	48 58.55	313 01 10	133 02 49	No. 92	5 584.7
T 96	36 40 11.72	116 46 12.69	140 54 17	320 51 59	Nye.....	9 026.0
No. 96	13.48	09.79	166 53 07	346 52 51	Shale.....	2 916.4
T 97	36 36 30.92	116 41 21.67	313 04 01	133 08 31	No. 93	15 302.8
No. 97	33.04	19.11	241 43 18	61 43 19	T 93 high.....	58.3
T 98	36 34 46.42	116 39 04.08	313 08 57	133 12 31	T 95	12 194.7
No. 98	35 03.70	20.81	313 08 23	133 11 04	No. 94	9 137.9
No. 98½	36 34 31.44	116 38 38.50	182 18 09	2 18 16	Dune.....	7 008.2
			281 35 31	101 37 43	Green.....	5 600.9
			313 10 29	133 11 23	No. 95	3 059.7
			133 28 07.6	313 24 34.4	T 93 high.....	12 176.3
			167 58 06.6	347 57 19.9	Dune.....	9 292.1
			313 11 38	133 13 19	No. 96	5 748.2
			169 20 10.3	349 19 48.1	Green.....	4 980.8
			217 31 49.5	37 33 27.7	Bleak.....	6 692.5
			313 14 06	133 16 59	No. 97	9 915.5
			133 17 47	313 14 53	T 96	9 929.2
			165 26 40	345 25 24	Bleak.....	12 514.8
			313 06 43	133 07 54	No. 98	4 028.6
			190 59 19	10 59 41	Funeral.....	4 844.0
			313 18 00	133 20 39	T 99	9 102.5
			313 23 44	133 24 09	No. 98½	1 447.4
			313 20 33	133 22 58	No. 99	8 319.0

* Not corrected.

** See note, end of table.

C** GEOGRAPHIC POSITIONS OF POINTS ON RANDOM AND CORRECTED LINES, 1893-1899--Continued.

Stations.	Latitude.			Longitude.			Azimuth.			Back azimuth.			To stations.	Distance.
	°	'	"	°	'	"	°	'	"	°	'	"		Meters.
T 99	36	31	23.81	116	34	37.81	128	38	09.9	308	35	20.1	T 98 high.....	9 074.0
No. 99			26.00			35.16	152	38	31.7	332	36	15.2	Funeral	12 387.8
T 100	36	28	34.68	116	30	56.21	313	21	30	133	23	42	No. 100	7 589.2
No. 100			36.91			53.59	108	44	30.9	288	41	35.4	Sexton	7 756.5
T 101 east	36	25	55.06	116	27	27.17	133	24	26.8	313	22	15.0	T 99	7 589.2
No. 101			57.38			24.36	313	20	18	133	22	22	No. 101	7 152.6
T 102	36	23	22.83	116	24	08.40	94	14	15.4	274	11	38.0	Butte	6 618.0
No. 102			25.12			05.61	133	24	11.5	313	22	07.3	T 100	7 152.6
T 103	36	21	05.42	116	21	09.13	313	26	41	133	28	39	No. 102	6 822.3
No. 103			07.75			06.29	222	02	43.6	42	03	25.0	King	2 594.2
T 104	36	19	29.90	116	19	04.68	353	07	10.4	173	07	14.6	S. Base	1 454.8
No. 104			33.36			03.30	313	25	38	133	27	24	No. 103	6 157.0
T 105	36	16	26.11	116	15	05.60	122	56	36.9	302	54	54.8	S. Base	5 115.7
No. 105			28.39			02.70	156	06	29.9	336	05	24.9	King	6 739.4
T 106	36	14	37.49	116	12	44.52	313	28	39	133	29	52	No. 104	4 227.5
No. 106			38.36			39.70	182	55	42.9	2	55	50.7	Shoshone.....	6 420.2
T 107	36	12	07.01	116	09	29.35	133	29	55.8	313	28	42.1	T 103	4 278.0
No. 107			09.45			26.37	313	28	53	133	31	15	No. 105	8 279.0
T 108	36	10	16.79	116	07	06.62	293	09	22.3	113	13	19.9	Rump	10 914.0
No. 108			23.14			08.67	313	32	19.5	133	33	42.9	T 106	4 859.3
T 109	36	07	16.86	116	03	13.99	313	30	53	133	32	17	T 106	4 904.0
No. 109			19.37			10.92	278	16	35.2	98	19	09.4	Rump	6 580.4
T 110	36	05	09.25	116	00	29.33	168	44	50.5	348	44	17.9	Pah	7 058.3
No. 110			11.80			26.31	313	33	47	133	35	42	No. 107	6 681.5
T 111	36	02	47.70	115	57	26.86	203	56	45.3	23	57	24.2	Rump	4 036.2
No. 111			50.27			23.72	133	35	38.4	313	33	43.1	T 106	6 728.5
T 112	36	00	44.70	115	54	48.63	313	35	33	133	36	54	No. 108	4 751.4
No. 112			47.32			45.41	263	36	30.2	83	37	00.5	End	1 290.7
T 113	36	00	09.92	115	54	03.77	340	42	00.8	160	43	17.6	Hard	9 852.2
No. 113			12.50			00.61	313	36	07	133	38	27	No. 109	8 210.1
T 114	35	58	51.66	115	52	23.28	133	39	30.9	313	37	13.7	T 108	8 036.0
No. 114			54.28			20.06	141	28	20.7	321	26	33.8	End	7 274.0
							313	39	55	133	41	32	No. 110	5 695.0
							313	40	43.8	133	42	31.3	T 111	6 315.3
							39	54	44.4	219	53	27.4	Dell	5 161.3
							313	39	22	133	41	09	No. 111	6 315.3
							93	18	14.6	273	15	10.3	Dell	7 853.3
							133	14	14.3	313	12	26.0	Manse	6 319.7
							313	42	10	133	43	43	No. 112	5 483.3
							48	17	59.6	228	16	23.2	Gap	5 501.5
							133	45	16.9	313	43	45.8	T 111	5 483.3
							313	43	37	133	44	06	No. 113	1 552.8
							63	41	02.4	243	38	59.7	Gap	5 836.5
							86	50	19.2	266	46	04.0	Blow	10 889.9
							313	44	06	133	45	05	No. 114	3 486.4
							48	10	32.4	228	08	51.3	Ring	5 787.3
							88	43	07.9	268	40	06.2	Gap	7 751.1
							313	45	10	133	46	04	No. 115	3 179.7

** See note, end of table.

C.** GEOGRAPHIC POSITIONS OF POINTS ON RANDOM AND CORRECTED
LINES, 1893-1899—Continued.

Stations.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To stations.	Distance.
	° ' "	° ' "	° ' "	° ' "		Meters.
T 115	35 57 40'33	115 50 51'59	313 48 45'5	133 50 15'2	T 116	5 397'2
No. 115	42'93	48'40	75 54 30'3	255 51 55'4	Ring	6 815'8
T 116	35 55 41'10	115 48 18'82	313 47 04	133 48 35	No. 116	5 370'0
No. 116	42'33	13'74	100 56 49'8	280 52 45'3	Ring	10 633'1
T 117	35 52 54'45	115 44 45'39	133 48 44'8	313 46 21'3	T 114	8 487'0
No. 117	53 23'90	45 16'29	313 47 04	133 48 48	No. 117	6 164'5
T 118	35 50 03'08	115 41 06'23	26 01 17'1	206 00 44'6	Mag	3 176'7
No. 118	05.85	02'81	133 50 24'1	313 48 18'9	T 116	7 417'8
T 119	35 48 26'68	115 39 03'17	313 48 18	133 50 46	No. 118	8 815'0
No. 119	29'48	38 59'72	69 02 36'7	249 01 22'2	Jumbo	3 420'3
T 120	35 47 07'37	115 37 21'97	109 24 58'4	289 22 17'5	Mag	7 308'5
No. 120	10'05	18'32	313 51 32	133 52 44	No. 119	4 285'9
T 121	35 45 06'93	115 34 48'50	59 34 02'7	239 31 19'8	Move	8 115'5
No. 121	13'36	49'61	103 55 26'4	283 54 05'9	Snow	3 558'1
T 122	35 42 44'44	115 31 47'19	313 51 53	133 52 52	No. 120	3 532'0
No. 122	47'32	43'64	41 11 16'6	221 09 46'5	Martin	5 881'4
T 123	35 39 49'62	115 28 05'10	133 53 47'5	313 52 48'3	T 119	3 526'0
No. 123	53.02	02.06	313 50 00	133 51 27	No. 121	5 185'2
T 124	35 39 29'21	115 27 39'20	61 17 05'0	241 16 07'2	Taylor	2 835'4
No. 124	(*)	(*)	84 44 23'8	264 41 24'1	Martin	7 761'7
T 125	35 36 20'80	115 23 40'39	313 54 33	133 56 45	No. 122	6 488'6
No. 125	23'77	36'72	113 17 21'3	293 14 37'6	Taylor	7 667'6
T 126	35 34 09'99	115 20 54'85	133 57 26'6	313 55 40'7	T 121	6 328'3
No. 126	12'98	51'15	313 56 12	133 58 21	No. 123	7 739'4
T 127	35 31 27'88	115 17 29'97	33 15 08'0	213 14 41'1	Spanish	2 117'1
No. 127	39'81	33'19	133 59 39'6	313 57 30'1	T 122	7 759'5
T 128	35 27 34'67	115 12 35'89	313 59 17	134 01 52	No. 125	9 282'2
No. 128	32'20	25'25	313 59 54'0	134 02 13'1	T 125	8 356'0
T 129	35 26 31'76	115 11 16'76	57 48 57'3	237 48 15'3	Spanish	2 142'0
No. 129	32'50	10'15	(*)	(*)	(*)	(*)
T 130	35 24 09'99	115 09 14'4	63 42 11'5	243 41 20'9	Well	2 439'6
No. 130	23'77	36'72	120 50 06'5	300 47 05'5	Spanish	9 105'6
T 131	35 22 09'99	115 07 17'2	314 01 23	134 02 59	No. 126	5 798'5
No. 131	12'98	51'15	85 14 03'0	265 12 38'7	Skit	3 662'6
T 132	35 20 09'99	115 05 14'0	114 55 14'0	294 52 47'1	Well	7 007'2
No. 132	39'81	33'19	314 19 00	134 20 55	No. 127	6 964'0
T 133	35 18 09'99	115 03 14'4	93 39 24'1	273 36 45'7	Patch	6 883'5
No. 133	32'20	25'25	112 26 20'5	292 24 02'1	Link	6 491'6
T 134	35 16 09'99	115 01 16'76	313 55 04	133 58 03	No. 128	10 781'0
No. 134	32'50	10'15	118 09 14'4	298 05 48'1	Storm	10 158'5
T 135	35 14 09'99	115 00 17'2	134 08 17'2	314 05 26'5	T 127	10 325'2
No. 135	39'81	33'19	314 06 48	134 07 32	No. 129	2 638'2
T 136	35 12 09'99	115 00 16'76	309 32 07'8	129 33 56'8	T 130 high	6 155'0
No. 136	32'50	10'15	332 48 53'4	152 50 07'7	Vanderbilt	7 086'8
T 137	35 10 09'99	115 00 16'76	314 02 49	134 04 30	No. 130	6 104'0

* Omitted.

** See note, end of table.

C.** GÉOGRAPHIC POSITIONS OF POINTS ON RANDOM AND CORRECTED
LINES, 1893-1899—Continued.

Stations.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To stations.	Distance.
	° ' "	° ' "	° ' "	° ' "		Meters.
T 130	35 24 08.44	115 08 16.54	134 11 15.5 201 51 25.8	314 09 31.1 21 51 30.4	T 129	6 338.8
No. 130	14.85	16.26	314 14 04	134 16 21	T 130 high.....	536.3
T 131	35 24 03.09	115 08 09.83	288 22 08.0 314 10 58.6	108 24 53.1 134 13 12.5	No. 132	8 310.0
No. 131	(*)	(*)	(*)	(*)	Searchlight.....	7 580.6
T 132	35 20 58.79	115 04 18.44	118 24 50.5 137 31 38.5	298 22 02.6 317 29 25.3	T 132	8 146.6
No. 132	21 04.89	22.72	314 12 09	134 13 59	(*)	(*)
T 133	35 18 32.31	115 01 14.89	134 15 07.5 208 17 11.3	314 13 21.3 28 18 01.1	Vanderbilt	8 322.6
No. 133	34.90	10.11	314 14 20	134 18 15	T 130 high.....	8 601.5
T 134	35 13 05.96	114 54 26.96	134 19 04.6 150 02 19.2	314 15 09.0 329 59 13.3	No. 133	6 704.2
No. 134	09.24	22.84	314 20 58	134 23 32	T 132	6 470.7
T 135	35 09 33.72	114 50 02.33	36 13 36.3 148 56 42.4	216 13 04.1 328 56 09.3	Setter	4 586.6
No. 135	33.92	49.54.74	314 17 18	134 19 04	No. 134	14 371.9
T 136	35 08 04.35	114 48 11.08	46 47 29.6 134 22 30.7	226 47 29.0 314 21 26.7	T 133	14 403.0
No. 136	(*)	(*)	(*)	(*)	Setter	16 274.9
T 137	35 07 04.42	114 46 56.55	105 57 53.1 134 23 13.6	285 56 18.1 314 21 26.7	No. 135	9 487.6
No. 137	16.16	50.44	314 19 47	134 19 54	Piute	2 391.8
T 138	35 06 45.28	114 46 34.03	170 23 21.4 327 05 15.1	350 23 16.5 147 05 36.4	House	2 822.7
No. 138	56.81	38.80	314 21 33	134 21 55	No. 137	6 519.0
No. 138½	35 06 26.79	114 46 01.44	314 22 18	134 22 36	T 136 high.....	38.4
T 139	35 06 00.39	114 45 36.95	85 57 08.9 148 13 37.5	265 56 57.4 328 12 59.8	T 135	3 938.8
No. 139	01.08	29.47	314 22 06	134 24 48	(*)	(*)
T 140	35 05 23.24	114 44 50.81	228 04 55.0 314 23 35.6	48 05 34.9 134 25 52.0	Gus.....	4 348.5
No. 140	(*)	(*)	(*)	(*)	T 135	6 579.5
T 141	35 02 12.02	114 40 53.43	133 58 41.7 150 19 40.9	313 56 24.2 330 18 04.4	No. 138	412.2
No. 141	13.59	46.84	314 24 37	134 25 14	Newberry	1 282.2
T 142	35 01 18.98	114 39 47.68	134 26 38.4 163 14 55.0	314 26 00.7 343 14 28.7	Vex	1 725.6
No. 142	22.24	43.12			No. 138½	1 323.0
Port Mohave, Ariz., flagstaff.	35 02 31.65	114 37 13.92	37 52 39 57 23 24	217 51 25 237 20 58	No. 139	1 132.4
					Vex	508.1
					Newberry	3 151.3
					No. 141	10 018.0
					Beatty.....	2 359.5
					T 141	8 421.2
					(*)	(*)
					T 140 high.....	8 425.8
					Beatty.....	8 597.3
					No. 142	2 261.0
					T 141	2 334.2
					Quail.....	4 042.7
					Von Schmidt E. post Peak	5 333.5 7 661.6

* Omitted.

** See note, end of table.

C** GEOGRAPHIC POSITIONS OF POINTS ON RANDOM AND CORRECTED LINES, 1893-1899—Continued.

Stations.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To stations.	Distance.
	° ' "	° ' "	° ' "	° ' "		Meters.
Iron monument, Von Schmidt, north shore Lake Tahoe.	39 13 19.18	120 00 21.94	339 05 53 62 16 03	159 07 58 242 12 39	Deadman Point.... Observatory Point..	13 329.4 8 767.5
Stone monument, Von Schmidt, north shore Lake Tahoe.	39 13 17.25	120 00 21.96	339 00 17 62 36 47	159 02 22 242 33 23	Deadman Point ... Observatory Point..	13 273.7 8 739.5

NOTE.—Points on the random line are designated by T 1, T 2, T 3, etc. Points on the corrected line are designated by No. 1, No. 2, No. 3, etc.

**NOTE.—The geographic positions in the tables C, D, and F depend on the following positions on the Yolo Base Datum for Mount Lola and Round Top.

Round Top: Latitude, $38^{\circ} 39' 43''$.636; longitude, $120^{\circ} 00' 04''$.997.

Mount Lola: Latitude, $39^{\circ} 28' 53''$.342; longitude, $120^{\circ} 21' 55''$.496.

Round Top to Mount Lola: Azimuth, forward, $159^{\circ} 51' 41''$.60; back, $339^{\circ} 37' 56''$.02. Distance, 91 038.53 meters; Log., 4.959 225 2.

This was the best available information at the time the work was done and the computation completed.

On March 13, 1901, the necessary connections between triangulation in widely separated localities having been made and the computations being sufficiently advanced to afford the basis for such a decision, the Coast and Geodetic Survey adopted a standard datum, to be known as the "U. S. Standard Datum," to which all geographic positions throughout the United States will be reduced, wherever possible, as rapidly as practicable, so as to make such positions strictly comparable in all portions of the country. On the U. S. Standard Datum the positions of Round Top and Mount Lola are as follows:

Round Top: Latitude, $38^{\circ} 39' 50''$.316; longitude, $120^{\circ} 00' 01''$.126.

Mount Lola: Latitude, $39^{\circ} 28' 00''$.061; longitude, $120^{\circ} 21' 51''$.594.

Round Top to Mount Lola: Azimuth, forward, $159^{\circ} 51' 45''$.92; back, $339^{\circ} 37' 60''$.33. Distance, 91 039.14 meters; Log., 4.959 228 2.

The corrections to reduce the positions here published to the U. S. Standard Datum will be of the same order of magnitude as the corrections at Round Top and Mount Lola indicated above, and will not be constant from one end of the line to the other.

The exact values of these corrections are not now available, and this note is inserted to prevent the use of the uncorrected positions for geographic purposes.

July 30, 1901.

EDITOR.

D.** GEOGRAPHIC POSITIONS OF RECOVERED POINTS ON THE VON SCHMIDT LINE.

Stations.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To stations.	Distance.
	° ' "	° ' "	° ' "	° ' "		Meters.
Lake shore stone....	38 57 25.05	119 57 05.99	310 51 35	130 51 35	V. S. 211 M. P.....	8046
V. S. 211 M. P.....	38 57 23.50	119 57 03.50	310 56 53	130 57 05	V. S. 211m. 30ch. P....	665
V. S. 211m. 30ch. P....	38 57 10.64	119 56 44.52	311 18 29	131 18 49	V. S. 212 M. P.....	1 003
V. S. 212 M. P.....	38 56 49.16	119 56 13.22	310 36 03	130 36 27	V. S. 212m. 53ch. 21l. P.	1 074
V. S. 212m. 53ch. 21l. P.	38 56 26.50	119 55 39.37	310 52 21	130 57 05	V. S. 221m. 76ch. P....	14 408
V. S. 221m. 76ch. P....	38 51 20.50	119 48 07.53	310 57 48	131 00 27	V. S. 227 M. P.....	8 117
V. S. 227 M. P.....	38 48 27.86	119 43 53.51	311 00 29	131 07 23	V. S. 239m. 64ch. P....	21 164
V. S. 239m. 64ch. P....	38 40 56.97	119 32 52.75	311 54 07	131 55 13	V. S. 242 M. P.....	3 448
V. S. 242 M. P.....	38 39 42.29	119 31 06.62	311 02 37	131 09 03	V. S. 254m. 49ch. P....	19 869
V. S. 254m. 49ch. P....	38 32 38.73	119 20 47.84	311 16 56	131 18 54	V. S. Mid. sister P....	6 122
V. S. Mid. sister P....	38 30 27.70	119 17 37.97	311 19 10	131 23 05	V. S. 266 M. P.....	12 198
V. S. 266 M. P.....	38 26 06.33	119 11 20.24	311 23 53	131 26 23	V. S. 270m. 61ch. P....	7 798
V. S. 270m. 61ch. P....	38 23 19.01	119 07 19.20	311 25 24	131 29 08	V. S. 278 M. P.....	11 716
V. S. 278 M. P.....	38 19 07.46	119 01 17.57	311 29 32	131 31 05	V. S. 281 M. P.....	4 871
V. S. 281 M. P.....	38 17 22.77	118 58 47.44	311 29 03	131 30 04	V. S. 283 M. P.....	3 214
V. S. 283 M. P.....	38 16 13.71	118 57 08.39	311 32 33	131 33 41	{Brawley Mountain, 285m. 14ch. 67l.}	3 560
V. S. 285m. 14ch. 67l.	38 14 57.13	118 55 18.81	311 32 54	131 38 14	V. S. 295m. 49ch. P....	16 812
V. S. 295m. 49ch. P....	38 08 55.17	118 46 42.08	311 36 11	131 48 53	{Stone monument, Carson and Colo- rado Railroad.}	40 385
Stone monument, V. S. 320m. 25ch. P....	37 54 23.66	118 26 05.94	311 49 34	131 56 00	V. S. 333m. 23ch. P....	20 634
V. S. 333m. 23ch. P....	37 46 56.87	118 15 37.58	311 52 18	131 53 03	V. S. 334m. 61ch. P....	2 393
V. S. 334m. 61ch. P....	37 46 05.05	118 14 24.77	311 58 39	132 06 20	{Fish Lake Valley, V. S. 350 M. P.}	24 894
V. S. 350 M. P.....	37 37 04.99	118 01 50.15	312 03 34	132 09 54	V. S. 363 M. P.....	20 623
V. S. 363 M. P.....	37 29 36.40	117 51 26.54	312 36 45	132 48 15	V. S. 377 M. P.....	38 084
V. S. 377 M. P.....	37 15 38.49	117 32 29.42	312 18 19	132 18 49	V. S. 388 M. P.....	1 660
V. S. 388 M. P.....	37 15 02.25	117 31 39.61	312 11 56	132 27 19	V. S. 420m. 70ch. P....	51 116
V. S. 420m. 70ch. P....	36 56 25.67	117 06 09.29	312 47 45	132 59 41	V. S. 446 M. P.....	40 384
V. S. 446 M. P.....	36 41 33.93	116 46 15.63	313 01 00	133 14 13	V. S. 474 M. P.....	45 386
V. S. 474 M. P.....	36 24 47.34	116 24 03.71	313 16 32	133 17 00	V. S. 475 M. P.....	1 611
V. S. 475 M. P.....	36 24 11.52	116 23 16.65	314 00 47	134 14 41	V. S. 505 M. P.....	49 035
V. S. 505 M. P.....	36 05 43.81	115 59 46.95	315 35 35	135 28 39	V. S. 512 M. P.....	11 139
V. S. 512 M. P.....	36 01 26.25	115 54 34.72	315 31 32	135 35 37	V. S. 521 M. P.....	14 903
V. S. 521 M. P.....	35 55 41.03	115 47 38.24	314 56 40	134 58 00	V. S. 524 M. P.....	4 833
V. S. 524 M. P.....	35 53 50.23	115 45 21.83	314 55 51	134 57 21	V. S. 528 M. P.....	5 462
V. S. 528 M. P.....	35 51 45.05	115 42 47.72	314 53 21	134 53 48	V. S. 529 M. P.....	1 615
V. S. 529 M. P.....	35 51 08.06	115 42 02.12	314 57 15	134 58 08	V. S. 531 M. P.....	3 229
V. S. 531 M. P.....	35 49 54.02	115 40 31.07	314 50 48	134 51 15	V. S. 532 M. P.....	1 614
V. S. 532 M. P.....	35 49 17.07	115 39 45.46	315 03 07	135 03 34	V. S. 533 M. P.....	1 615
V. S. 533 M. P.....	35 48 39.98	115 39 00.01	315 00 55	135 01 22	V. S. 534 M. P.....	1 616
V. S. 534 M. P.....	35 48 02.90	115 38 14.52	314 58 22	134 58 59	V. S. 535 M. P.....	1 616
V. S. 535 M. P.....	35 47 25.85	115 37 29.01	314 56 16	134 56 43	V. S. 536 M. P.....	1 616
V. S. 536 M. P.....	35 46 48.82	115 36 43.47	314 55 31	134 55 58	V. S. 537 M. P.....	1 614
V. S. 537 M. P.....	35 46 11.85	115 35 57.99	315 00 41	135 01 08	V. S. 538 M. P.....	1 613
V. S. 538 M. P.....	35 45 34.78	115 35 12.53	314 33 01	134 56 04	V. S. 592 M. P.....	84 562
V. S. 592 M. P.....	35 13 23.21	114 55 29.64	314 36 15	134 44 01	V. S. 610 M. P.....	28 845
V. S. 610 M. P.....	35 02 25.16	114 41 59.36	314 34 36	134 35 02	V. S. 611 M. P.....	1 596
V. S. 611 M. P.....	35 01 48.80	114 41 14.50	313 14 56	133 15 22	V. S. 612 M. P.....	1 599
V. S. 612 M. P.....	35 01 13.24	114 40 28.55				
V. S. West lat. post..	35 00 15.02	114 39 41.51				
V. S. East lat. post..	35 00 15.02	114 39 23.06				
V. S. Iron monu- ment.	35 00 44.22	114 39 35.52				

NOTE.—m. = miles, ch. = chains, and l. = links, M. P. = mile post, P. = post, V. S. = Von Schmidt.

** See note, end of Table C.

E. DISTANCES AND DESCRIPTION OF RECOVERED POINTS ON THE VON SCHMIDT LINE.

Nos.	Distance between Von Schmidt points.		Remarks.
	Meters.	Miles.	
210 ^m 76 ^{ch}	0'0	0'00	A granite monument 6 feet long, 4 feet above ground, 8½ inches at top, 10½ inches at bottom, terminating in a flat pyramid. Marked O, 210 ^m 76 ^{ch} , 1873 (changed from 1863), NEV., Calif. Stands about 100 feet from the water on south-east shore of Lake Tahoe. It is 590 meters southwest of the corrected line, United States Coast and Geodetic Survey. The distances on the Von Schmidt line posts, miles and chains, are reckoned from Oregon. This stone being the first on the shore of Lake Tahoe to mark the oblique boundary, was used by Grunsky and Minto in 1889 as the starting point from which to fix their initial mark on the shore of the lake.
211 ^m	80'46	0'05	In the marsh or meadow land, a post said to be cottonwood, about 8 feet long, 10 inches square, in good state of preservation, 585 meters southwest of corrected line.
211 ^m 30 ^{ch}	605	0'38	A cut granite monument in road on southeast side fronting Lake Side Tavern, old house of Lapham, 580 meters southwest of corrected line. This monument was used as the starting point of the United States Coast and Geodetic Survey in 1893, for the determination of latitude and longitude (telegraphic) on account of its convenience to the telephone wire running to Carson City, which was utilized for the exchange of telegraphic longitude signals. The first point on the lake shore was established by measurement, with reference to this stone.
212 ^m	1 003	0'63	Pine post 6 inches by 6 inches by 7 feet on foot hills, west slope, 570 meters southwest of corrected line.
212 ^m 53 ^{ch} 21 ^l	1 074	0'67	Site for Von Schmidt's iron monument, which was never set. A pine tree, 8 inches diameter, marked "CAL.," "NEV. 1873," and the distance was found in place; 543 meters southwest of corrected line.
221 ^m 76 ^{ch}	14 408	8'95	Cut granite monument, cairn built around it, in Carson Valley, ¼ mile west of Baldwin's house, nearly due south of No. 10 and 576 meters distant; 460 meters southwest of corrected line.

E. DISTANCES AND DESCRIPTION OF RECOVERED POINTS ON THE VON SCHMIDT LINE—Continued.

Nos.	Distance between Von Schmidt points.		Remarks.
	Meters.	Miles.	
227 ^m	8 117	5'04	Pine post northwest of road to middle fork of Carson River in Carson Valley, near Galliner's house; 440 meters southwest of corrected line.
239 ^m 64 ^{ch}	21 164	13'15	Pine post on west side of road from Holbrook to Coleville, northwest side of Alkali Lake; 250 meters southwest of corrected line.
242 ^m	3 448	2'14	On northwest side of Rickey's meadow in Antelope Valley, in fence line, post found lying on the ground; about 240 meters southwest of corrected line.
254 ^m 49 ^{ch}	19 869	12'33	No post; pile of stones due south of No. 31, 120 meters distant; 92 meters southwest of corrected line.
Middle Sister	6 122	3'80	A small flag pole 80 meters southwest of No. 32, 64 meters southwest of corrected line; elevation 10 942 feet by aneroid barometer.
266 ^m	12 198	7'58	Pine post in Sweetwater Valley, about 1 mile northwest of No. 34; very close to and northeast of corrected line.
270 ^m 61 ^{ch}	7 798	4'85	Post and pile of rocks on same hill and only 3 feet southeast of Red Δ and 70 meters northeast of No. 36 and the corrected line.
278 ^m	11 716	7'28	Cedar post, 120 meters northeast of No. 39 and the corrected line.
281 ^m	4 871	3'03	Mountain mahogany post one-half mile northeast of No. 40 on northeast slope of Beauty Peak, 160 meters northeast of the corrected line.
283 ^m	3 214	2'00	Pine post 400 meters east of No. 41, on top of steep bluff northwest of Bodie Creek, 168 meters northeast of corrected line.
Brawley, 285 ^m 14 ^{ch} 67 ^l	3 560	2'21	A small pole in cairn on southeast side of West Brawley summit, 220 meters east of No. 42 and 175 meters northeast of the corrected line.
295 ^m 49 ^{ch}	16 812	10'45	Juniper post east of road across desert from Aurora to Adobe Meadows, 500 meters north of No. 46 and 310 meters northeast of the corrected line.
Stone monument ..	40 385	25'09	Von Schmidt, 32 0 ^m 25 ^{ch} P. Cut granite monument at crossing of Carson and Colorado R. R., west side, and 600 meters northeast of No. 59 and the corrected line; in first valley northwest of the White Mountains.

E. DISTANCES AND DESCRIPTION OF RECOVERED POINTS ON THE VON SCHMIDT LINE—Continued.

Nos.	Distance between Von Schmidt points.		Remarks.
	Meters.	Miles.	
333 ^m 23 ^{ch}	20 634	12'82	725 meters northeast of No. 62 and the corrected line.
334 ^m 61 ^{ch}	2 393	1'49	Pine post 0.9 mile north of No. 63 and 760 meters northeast of the corrected line.
350 ^m	24 894	15'47	In Fish Lake Valley, 0.82 mile north of No. 68 and 900 meters northeast of the corrected line; cottonwood post.
363 ^m	20 623	12'81	Cottonwood post in Fish Lake Valley, 1.02 miles east of No. 74, one-fourth mile southeast of the road to Silver Peak, on northwest slope of first hill in valley east of Piper's upper ranch, 1 020 meters northeast of the corrected line.
387 ^m	38 084	23'66	Pine post, 1.29 miles nearly north of No. 82 and seven-eighths mile northwest of road from Tule Cañon to Sand Springs; 1 000 meters northeast of the corrected line.
388 ^m	1 660	1'03	Pine post, 1 020 meters northeast of No. 82, on bluff bank southeast of wash and road; 1 000 meters northeast of the corrected line.
420 ^m 70 ^{ch}	51 116	31'76	Nut pine post, 400 meters northeast of Nye Δ and 1 536 meters northeast of the corrected line.
446 ^m	40 384	25'09	Pine post, 1 $\frac{1}{2}$ miles north of No. 96 and 1 672 meters northeast of corrected line.
474 ^m	45 386	28'20	Mesquite post in Amargosa Desert, 1 $\frac{1}{2}$ miles north of No. 102 and 1 860 meters northeast of corrected line; near Franklin Well.
475 ^m	1 611	1'00	Mesquite post, 1.15 miles northeast of No. 102; three-eighths mile southwest of King Δ (Sand Hill), and 1 850 meters northeast of corrected line.
505 ^m	49 035	30'47	Mesquite post in Pahrump Valley; 1 384 meters northeast of corrected line.
512 ^m	11 139	6'92	Mesquite post in Pahrump Valley, three-fourths mile and a little east of west from No. 112; 1 040 meters northeast of corrected line.
521 ^m	14 903	9'26	Willow post in Pahrump Valley, one-half mile east of No. 116. Not on line with other posts. The line (not the 521 M. P.) is 640 meters northeast of corrected line, while the 521 M. P. is only 576 meters northeast of the corrected line.

E. DISTANCES AND DESCRIPTION OF RECOVERED POINTS ON THE VON SCHMIDT LINE—Continued.

Nos.	Distance between Von Schmidt points.		Remarks.
	Meters.	Miles.	
524 ^m	4 833	3'00	Willow post in Pahrump Valley, one-half mile north of No. 117; on line, but the distance does not agree with other mileposts; 496 meters northeast of corrected line.
528 ^m	5 462	3'39	Willow post in Mesquite Valley, 2½ miles northwest of No. 118; 360 meters northeast of corrected line.
529 ^m	1 615	1'00	Willow post in Mesquite Valley, 1½ miles northwest of No. 118; 320 meters northeast of corrected line.
531 ^m	3 229	2'01	Willow post in Mesquite Valley, one-half mile east of No. 118; 290 meters northeast of corrected line.
532 ^m	1 614	1'00	Willow post in Mesquite Valley, 1½ miles southeast of No. 118; 270 meters northeast of corrected line.
533 ^m	1 615	1'00	Willow post in Mesquite Valley, one-fourth mile north of No. 119; 225 meters northeast of corrected line.
534 ^m	1 616	1'00	Mesquite post in Mesquite Valley, seven-eighths mile southeast of No. 119; 190 meters northeast of corrected line.
535 ^m	1 616	1'00	Mesquite post in Mesquite Valley, three-eighths mile north and a little east of No. 120, one-fourth mile northeast of crossroads southwest of Sandy Post-Office; 160 meters northeast of corrected line.
536 ^m	1 616	1'00	Mesquite post in Mesquite Valley, three-fourths mile southeast of No. 120; 120 meters northeast of corrected line.
537 ^m	1 614	1'00	Mesquite post in Mesquite Valley, 1¾ miles southeast of No. 120; 82 meters northeast of corrected line.
538 ^m	1 615	1'00	Mesquite post in Mesquite Valley, five-eighths mile northwest of No. 121; 60 meters northeast of corrected line.
592 ^m	84 562	52'54	Cottonwood post 1½ miles west and a little north of No. 134, 1 mile northeast of four buttes in the valley (Piute Valley); 870 meters southwest of the corrected line.

E. DISTANCES AND DESCRIPTION OF RECOVERED POINTS ON THE VON SCHMIDT LINE--Continued.

Nos.	Distance between Von Schmidt points.		Remarks.
	Meters.	Miles.	
610 ^m	28 845	17'92	Cottonwood post 1½ miles west of No. 141, on south side of ravine one-fourth mile east of foot of bald hill; 990 meters southwest of corrected line
611 ^m	1 596	'99	Cottonwood post two-thirds mile southwest of No. 141; 990 meters southwest of corrected line.
612 ^m	1 599	'99	Cottonwood post two-thirds mile southwest of No. 142; 990 meters southwest of corrected line.
Iron monument			611 ^m 59 ^{ch} iron monument, Colorado River. This monument was not on prolongation of line through 610 ^m , 611 ^m , and 612 ^m posts, but was 150 meters northeast and 960 meters north of Von Schmidt's east latitude post.

*F.** GEOGRAPHIC POSITIONS AND HEIGHTS OF TRIANGULATION STATIONS.*

Stations.	Latitude.			Longitude.			Height above sea level.	Remarks.
	°	'	"	°	'	"	Feet.	
Lake Tahoe (surface)							6 224	Deduced from Mt. Grant.
Rubicon	38	59	52'20	120	05	47'53	6 232	
Folsom	38	59	02'85	119	57	01'98	6 717	
Castle Rock	38	59	18'03	119	54	33'14	7 922	
Lake Shore Stone	38	57	25'05	119	57	05'99	6 229	
Ledge	38	56	56'85	119	52	31'02	8 058	
Boulder	38	56	37'85	119	53	43'49	9 080	
East Peak	38	56	27'64	119	54	27'85	9 590	
Rock Cliff	38	50	21'93	119	41	45'70	5 569	
Barber	38	46	32'68	119	44	29'00	6 090	
Bald	38	45	27'59	119	41	13'22	6 464	
Ridge	38	44	41'86	119	39	11'24	7 115	
Cold Hill	38	44	23'24	119	32	44'60	6 301	
High Peak	38	42	18'83	119	37	42'04	8 468	
Knoll	38	42	59'48	119	35	17'83		
Dome	38	41	34'91	119	35	13'83	8 260	
Lake	38	42	24'17	119	32	19'50		
Pine Nut	38	36	33'25	119	21	56'25		
Flat	38	34	40'04	119	23	43'16		

** See note, end of Table C, p. 346.

F. GEOGRAPHIC POSITIONS AND HEIGHTS OF TRIANGULATION
STATIONS—Continued.

Stations.	Latitude.			Longitude.			Height above sea level.	Remarks.
	°	'	"	°	'	"	Feet.	
Don.....	38	34	13'93	119	18	47'25	.....	
Mahogany.....	38	33	10'40	119	22	39'41	.....	
East Sister.....	38	31	18'24	119	17	25'89	.....	
Sweetwater Ecc.....	38	29	15'06	119	09	34'64	7 782	
West Walker.....	38	24	15'69	119	04	33'85	7 097	
Red.....	38	23	19'01	119	07	19'20	.....	
Long.....	38	22	16'27	119	02	47'94	8 052	
Sugar Loaf.....	38	20	06'13	118	58	41'14	7 643	
Bald Peak.....	38	18	05'23	118	58	16'07	7 911	
Beauty Peak.....	38	17	06'62	118	58	31'69	8 977	From Mt. Grant (direct).
Aurora Peak.....	38	16	33'65	118	51	39'33	8 712	
Lake View.....	38	13	49'72	118	54	42'85	.....	
Cedar.....	38	12	24'87	118	47	29'42	.....	
Spring Peak.....	38	15	12'50	118	50	25'84	.....	
Sag.....	38	08	30'61	118	42	30'12	8 606	
Top.....	38	01	56'05	118	32	33'25	.....	
Sounding Rock.....	38	01	07'08	118	33	13'79	.....	
Trail.....	37	59	50'78	118	34	10'19	.....	
Queen.....	37	59	48'32	118	32	24'78	.....	
T 38.....	38	20	50'97	119	03	54'33	8 348	From Mount Grant (direct).
Roach.....	37	57	27'68	118	29	33'68	8 114	From North Peak, White Mountains.
Cap.....	37	59	10'13	118	28	15'82	8 526	
Mine.....	37	53	16'17	118	18	32'38	10 252	
Lava.....	37	56	11'42	118	26	33'24	7 078	
White, East Peak, White Mountains.	37	50	40'05	118	21	05'73	13 145	
Hogback.....	37	50	49'53	118	13	09'81	6 989	
Black.....	37	49	27'14	118	15	40'81	9 720	
Davis.....	37	47	51'76	118	13	21'54	8 847	
McNett.....	37	48	00'17	118	08	01'59	5 221	
T 62 High.....	37	46	35'90	118	16	07'08	9 976	
T 64 High.....	37	44	54'34	118	13	15'78	9 346	
Sand.....	37	45	56'23	118	05	47'89	4 926	
Leidy.....	37	42	52'37	118	02	59'15	4 861	
Slate.....	37	40	39'01	118	00	35'05	5 353	
Esmeralda.....	37	35	58'70	117	57	37'84	4 947	

*F. GEOGRAPHIC POSITIONS AND HEIGHTS OF TRIANGULATION
STATIONS—Continued.*

Stations.	Latitude.			Longitude.			Height above sea level.	Remarks.
	°	'	"	°	'	"	<i>Feet.</i>	
Lučk.....	37	33	22.06	117	55	00.77	5 240	
Pike.....	37	31	00.53	117	51	13.66	6 456	
Bab.....	37	28	50.48	117	49	21.59	5 936	
Cab.....	37	27	56.44	117	47	11.02	6 143	
Dab.....	37	25	56.51	117	45	57.26	6 886	
Fab.....	37	24	16.29	117	43	21.69	7 851	
Gab.....	37	23	43.92	117	42	09.82	.....	
Hab.....	37	22	30.10	117	41	51.89	8 197	
Jab.....	37	23	03.30	117	40	20.46	.....	
Mab.....	37	21	33.69	117	37	37.11	7 624	
T 80 high.....	37	19	56.54	117	40	15.06	7 467	
Sclav.....	37	18	03.16	117	33	22.44	5 534	
Granite.....	37	16	27.53	117	36	23.75	5 240	
Nig.....	37	15	24.29	117	29	48.12	4 872	
Cone.....	37	13	01.06	117	25	44.22	6 575	
Wash.....	37	11	55.76	117	28	38.77	4 216	
Crystal.....	37	10	55.82	117	24	47.13	6 182	
T 85 high.....	37	09	42.20	117	25	44.74	5 167	
Palmetto.....	37	09	42.65	117	24	05.17	6 167	
Baldwin.....	37	09	28.11	117	21	11.95	.....	
T 86 high.....	37	07	03.60	117	21	57.21	5 698	
Oucer.....	37	07	01.00	117	16	05.69	5 793	
Helmet.....	37	02	17.81	117	11	34.34	7 044	
T 89 high.....	36	59	30.78	117	12	15.88	8 410	
Coyote.....	36	59	50.67	117	07	56.24	8 600	
Vine.....	36	59	34.45	117	03	48.56	6 446	
Grape.....	36	57	48.81	117	09	01.74	8 771	
Nye.....	36	56	16.81	117	06	21.02	8 658	
Sage.....	36	55	58.20	116	58	32.09	5 522	
Shale.....	36	54	01.80	117	02	57.74	7 440	
Sharp.....	36	53	02.10	116	54	24.75	4 820	
T 93 high.....	36	46	51.04	116	54	57.80	5 072	
Dune.....	36	47	14.25	116	50	19.55	3 560	
Jock.....	36	44	24.04	116	46	42.49	3 327	
Green.....	36	42	50.51	116	46	49.83	4 016	
Bleak.....	36	43	03.87	116	43	28.41	2 744	
Funeral.....	36	37	20.69	116	38	26.92	3 552	
T 98 High.....	36	34	27.52	116	39	22.89	3 677	
Sexton.....	36	29	55.43	116	35	51.34	2 680	

F. GEOGRAPHIC POSITIONS AND HEIGHTS OF TRIANGULATION
STATIONS—Continued.

Stations.	Latitude.			Longitude.			Height above sea level.	Remarks.
	°	'	"	°	'	"	Feet.	
Butte.....	36	26	10.84	116	31	52.15	.....	
Rose.....	36	23	35.24	116	28	34.60	.....	
King.....	36	24	25.32	116	22	58.68	.....	
South Base, Amargosa.	36	22	35.64	116	24	01.36	2 160	
Watkins.....	36	22	55.63	116	21	48.53	.....	
Shoshone.....	36	22	57.92	116	18	51.53	2 157	
Hunch.....	36	19	23.07	116	17	12.88	2 793	
Pah.....	36	18	22.08	116	13	39.72	2 779	
T 105 High.....	36	16	33.77	116	15	01.44	3 937	
Rump.....	36	14	06.68	116	08	23.76	3 291	
Low.....	36	11	06.52	116	04	16.80	2 504	
End.....	36	10	21.45	116	06	15.30	2 766	
Crown.....	36	07	35.49	116	02	46.40	2 592	
Hard.....	36	05	15.09	116	04	56.47	2 820	
Manse.....	36	05	08.12	116	00	30.89	2 515	
Dell.....	36	03	02.27	116	02	40.10	2 780	
Blow.....	35	59	50.22	116	01	17.89	3 221	
Gap.....	35	58	45.93	115	57	32.59	2 541	
Ring.....	35	56	46.41	115	55	15.35	2 617	
Belle.....	35	52	35.93	115	47	35.90	2 984	
T 117 High.....	35	52	54.07	115	44	46.08	2 924	
Mag.....	35	51	21.82	115	45	40.94	2 870	
Jumbo.....	35	49	23.37	115	43	13.47	2 643	
Snow.....	35	48	54.44	115	41	20.74	2 645	
Move.....	35	46	13.22	115	43	41.74	2 893	
Martin.....	35	44	43.73	115	39	56.11	2 835	
Taylor.....	35	44	22.72	115	36	27.47	2 537	
Bullock.....	35	40	55.26	115	33	19.31	2 561	
Spanish.....	35	38	52.17	115	28	51.25	4 547	
T 123 High.....	35	40	05.23	115	27	49.58	4 723	
Well.....	35	35	45.72	115	25	07.29	2 592	
Skit.....	35	34	00.09	115	23	19.79	2 595	
Link.....	35	32	48.21	115	21	28.19	2 693	
Patch.....	35	31	42.03	115	22	02.64	2 592	
Storm.....	35	30	10.05	115	18	31.28	2 846	
T 128 High.....	35	27	33.91	115	12	37.06	4 092	
Palisade.....	35	26	31.77	115	13	52.92	3 564	
T 129 High.....	35	26	22.42	115	11	33.76	4 528	
Quartz Ledge.....	35	25	43.34	115	13	34.33	3 784	

F. GEOGRAPHIC POSITIONS AND HEIGHTS OF TRIANGULATION STATIONS—Continued.

[illegible]

APPENDIX NO. 3. BOUNDARY LINE BETWEEN CALIFORNIA AND NEVADA. 357

G. VALUES OF THE MAGNETIC DECLINATION ALONG THE CALIFORNIA AND NEVADA BOUNDARY LINE FROM LAKE TAHOE TO THE COLORADO RIVER.

[Observed in 1894, 1895, and 1899, under the direction of C. H. Sinclair, assistant, Coast and Geodetic Survey, and reduced to January 1, 1900.]

Station.	Latitude.	Longitude west of Greenwich.	Date.	Magnetic declination (east).		Observer.
				At date of observation.	On January 1, 1900.	
	° /	° /	1894.	° /	° /	
initial 1894	38 57'8	119 57'0	Aug. 18	16 29	.....	J. H. Mather.
T 1	38 57'6	119 56'7	Sept. 1	16 43	.....	Do.
T 3	38 56'4	119 54'9	Aug. 24	17 08	.....	Do.
T 4	38 56'3	119 54'8	do....	16 26	.....	Do.
T 5	38 55'9	119 54'3	Aug. 23	16 35	.....	Do.
T 6	38 55'7	119 53'9	do....	16 14	.....	Do.
T 7	38 55'5	119 53'6	Aug. 24	15 42	.....	Do.
Mean	38 56'5	119 55'0	.....	16 28	16 28	
T 8	38 52'8	119 49'8	Sept. 4	16 52	.....	Do.
T 9	38 52'2	119 48'8	Sept. 8	17 10	.....	Do.
T 10	38 51'7	119 48'1	Sept. 5	17 06	.....	Do.
T 11	38 51'2	119 47'4	do....	17 11	.....	Do.
T 12	38 50'3	119 46'2	Sept. 6	17 16	.....	Do.
T 13	38 50'1	119 45'9	Sept. 8	15 48	.....	Do.
T 14	38 49'8	119 45'4	Sept. 12	16 49	.....	Do.
Mean	38 51'2	119 47'4	.....	16 53	16 53	
T 15	38 48'8	119 44'0	Sept. 15	16 34	.....	Do.
T 16	38 48'6	119 43'6	do....	16 48	.....	Do.
T 17	38 48'0	119 42'7	Sept. 19	15 52	.....	Do.
T 18	38 47'3	119 41'7	do....	16 06	.....	Do.
T 19	38 46'8	119 41'1	do....	16 20	.....	Do.
T 20	38 46'4	119 40'5	do....	16 18	.....	Do.
Mean	38 47'6	119 42'3	.....	16 20	16 20	
T 22	38 43'7	119 36'6	Oct. 4	18 56	.....	Do.
T 23	38 42'2	119 34'5	Oct. 3	16 39	.....	Do.
T 24	38 41'1	119 32'9	Oct. 5	17 08	.....	Do.
T 25	38 40'3	119 31'7	do....	17 07	.....	Do.
T 27	38 39'0	119 29'8	do....	16 23	.....	Do.
Mean	38 41'3	119 33'1	.....	17 05	17 15	
T 28	38 37'6	119 27'9	Oct. 5	16 48	.....	Do.
T 29	38 34'8	119 23'7	Oct. 9	16 57	.....	Do.
T 30	38 33'4	119 21'8	Oct. 10	16 27	.....	Do.
T 31	38 32'7	119 20'8	do....	16 45	.....	Do.
T 32	38 30'5	119 17'6	Oct. 15	15 52	.....	Do.
Mean	38 33'8	119 22'4	.....	16 23	16 33	

G. VALUES OF THE MAGNETIC DECLINATION ALONG THE CALIFORNIA
AND NEVADA BOUNDARY LINE, ETC.—Continued.

Station.	Latitude.	Longitude west of Greenwich.	Date.	Magnetic declination (east).		Observer.
				At date of obser- vation.	On Janu- ary 1, 1900.	
	° /	° /	1894.	° /	° /	
T 33.....	38 27.4	119 13.3	Oct. 16	17 30	.....	J. H. Mather.
T 34.....	38 25.5	119 10.5	Oct. 21	16 33	.....	Do.
T 35.....	38 25.3	119 10.2	Oct. 16	16 39	.....	Do.
T 36.....	38 23.3	119 07.4	Oct. 23	16 37	.....	Do.
T 37.....	38 21.8	119 05.2	Oct. 30	15 18	.....	Do.
T 38.....	38 20.8	119 03.9	Oct. 29	16 24	.....	Do.
Mean	38 24.0	119 08.4	.....	16 30	16 30	
T 42.....	38 14.9	118 55.5	Nov. 7	*20 27	*20 27	Do.
T 39.....	38 19.1	119 01.4	Oct. 29	16 27	.....	Do.
T 40.....	38 17.0	118 58.5	Nov. 1	14 59	.....	Do.
T 43.....	38 13.9	118 54.1	Nov. 7	16 09	.....	Do.
T 44.....	38 12.9	118 52.7	do	16 55	.....	Do.
T 45.....	38 11.3	118 50.4	Nov. 8	15 17	.....	Do.
Mean	38 14.8	118 55.4	.....	15 57	15 57	
T 46.....	38 08.6	118 46.7	Nov. 8	16 16	.....	Do.
T 48.....	38 05.7	118 42.5	Nov. 9	17 35	.....	Do.
T 49.....	38 05.3	118 42.0	do	15 57	.....	Do.
T 50.....	38 02.9	118 38.6	Nov. 11	15 54	.....	Do.
T 53.....	37 59.8	118 34.2	Nov. 10	16 20	.....	Do.
Mean	38 04.5	118 40.8	.....	16 24	16 24	
T 58.....	37 55.9	118 28.8	Nov. 10	*13 42	13 42	Do.
			1895.			
T 59.....	37 54.1	118 26.4	July 2	16 22	.....	A. W. Cuddeback.
T 60.....	37 50.4	118 21.3	June 30	16 18	.....	Do.
T 61.....	37 48.6	118 18.7	June 26	17 35	.....	Do.
T 62.....	37 46.6	118 16.0	June 25	17 02	.....	Do.
T 63.....	37 45.3	118 14.2	July 9	16 18	.....	Do.
Mean	37 49.0	118 19.3	.....	16 43	16 43	
T 64.....	37 44.8	118 13.4	June 24	16 26	.....	Do.
T 65.....	37 44.0	118 12.3	July 30	16 19	.....	Do.
T 66.....	37 42.5	118 10.3	July 4	15 55	.....	Do.
T 67.....	37 40.1	118 07.0	Aug. 3	16 16	.....	Do.
T 67½.....	37 37.6	118 03.5	July 26	16 08	.....	Do.
Mean	37 41.8	118 09.3	.....	16 13	16 13	

* Local disturbance.

G. VALUES OF THE MAGNETIC DECLINATION ALONG THE CALIFORNIA AND NEVADA BOUNDARY LINE, ETC.—Continued.

Station.	Latitude.	Longitude west of Greenwich.	Date.	Magnetic declination (east).		Observer.
				At date of observation.	On January 1, 1900.	
	° /	° /	1895.	° /	° /	
T 68.....	37 36.3	118 01.8	July 26	16 20	.....	A. W. Cuddeback.
T 69.....	37 35.3	118 00.3	Aug. 6	16 18	.....	Do.
T 70.....	37 34.8	117 59.7	do	17 24	.....	Do.
T 71.....	37 34.3	117 59.0	do	16 08	.....	Do.
T 72.....	37 32.6	117 56.7	do	16 13	.....	Do.
Mean	37 34.7	117 59.5	.....	16 29	16 29	
T 73.....	37 30.7	117 54.0	Aug. 7	16 37	.....	Do.
T 74.....	37 29.6	117 52.6	do	16 26	.....	Do.
T 75.....	37 28.1	117 50.5	do	16 14	.....	Do.
T 76.....	37 27.7	117 49.9	do	16 02	.....	Do.
T 77.....	37 27.0	117 49.0	do	16 15	.....	Do.
Mean	37 28.6	117 51.2	.....	16 19	16 19	
T 78.....	37 25.0	117 46.3	Aug. 12	16 10	.....	Do.
T 79.....	37 23.1	117 43.7	do	16 34	.....	Do.
T 80.....	37 20.2	117 39.8	Aug. 16	15 53	.....	Do.
T 82.....	37 14.5	117 32.1	Aug. 22	15 57	.....	Do.
T 83.....	37 11.9	117 28.6	Aug. 28	17 07	.....	Do.
Mean	37 18.9	117 38.1	.....	16 20	16 20	
T 86.....	37 07.0	117 22.0	Oct. 18	*20 58	20 58	Do.
T 84.....	37 10.7	117 26.9	Aug. 26	15 55	.....	Do.
T 85.....	37 09.6	117 25.4	Aug. 29	16 10	.....	Do.
T 88.....	37 03.1	117 16.7	Oct. 17	16 33	.....	Do.
T 89.....	36 59.8	117 12.3	Oct. 18	15 56	.....	Do.
Mean	37 05.8	117 20.3	.....	16 08	16 08	
T 90.....	36 57.4	117 09.0	Sept. 6	16 08	.....	Do.
T 91.....	36 54.5	117 05.2	Sept. 7	16 12	.....	Do.
T 92.....	36 52.5	117 02.5	Sept. 20	16 09	.....	Do.
Mean	36 54.8	117 05.6	.....	16 10	16 10	
T 94.....	36 43.5	116 50.5	Oct. 9	15 52	.....	Do.
T 95.....	36 42.3	116 49.0	do	15 37	.....	Do.

* Local disturbance.

*G. VALUES OF THE MAGNETIC DECLINATION ALONG THE CALIFORNIA
AND NEVADA BOUNDARY LINE, ETC.—Continued.*

Station.	Latitude.	Longitude west of Greenwich.	Date.	Magnetic declination (east).		Observer.
				At date of obser- vation.	On Janu- ary 1, 1900.	
	° /	° /	1895.	° /	° /	
T 96.....	36 40'2	116 46'2	Oct. 8	15 47	.....	A. W. Cuddeback.
T 97.....	36 36'5	116 41'4	Oct. 10	15 36	.....	Do.
T 98.....	36 34'8	116 39'1	do....	15 30	.....	Do.
Mean	36 39'5	116 45'2	.....	15 40	15 40	
			1899.			
T 98.....	36 34'8	116 39'1	Mar. 18	15 35	.....	F. W. Edmonds.
T 99.....	36 31'4	116 34'6	Mar. 17	15 18	.....	Do.
T 100.....	36 28'6	116 30'9	do....	15 18	.....	Do.
T 101.....	36 25'9	116 27'5	Mar. 16	15 22	.....	Do.
Mean	36 30'2	116 33'0	.....	15 23	15 23	
T 102.....	36 23'4	116 24'1	Mar. 16	15 19	.....	Do.
T 103.....	36 21'1	116 21'2	Mar. 15	15 12	.....	Do.
T 104.....	36 19'5	116 19'1	do....	15 02	.....	Do.
T 106.....	36 14'6	116 12'7	Mar. 14	15 05	.....	Do.
Mean	36 19'6	116 19'3	.....	15 10	15 10	
T 107.....	36 12'1	116 09'5	Mar. 13	15 19	.....	Do.
T 108.....	36 10'3	116 07'1	Mar. 11	15 08	.....	Do.
T 109.....	36 07'3	116 03'2	do....	15 02	.....	Do.
T 110.....	36 05'2	116 00'5	do....	15 22	.....	Do.
Mean	36 08'7	116 05'1	.....	15 13	15 13	
T 111.....	36 02'8	115 57'4	Mar. 10	15 07	.....	Do.
T 112.....	36 00'7	115 54'8	Mar. 12	15 12	.....	Do.
T 113.....	36 00'2	115 54'1	Mar. 10	14 56	.....	Do.
T 114.....	35 58'9	115 52'4	do....	15 16	.....	Do.
T 115.....	35 57'7	115 50'9	do....	14 59	.....	Do.
Mean	36 00'1	115 53'9	.....	15 06	15 06	
T 116.....	35 55'7	115 48'3	Mar. 7	15 19	.....	Do.
T 117 (high)....	35 52'9	115 44'8	do....	15 04	.....	Do.
T 119.....	35 48'4	115 39'1	Mar. 6	14 56	.....	Do.
T 120.....	35 47'1	115 37'4	do....	14 52	.....	Do.
Mean	35 51'0	115 42'4	.....	15 03	15 03	

G. VALUES OF THE MAGNETIC DECLINATION ALONG THE CALIFORNIA AND NEVADA BOUNDARY LINE, ETC.—Continued.

Station.	Latitude.	Longitude west of Greenwich.	Date.	Magnetic declination (east).		Observer.
				At date of observation.	On January 1, 1900.	
	° /	° /	1895.	° /	° /	
T 121.....	35 45.1	115 34.8	Mar. 8	14 51	.....	F. W. Edmonds.
T 122.....	35 42.7	115 31.8	Mar. 6	14 57	.....	Do.
T 124.....	35 39.5	115 27.7	Mar. 5	15 02	.....	Do.
T 125.....	35 36.3	115 23.7	Mar. 3	14 52	.....	Do.
Mean	35 40.9	115 29.5	.....	14 56	14 56	
T 127.....	35 31.5	115 17.5	Mar. 4	*11 39	*11 39	Do.
T 130 (high)....	35 24.1	115 08.5	Feb. 27	14 37	.....	Do.
T 132.....	35 21.0	115 04.3	do.....	13 35	.....	Do.
T 133.....	35 18.5	115 01.2	Feb. 25	15 39	.....	Do.
Mean	35 21.2	115 04.6	.....	14 37	14 37	
On line between T 134 and T 135.	35 11.5	114 52.4	Feb. 21	15 11	.....	Do.
T 135.....	35 09.6	114 50.0	do.....	14 10	.....	Do.
T 138.....	35 06.8	114 46.6	Feb. 18 } Feb. 20 }	14 52	.....	Do.
T 139.....	35 06.0	114 45.6	Feb. 18	14 37	.....	Do.
Mean	35 08.5	114 48.6	.....	14 42	14 42	
T 141.....	35 02.2	114 40.9	Feb. 17	14 10	.....	Do.
T 142.....	35 01.3	114 39.8	do.....	14 19	.....	Do.
Von Schmidt 35° E. latitude post.	35 00.3	114 39.4	Feb. 16	14 06	.....	Do.
Mean	35 01.3	114 40.0	.....	14 12	14 12	

* Local disturbance.

The above observations were made with Coast and Geodetic Survey Compass Declinometer No. 741; they have all been referred to the mean value per day (24 hours).

RECAPITULATION OF MEAN VALUES OF MAGNETIC DECLINATIONS ALONG
BOUNDARY LINE.

Stations.	Latitude.	Longitude west of Green- wich.	Magnetic declination east Jan. 1, 1900.
Initial 1894, T 1, T 3, T 4, T 5, T 6, T 7.....	38 56.5	119 55.0	16 28
T 8, T 9, T 10, T 11, T 12, T 13, T 14.....	38 51.2	119 47.4	16 53
T 15, T 16, T 17, T 18, T 19, T 20.....	38 47.6	119 42.3	16 20
T 22, T 23, T 24, T 25, T 27.....	38 41.3	119 33.1	17 15
T 28, T 29, T 30, T 31, T 32.....	38 33.8	119 22.4	16 33
T 33, T 34, T 35, T 36, T 37, T 38.....	38 24.0	119 08.4	16 30
T 39, T 40, T 43, T 44, T 45.....	38 14.8	118 55.4	15 57
T 46, T 48, T 49, T 50, T 53.....	38 04.5	118 40.8	16 24
T 59, T 60, T 61, T 62, T 63.....	37 49.0	118 19.3	16 43
T 64, T 65, T 66, T 67, T 67½.....	37 41.8	118 09.3	16 13
T 68, T 69, T 70, T 71, T 72.....	37 34.7	117 59.5	16 29
T 73, T 74, T 75, T 76, T 77.....	37 28.6	117 51.2	16 19
T 78, T 79, T 80, T 82, T 83.....	37 18.9	117 38.1	16 20
T 84, T 85, T 88, T 89.....	37 05.8	117 20.3	16 08
T 90, T 91, T 92.....	36 54.8	117 05.6	16 10
T 94, T 95, T 96, T 97, T 98.....	36 39.5	116 45.2	15 40
T 98, T 99, T 100, T 101.....	36 30.2	116 33.0	15 23
T 102, T 103, T 104, T 106.....	36 19.6	116 19.3	15 10
T 107, T 108, T 109, T 110.....	36 08.7	116 05.1	15 13
T 111, T 112, T 113, T 114, T 115.....	36 00.1	115 53.9	15 06
T 116, T 117, T 119, T 120.....	35 51.0	115 42.4	15 03
T 121, T 122, T 124, T 125.....	35 40.9	115 29.5	14 58
T 130, T 132, T 133.....	35 21.2	115 04.6	14 37
(T 134, T 135), T 135, T 138, T 139.....	35 08.5	114 48.6	14 42
T 141, T 142, Von Schmidt, 35° E. latitude post.....	35 01.3	114 40.0	14 12
Carson City, Nev., pavilion grounds.....	39 10	119 46	16 36
Lake Tahoe, southeast end California Astronomic Station.....	38 57	119 57	17 00

The last two results were obtained by theodolite magnetometer on three days at each station.

H. RESULTS FOR LATITUDE OF STATION NEEDLES, CAL., 1889.

[Observer, C. H. Sinclair. Date, June, 1889. Instrument, meridian instrument No. 2. Level, 1 division = 0".91. Micrometer, 1 revolution = 65".818. Number pairs, 21. Number observations, 69.]

Pairs of stars, C. and G. S. Catalogue.	n .	w .	Latitude.	Extremes.
			° ' "	
1162 1191	1	2	34 50 17.24	
1183 1191	2	5	17.49	
1197 1201	3	5	18.26	
1201 1215	3	6	17.75	
1232 1236	3	8	16.87	
1237 1254	3	5	17.98	
1237 1260	3	5	18.41	
1265 1276	3	8	17.54	
1296 1300	4	9	18.91	
1303 1315	4	10	17.36	
1325 1328	4	9	18.27	
1333 1335	4	10	18.10	
1347 1350	4	10	16.02	Minimum.
1359 1362	3	8	18.41	
1369 1371	3	7	20.48	Maximum.
1383 1396	3	7	18.36	
1410 1418	4	10	17.49	
1432 1443	4	5	17.13	
1437 1443	4	5	18.10	
1443 1449	4	5	18.14	
1460 1464	3	8	17.98	
Mean			34 50 17.92	

Weighted mean, $34^{\circ} 50' 17''.90 \pm 0''.14$.

Reduction to longitude pier $+ 00''.27$.

Latitude of longitude station, $34^{\circ} 50' 18''.17 \pm 0''.14$.

I. RESULTS FOR LATITUDE, VON SCHMIDT'S EAST POST, COLORADO RIVER,
1893.

[Observer, C. H. Sinclair. Date, May, 1893. Instrument, zenith telescope, No. 6. Number of pairs, 18. Number of observations, 87.]

Pairs of stars, C. and G. S. Catalogue.		n.	w.	Latitude.			Δ
				°	'	"	"
1056	1067	3	9	35	00	14'74	+0'28
1073	1084	5	9			15'74	- '72
1097	1100	5	13			15'25	- '23
1121	1131	5	11			15'22	- '20
1129	1133	5	13			16'11	-1'09
1142	1150	5	13			14'38	+ '64
1154	1175	5	4			14'90	+ '12
1182	1184	5	13			14'99	+ '03
1191	1203	5	13			15'09	- '07
1208	1216	5	11			14'95	+ '07
1232	1236	5	13			14'32	+ '70
1241	1254	5	12			15'51	- '49
1260	1265	5	12			14'97	+ '05
1276	1291	5	13			14'71	+ '31
1308	1313	5	11			14'70	+ '32
1320	1326	5	9			15'20	- '18
1324	1326	5	9			15'11	- '09
1335	1341	4	10			14'54	+ '48
Mean				50	00	15'02	

Weighted mean, $35^{\circ} 00' 15''.02 \pm 0''.08$.

Station on a bluff of sand and gravel on the west bank of the Colorado River, about 15 meters above the water and about 40 meters from its edge. It is also in the latitude of Von Schmidt's east post of 1873, which is supposed to have been intended for the parallel of 35° N. latitude. A concrete pier was built in 1893, 18 inches by 18 inches by 5 feet long (3 feet above ground), 5.87 meters due west of this post for zenith-telescope No. 6. The station (post) is connected by triangulation with the astronomic station at Needles, Cal., occupied in 1889 by Assistant C. H. Sinclair.

J. RESULTS FOR LATITUDE, SOUTHEAST END OF LAKE TAHOE, CALIFORNIA, 1893.

[Date, August, 1893. Observer, C. H. Sinclair. Instrument, zenith telescope, No. 6, focal length 66 cm., aperture 5 cm. 1 division latitude level = $2''\cdot172$. Value 1 turn micrometer, $76''\cdot172$ from observations on δ Ursa Minoris U. C., August 21, 1893. Number of pairs, 22. Number of observations, 108.]

Pairs of stars. B. A. C. Catalogue.	<i>n</i> .	<i>w</i> .	Latitude.	Δ
			° ' "	"
5940 5972	4	15	38 57 19'88	- '10
6005 (1484)	5	14	20'75	- '93
6069 6114	5	13	19'92	- '14
6109 (1521)	5	14	19'31	+ '47
(1533) (1536)	5	10	19'35	- '43
6246 18083 P.	5	12	19'82	- '04
6246 18084 P.	5	12	19'77	+ '01
6355 G. 2644	5	11	19'46	- '32
6355 6391	5	14	19'76	+ '02
1590 3461	5	6	20'76	- '98
6478 6471	5	16	20'07	- '29
6563 6597	5	15	19'41	+ '37
6615 6662	5	17	19'97	- '19
6670 6702	5	13	19'97	- '19
G. 2900 6715	4	14	19'80	- '02
6731 6784	5	16	19'10	+ '68
6834 6868	5	14	19'38	+ '40
6926 (1768)	5	15	19'78	'00
(1776) 6976	5	13	19'61	+ '17
G. 3133 7008	5	9	19'44	+ '34
7022 7061	5	16	20'20	- '42
7098 7149	5	18	19'59	+ '19
Mean			38 57 19'78	

Weighted mean, $38^{\circ} 57' 19''\cdot76 \pm 0''\cdot06$.

The station was 50 inches due west of the longitude pier, which is $61\frac{1}{2}$ feet south and 33 feet west of the second granite monument of Von Schmidt, 1873, which is therefore in latitude $38^{\circ} 57' 20''\cdot37$, longitude $119^{\circ} 59' 47''\cdot020$ ($0''\cdot028$ east of the longitude pier southeast side of Lake Tahoe).

*K. DIFFERENCE OF LONGITUDE BETWEEN LOS ANGELES, CAL., AND
NEEDLES, CAL.*

Date.	Observer at—		From western or Los An- geles sig- nals.	From eastern or Needles signals.	W.-E.	Mean of W. and E. signals.	Per- sonal equa- tion.	Difference of longi- tude ΔA .	ρ .	ν .
	Los Angeles.	Needles.								
1889.			m. s.	m. s.	s.	m. s.	s.	m. s.		
May 22	R. A. Marr.	C. H. Sin- clair.	14 37'052	14 37'005	0'047	14 37'028	-0'282	14 36'746	6	-0'010
23	do	do	36'996	36'956	'040	36'976		'694	8	-'062
24	do	do	37'030	36'988	'042	37'009		'727	6	-'029
June 1	do	do	37'014	36'976	'038	36'995		'713	6	-'043
5	do	do	37'229	37'174	'055	37'202		'920	6	+'164
Mean.					'044	14 37'042				
June 7	C. H. Sin- clair.	R. A. Marr.	14 36'439	14 36'396	'043	14 36'418	+0'282	7'00	6	+'056
8	do	do	'532	'497	'041	'511		'793	6	+'037
12	do	do	'504	'474	'030	'489		'771	4	+'015
13	do	do	'507	'459	'048	'483		'765	2	+'009
15	do	do	'549	'497	'052	'523		'805	3	+'049
16	do	do	'466	'432	'032	'449		'731	4	+'025
Mean.					'041	14 36'479		14 36'760		

Weighted mean, $14^m 36^s.756 \pm 0^s.013$.

Transmission time, $0^s.021 \pm 0^s.001$.

Personal equation, S.-M. = $+0^s.282 \pm 0^s.018$.

At Los Angeles transit No. 19 was placed over the station in the grounds of the normal school.
At Needles transit No. 18 was mounted over a station in the inclosure of the Catholic church.

Adjusted longitude of Needles, Cal., $7^h 38^m 24^s.836$ west from Greenwich.

*L. DIFFERENCE OF LONGITUDE BETWEEN LAKE TAHOE, CALIFORNIA,
AND CARSON CITY, NEV.*

Date.	Observations at—		From western or Lake Tahoe sig- nals.	From eastern or, Carson City sig- nals.	W.-E.	Mean of W. and E. signals.	Per- sonal equa- tion.	Difference of longi- tude ΔA .	ρ .	ν .
	Lake Tahoe.	Carson City.								
1893.			m. s.	m. s.	s.	m. s.	s.	m. s.		s.
Aug. 3	C. H. Sin- clair.	G. David- son.	0 44'432	0 44'431	0'001	0 44'432	-0'358	0 44'074	3	-0'035
4	do	do	'496	'493	'003	'494		'136	3	+'027
6	do	do	'482	'473	'009	'478		'120	7	+'011
7	do	do	'476	'476	'000	'476		'118	4	+'009
8	do	do	'447	'436	'011	'441		'083	3	-'026
Mean.					'005	0 44'464				
Aug. 9	G. David- son.	C. H. Sin- clair.	0 43'794	0 43'785	'009	0 43'789	+0'358	0 44'147	4	+'038
17	do	do	'739	'732	'007	'735		'093	6	-'016
12	do	do	'748	'741	'007	'744		'102	9	-'007
Mean.					'008	0 43'756		0 44'109		

Weighted mean, $0^m 44^s.109 \pm 0^s.006$.

Reduction to transit, Friend's Observatory — $0^s.022$.

$\Delta\lambda$ Lake Tahoe, southeast end T_{1893} — Carson City, Friend's Observatory $T_{1889} = 0^m 44^s 08.7 \pm 0^s 00.6$.
Transmission time $= 0^s 00.3 \pm 0^s 00.05$.

Personal equation, $D-S = -0^s 35.4 \pm 0^s 00.6$; same from weighted means $= -0^s 35.8$. A large but reliable value.

At Lake Tahoe transit No. 18 was mounted upon a brick and cement pier on the east side of the road from Bijou post-office to Glenbrook, near Lake Side Tavern. The pier is $61\frac{1}{2}$ feet south and 33 feet west of the granite monument of Von Schmidt, marked 211 miles 30 chains, counting from Oregon.

At Carson City the station was a brick pier 0.803 meters north and 8.015 meters ($= 0^s 02.2$) east of the transit pier in Friend's Observatory. Transit No. 19 was mounted on this pier.

Longitude of transit pier southeast end Lake Tahoe (observed), $7^h 59^m 47^s 04.8$.

Longitude of transit, Friend's Observatory, Carson City (observed), $7^h 59^m 02^s 96.1$.

Latitude of transit, Friend's Observatory, Carson City (observed), $39^{\circ} 09' 47'' 50 \pm 0'' 06$.

V. DESCRIPTION OF ASTRONOMIC TRANSITS NO. 18 AND NO. 19.

[See illustration No. 12.]

These instruments were constructed at the Office of the United States Coast and Geodetic Survey in Washington, D. C., in 1887-88. They were made as nearly alike as possible; aperture, 3 inches; focal length, 37 inches; magnifying power about 104; glass diaphragm with 2 horizontal and 13 vertical lines, of which 11 were used for time observations, arranged in 3 tallies of 3, 5, and 3 lines each, and 2 outside lines for eye and ear observations, the star being confined between the horizontal lines while transiting; equatorial intervals about 2.5 seconds; diameter of pivots $1\frac{1}{4}$ inches; the pivots rest along their entire length in the Ys; the azimuth and level adjustments are made at the base of the iron stand supporting the Ys; the iron stand rests upon an iron sub-base to which it is attached by 3 holding-down screws, of which 2 are in slots to permit adjustment in azimuth; the sub-base is fastened to the pier with plaster of paris or cement. Striding level of No. 18 one division equals 1.674, of No. 19 equals 1.85 seconds of arc.

For longitude work the observations are recorded on a Fauth cylinder chronograph (see illustration No. 13) by means of an observing key held in the hand of the observer, who breaks the electric circuit as the star crosses each line of the diaphragm of the transit. During the exchange of longitude signals the chronograph is made to revolve at double speed so that the signals may be read to 0.01.

A sidereal break-circuit chronometer is used to make the chronographic record at regular intervals of one or two seconds, the transits of stars being on the same sheet.

VI. APPENDIX.

A. LETTER OF THE SUPERINTENDENT TO PROFESSOR DAVIDSON.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE SUPERINTENDENT,
Washington, D. C., March 8, 1893.

DEAR PROFESSOR DAVIDSON: Yours relating to the proposed survey of the Nevada-California boundary line has been under consideration for some time. I submitted it to Mr. Schott, requesting him to make a full memorandum of his views on the best method of doing the work. His reply is extremely interesting, and I send you a copy of it herewith.

I am strongly inclined to the "geodetic method" of locating the line, that is, by means of a system of triangulation connecting the two extremities, provided it does not prove to be too expensive. Local deflection is likely to introduce such errors into the determination of astronomical positions that the result would never be entirely satisfactory. I wish you would read the paper carefully and send me your views at your early convenience. In the meantime the location of the extremities of the line might be gone into. It is only the *oblique* portion of the line that we are required to survey. Undoubtedly the meridian north from Lake Tahoe is in error, but the appropriation does not provide for this. If found to be a serious matter it may be corrected in the future. Within a month Mr. Sinclair and Mr. Walter Fairfield will be available for this work and will be directed to report to you. Mr. Sinclair will be in the "neighborhood" of the southern extremity of the line, and he might receive instructions to look into the matter there, as to the existence and whereabouts of the monument and other matters relating thereto, without reporting to you in person. He might also connect our telegraphic longitude station at Needles with the boundary point and proceed with the determination of the southern point. Mr. Fairfield might also begin operations in the vicinity of Lake Tahoe. Here it will probably be necessary to establish a telegraph line from one of our stations to the shore of the lake, and the latitude and longitude of a point on the shore as near the presumable intersection of the boundary line as possible must be ascertained. All of this work can be done independent of any decision as to how the line itself is to be run.

About \$5 000 will be available, and I would like to see it judiciously expended before July 1. If not possible to expend all of it wisely in the field, it might be invested in material, supplies, equipment, camp, etc., which would be required after July 1.

I will be glad to hear from you with reference to these matters at an early date.

Yours, faithfully,

Prof. GEORGE DAVIDSON,

Suboffice Coast and Geodetic Survey, San Francisco, Cal.

T. C. MENDENHALL, *Superintendent.*

*B. LETTER OF ASSISTANT C. A. SCHOTT TO THE SUPERINTENDENT ON
GEODETIC LINES.*

COMPUTING DIVISION,

UNITED STATES COAST AND GEODETIC SURVEY,

Washington, D. C., February 28, 1893.

Dr. T. C. MENDENHALL,

Superintendent United States Coast and Geodetic Survey.

SIR: The letter submitted to you by Assistant Davidson on the California and Nevada line does not exaggerate the difficulties to be encountered in marking it, yet there are some points, either lightly or not at all touched upon, in that letter which I deem of importance, and beg leave to submit them for consideration.

I. LOCAL DEFLECTION.

The line is to begin at the intersection of the one hundred and twentieth degree of longitude with the thirty-ninth degree of latitude, thence to run in a *straight* line to a point where the channel of the Colorado crosses the thirty-fifth degree of latitude. These termini fall in the water and are inaccessible. The first step to be taken is the fixation of two points on terra firma *nearest to them* and *in* the junction line. To do this we have to decide whether the law contemplates astronomic or geodetic data; in other words, is the line to be run *with* or *without* local deflections, that is, is it to be a wavy and irregular line or a straight and smooth one; the law calls for a "straight line." Let us see, however, what these local deflections amount to:

Average local deflection from 59 latitudes, Maine to Georgia. (Appendix 8, Report	"
1879)	+ 2'9
Same, from 48 azimuths	+ 4'2
Average local deflection from 31 latitudes, central California to Santa Barbara	± 4'8
Same from 24 azimuths	± 4'8

Taking the value $\pm 4''$, it amounts to 123 meters, or about 400 feet, on the average, and to three times this amount in extreme cases. When the astronomic latitude and longitude is specified for

each of two points their relative true position may be out several hundred feet, as found by their geodetic latitude and longitude; in fact, we can not get the real azimuth and distance of the line joining them so long as they are laid down astronomically only, the local deflections being included; this is our case. What sort of a line, then, would we get by starting from an astronomical end point (charged with local deflection in latitude and longitude) with a local deflection azimuth and try to reach, by alternate forward and backward sighting, the opposite end, likewise charged with local deflections, as well as every intermediate point of our line where the instrument was set up, its verticality depending on the local azimuth? The surveyor may find himself several hundred feet out of line and not know whether this was due to defective work or purely difference of local deflections.

Suppose we have placed our two auxiliary end monuments in position (by astronomic or geodetic means) we must connect them by triangulation if we require to know their distance apart and *direction*; the mere computing based upon *disconnected* latitudes and longitudes will land us in the above local-deflection uncertainty. Hence to locate the line accurately demands triangulation from one end to the other. Indeed, we have already a triangulation point—White Mountain N., located by Assistant Eimbeck, in or close to the line about 115 miles from Lake Tahoe.

The triangulation being effected, any desired number of points in the line may be located with accuracy, triangulation being independent of local deflection. A surveyor attempting to follow the line by sighting will soon find himself stopped by obstructions ranging above 12 900 feet (White Mountains) of elevation (Lake Tahoe is 6 224 feet above the sea and the Colorado River at Fort Mohave 514 feet) and would have to resort to a local triangulation, as Assistant Davidson has already pointed out; further, should he attempt to take up a new (verification) azimuth it would not be completed without a knowledge of his latitude and longitude. The former he may observe, the latter get from distance run and direction of line. His assigned distance will be too rough (for instance; he has to climb within 4 miles of Lake Tahoe, an altitude of nearly 3 200 feet, and come down again at the other side of the spur; also the incline will have to be allowed for). The number of permanent monuments in the line may be estimated by the consideration that about 20 miles should be their greatest distance apart, so that a surveyor setting up his transit at one end of them may get a sight forward and backward over the line; further monuments are required where a road crosses the line, and in particular where obstructions limit the length of the sight. For 400 miles 20 monuments and for special sights perhaps as many more would be needed.

* * * * *

2. VARIETY OF LINES BETWEEN THE TERMINALS.

As to the kind of line between two points *not intervisible*, contemplated by the law givers, their term "straight" line may be interpreted to mean any of the following eight theoretical lines, viz:

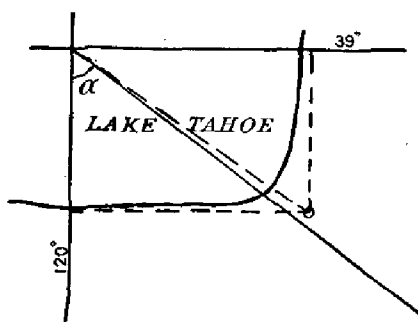
- (a) The intersection of the surface by a plane through the normal at one end (A), and through the other end (B). It is a plane elliptic arc.
- (b) A similar plane curve passing through the normal of B and through A. These two curves will be distant at about the middle of our line, say 202 miles from either end, by only 1^m.83 or 6 feet (see my report of July 17, 1885), and the angles contained between these arcs at A and B will be 2''45 and 2''19 (see my report of January 6, 1890).
- (c) A line called "line of alignment" by Clarke, defined by the property that at every point in it the azimuths of A and B are 180° apart, and it is important to observe that no other three points in the line possess this π property. It is a tortuous curve closely approaching—
- (d) The geodetic or shortest line between A and B; it has no element in common with either (a), (b), or (c).
- (e) A forward straight line starting in the plane through the normal at A and through B, and in advancing keeping B constantly sighted.
- (f) A forward sight line starting at B as above; these lines are distinct and tortuous.
- (g) A forward and backward sight line over limited distances, i. e., in which the azimuths of the *nearest points* forward and backward equal π , and which has been contemplated in speaking of the direct tracing out of our line. It is simply a composition of a series of lines each having the character of (e).

(4) A line of the same kind as preceding, but starting from the opposite end. The two lines are distinct. It can also be asserted that the length of these lines are practically equal, no one difference amounting to a millimeter, and 6 of these lines are packed in between the first two plane arcs. Hence it is immaterial which of these curves the computer may adopt, and in particular for the above steps of 20 miles they are absolutely undistinguishable one from the other. We may take then the geodetic line, or we may use the formulæ on page 463, Appendix 9, Report for 1885, which are quite rigorous enough, after they have been accommodated to the *inverse* problem.

Let us now examine the method of locating the *end points at Lake Tahoe* and near Mohave*, both from an astronomic and from a geodetic point of view.

3. THE LAKE TAHOE TERMINAL CONSIDERED ASTRONOMICALLY.

Select a point on the shore and as near as may be in the line. It will probably be less than 5 miles from the intersection of latitude 39° and longitude 120° . Observe here an astronomic latitude and an astronomic longitude, the latter by means of transfer of the nearest telegraphic longitude station, viz, at Genoa. It is but $6\frac{1}{2}$ miles distant in an air line, but separated from our line by a high



range of mountains (the pass is 3 300 feet above the lake); hence to get the difference of longitude by wire, by rockets, by azimuthal difference, or by chronometers would be equally difficult or impracticable. Suppose, however, we have it; hence also the dotted line (in figure).

To get a point on the boundary line we must necessarily know the azimuth of the boundary line. This can only be had approximately, as we do not know the difference in the local deflections of the end points of the line; my calculations make it $48^\circ 41' 29''\cdot6$, the longitude of the Colorado end being given (in 1885) as $114^\circ 37' 53''\cdot5$; but with the later longitude, $114^\circ 38' 45''\cdot3$, as given me in 1890, azimuth becomes $48^\circ 40' 23''\cdot0$; thus a few feet (7) of uncertainty will enter in our problem, one or the other

longitude being assumed correct (may be neither is so). The solution of a spherical triangle with difference of latitude (say) as a side and angles, α and $\frac{\pi}{2}$, gives a point in the boundary line;

comparing this point with the astronomic point, the direction and azimuth, the latter is to be shifted to get in line, becomes known. We thus secure the first boundary monument. The two maps referred to show a nonconformity with the law, inasmuch as the boundary line when produced backward fails to intersect latitude 39° in longitude 120° , but intersects in $120^\circ 00' 45''$ nearly; the actual line is accordingly three-fourths of a mile too far west, taking off that much from California. Now it was known since 1874 (see my report of April 8 1874) that the boundary monument at Verdi was in longitude $120^\circ 00' 48''\cdot6$, and this seems to be the explanation for the difference shown on the map, the topography of which is correct, but not so the boundary line. There is no telling whether or not that erroneous longitude marked at Verdi was correctly transferred south to the lake; most likely not, since Assistant Davidson notes a heavy difference *north* of Verdi in latitude 42° . With this meridional boundary line, however, we are not concerned at present.

4. THE LAKE TAHOE TERMINAL CONSIDERED GEODETICALLY.

Locate a point geodetically near the boundary and place the same in line as before, and the first boundary monument is secured. Not to depend on the present geodetic data of the triangulation, the later telegraphic longitude stations, Verdi, Virginia City, Carson City, and Genoa, should all be connected with the triangulation, a work which has to be done anyhow as part of the survey of the

*For Lake Tahoe, see Wheeler's topographical maps, United States Geological Surveys, scale 1 inch to the mile, and Atlas sheet No. 56 B. For Mohave, see sheet No. 74; also Explorers and Surveyors, War Department, Rio Colorado of the West, map No. 1, 1858. For intermediate parts of the line see maps Nos. 56 B, 57, and 66.

thirty-ninth parallel; it is already nearly three years since these longitudes were determined, and there is danger of losing the stations. The best sketch showing the triangulation is No. 10, Report for 1890, and there is Assistant Eimbeck's reconnaissance sketch of 1875. The only astronomical work required would be the measure of an azimuth at the boundary monument. The positions of a number of secondary triangulation stations (unoccupied) are already known, as *Peavine*, *Washoe*, *Sage*, *Saddle*, *Freels*, *Cary's*, etc.

5. THE COLORADO RIVER TERMINAL, CONSIDERED ASTRONOMICALLY AND GEODETICALLY.

Here we have the same problem and similar considerations as at the Tahoe end, only further complicated by the uncertainty of the boundary monument, it may or may not be in existence now; if not, it is to be reestablished as the course of the river was at a certain given former time or as it is found now. The required azimuth here is $134^{\circ} 32' 09'' \cdot 8$ or $134^{\circ} 33' 09'' \cdot 3$. The latitude and longitude of the monument may be had from a triangulation of about a dozen miles from Needles and the longitude must be had from the telegraphic longitude of Needles, viz: $114^{\circ} 36' 11'' \cdot 0$ nearly (Sinclair 1889). At the beginning of the line latitude and azimuth also should be observed. The latitude of the Needles is $34^{\circ} 50' 17'' \cdot 90 \pm 0'' \cdot 14$ (Sinclair, 1889). Fort (or camp) Mohave, Arizona, is said to be in latitude $35^{\circ} 02' 09'' \cdot 0$ and longitude $114^{\circ} 35' 54'' \cdot 0$ (Wheeler* in 1875 by connection with *iron monument* of California boundary, an important remark). The Colorado at Mohave was reached by Captain Sitgreaves in 1852, by Lieutenant Ives in 1858, and by Lieutenant Wheeler in 1871, and there is more than one topographic sketch of the river at that point extant (see illustrations Nos. 1, 4, 5, 10, and 57). Mohave is about $2\frac{1}{2}$ miles from the boundary terminus. (See also Wheeler's map of the Grand Cañon of the Colorado, 1871.) The positions of the two terminal line monuments being thus established the whole line may be run—

- (1) By successive steps, starting from astronomic data and following the line in the manner already considered, and taking our chances to meet properly in the middle.
- (2) By connecting the two terminal line monuments by triangulation (and computing the position of the line accurately) and locating in or close to it a number of points by triangulation, say 50 miles apart, and at all special points, and ascertaining by computation how far, and in what direction each is off the line, and finally placing them in the line.

The intervening line spaces can be run direct as in the first case. Here we have absolute certainty to succeed.

To make the geodetic connection of the end monuments two courses are open, one to follow the line via Conness triangulation point and Lone Mountain triangulation point southeastward, and the other to start from Utah on the line Pioche triangulation point and Tushar triangulation point where three peaks are indicated about latitude 37° and follow along the Utah-Nevada boundary southward. To reach the Colorado end by this route is considered by Assistant Eimbeck as perfectly feasible and it strikes me to be preferable to the other route, probably involving less exposure.

To sum up this somewhat lengthy dissertation, the *modus operandi*—i. e., whether it should be of a more astronomical or geodetical character, is first to be decided; this done there will be needed to place in the field "the Lake Tahoe party" to connect the telegraphic longitude stations with the primary triangulation and to establish the first boundary monument; also to start a second party, "the Colorado-Mohave party," to connect the astronomical station Needles with the boundary monument after locating the latter; and if geodetic connection is resolved upon to start a third party, "the California-Nevada or the Nevada-Utah triangulation party," as the case may be, to connect the two end monuments of the line; and lastly, to send into the field at least two parties to run the line or locate the line itself. Three years will be consumed, even with *full means*, and more years will be needed with inadequate annual means (of *men and money*). A total expenditure of \$40,000 may be taken as a minimum with which to accomplish the work, one of the most difficult that could be offered to the geodesist.

Considering that a contribution toward elucidating the best means of dealing with the problem in hand may in the end save time and money, this report may not be taken as too lengthy.

I remain, sir, yours, respectfully,

CHAS. A. SCHOTT, *Assistant*.

*Tables of geographical positions, etc.; Washington, 1885, p. 43.

C. COMPUTATION TO ACCOMPANY REPORT OF JULY 17, 1885, BY ASSISTANT
C. A. SCHOTT, USING DATA OF JANUARY 4, 1890.

[See letter of Schott to the Superintendent, dated February 28, 1893—practically the same as his report of July 17, 1885.]

APPENDIX I.—Length and azimuth of the geodetic line and computation of position.

Colorado River $\varphi = 35^\circ$ $\lambda = 114^\circ 38' 45'' \cdot 3$ (1890)
Lake Tahoe $\varphi = 39^\circ$ $\lambda = 120^\circ 00' 00'' \cdot 0$

[Spheroid of 1866, Clarke's Geodesy, 1880, Oxford edition.]

Meters.			$e^2 = \frac{a^2 - b^2}{a^2}$
$a = 6\ 378\ 206 \cdot 4$	$\log a$	6·804 698 57	
$b = 6\ 356\ 583 \cdot 8$	$\log b$	6·803 223 78	$\log e^2 \operatorname{cosec} 2'' = 2 \cdot 843\ 90$
$e^2 = 0 \cdot 006\ 768\ 658\ 0$	$\log e^2$	7·830 502 57—10	
$1 - e^2 = 0 \cdot 993\ 231 \cdot 342\ 0$	$\log (1 - e^2)$	9·997 050 42—10	$\sqrt{1 - e^2} = \frac{b}{a}$
	$\log \sqrt{1 - e^2}$	9·998 525 21—10	
	$\log a \sqrt{1 - e^2}$	6·803 223 78	

Reduced latitudes $\varphi' = 35^\circ$		$\varphi_1 = 39^\circ$	
$\tan \mu = \frac{b}{a} \tan \varphi$	$\log \tan \varphi'$	9·845 226 8	$\log \tan \varphi_1$
	$\log \frac{b}{a}$	9·998 525 2	9·908 369 2
	$\log \tan \mu'$	9·843 752 0	$\log \frac{b}{a}$
	$\mu' = 34^\circ 54' 31'' \cdot 089$		9·998 525 2
	$\log \cos \mu'$	9·913 848 6	$\log \tan \mu_1$
Difference of longitude $\omega = 5^\circ 21' 14'' \cdot 7$			9·906 894 4
			$\mu_1 = 38^\circ 54' 17'' \cdot 558$
			$\log \cos \mu_1$
			9·891 085 5
			$\log \sin \omega$
			8·969 930 2
			$\log \cos \omega$
			9·998 101 1

$\cos \sigma_0 = \sin \mu_1 \sin \mu' + \cos \mu_1 \cos \mu' \cos \omega$	$\log \cos \mu_1$	9·891 085 5
	$\log \sin \mu_1$	9·797 979 95
	$\log \sin \mu'$	9·757 600 6
		9·555 580 55
		0·359 402 0
		0·635 382 5
	$\cos \sigma_0$	0·994 784 5
	$\log \sin \sigma_0$	9·008 598 7
$\delta \omega = e^2 \operatorname{cosec} 2'' \sec^{\frac{1}{2}} \sigma_0 \cos \mu_1$		
	$\cos \mu' \sin \omega$	
$\delta \omega = + 41'' \cdot 641$		

log cos μ_1 cos μ'	9.804 934 1
log sin $\tilde{\omega}_1$	8.970 864 7
log cosec σ_1	0.990 902 5
log cos U	9.766 701 3
U=54° 14' 24'' 82	
log sin U	9.909 274 8
log e^2	7.830 502 6
log cos ² U	9.533 402 6
$e^2 \cos^2 U = 0.002 311 56$	7.363 905 2
cos Σ sin U = sin μ_1	
0 / "	
$\Sigma = -39 17 28.7$	
2 $\Sigma = -78 34 57.4$	
$\sigma_1 = + 5 51 39.9$	
2 $\Sigma - \sigma_1 = -84 26 37.3$	

$$N = e^2 \cos \mu_1 \cos \mu' \sin \tilde{\omega}_1 \operatorname{cosec} 2''$$

$$\delta\omega = \frac{e^2}{\sin 2''} \left(\frac{\sigma_1}{\sin \sigma_1} \right) \cos \mu_1 \cos \mu' \sin \omega$$

$$\omega - \tilde{\omega} = \frac{e^2}{2} \cos U \left\{ \sigma_1 \left(1 + \frac{e^2}{4} \frac{k^2}{2} \right) - \frac{k^2}{2} \cos (2\Sigma - \sigma) \sin \sigma \right\}$$

$$\frac{1}{4} e^2 = 0.001 692 16$$

$$\frac{1}{2} k^2 = 0.000 558 42$$

$$\frac{e^2}{4} - \frac{k^2}{2} = 0.001 133 74$$

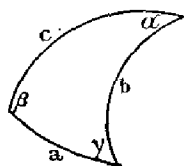
log e^2	7.830 503
log cos μ_1 cos μ'	9.804 934
log sin $\tilde{\omega}_1$	8.970 865
log cosec $2''$	5.013 395
log N	1.619 697
log cos σ_1	9.997 724
log sec σ_1	0.002 276
log sec $\frac{1}{2} \sigma_1$	0.000 759
41'' 731	1.620 456
log $\left(\frac{e^2}{4} - \frac{k^2}{2} \right)$	7.054 314
+ 0'' 047	8.674 97
log N	1.619 7
log cos $(2\Sigma - \sigma_1)$	8.986 0
log $\frac{k^2}{2}$	6.746 9
- 0'' 002	7.352 6 _n

$$\tilde{\omega} = \omega + 41'' 776 = 5^\circ 21' 56'' 476.$$

$$90 - \mu_1 = 51^\circ 05' 42'' 442.$$

$$90 - \mu' = 55^\circ 05' 28'' 911.$$

For solution of spherical triangle:



$$\tan \frac{\beta + \gamma}{2} = \frac{\cos \frac{b - c}{2}}{\cos \frac{b + c}{2}} \cot \frac{\alpha}{2}$$

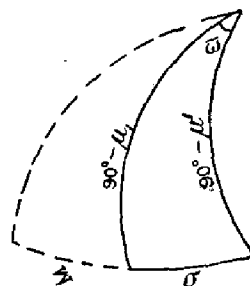
$$\tan \frac{\beta - \gamma}{2} = \frac{\sin \frac{b - c}{2}}{\sin \frac{b + c}{2}} \cot \frac{\alpha}{2}$$

log e^2	7.830 502 6
colog 4	9.397 940 0
log sin ² U	9.818 549 6
log $(\frac{1}{4} e^2 \sin^2 U)$	7.046 992 2
log $(1 + e^2 \cos^2 U)$	0.001 002 7
log k^2	7.047 994 9
k^2	0.001 116 85

$$\log \sin \mu_1 \quad 9.797 979 95$$

$$\log \sin U \quad 9.909 274 8$$

$$\log \cos \Sigma \quad 9.888 705 2$$



$$b - c = 90 - \mu' - 90 + \mu_1 = + 3^\circ 59' 46'' 469.$$

$$\frac{1}{2} (b - c) = \frac{1}{2} (\mu_1 - \mu') = + 1^\circ 59' 53'' 234.$$

$$b + c = 90 - \mu' + 90 - \mu_1 = + 106^\circ 11' 11'' 353.$$

$$\frac{1}{2} (b + c) = 90 - \frac{1}{2} (\mu_1 + \mu') = + 53^\circ 05' 35'' 676.$$

$\log \cos \frac{b-c}{2}$	9'999 735 9	$\log \sin \frac{b-c}{2}$	8'542 411 0	$\alpha = \hat{\omega} = 5^{\circ} 21' 56'' \cdot 476$
$\log \cot \frac{\alpha}{2}$	1'329 209 7	$\log \cot \frac{\alpha}{2}$	1'329 209 7	$\frac{\hat{\omega}}{2} = 2^{\circ} 40' 58'' \cdot 238$
	1'328 945 6		9'871 620 7	$A = a \sqrt{1-e^2} (1+k^2 + \frac{13}{4} k^4)$
$\log \cos \frac{b+c}{2}$	9'778 523 5	$\log \sin \frac{b+c}{2}$	9'902 880 3	$B = a \sqrt{1-e^2} (k^2 + 3k^4)$
$\log \tan \frac{\beta+\gamma}{2}$	1'550 422 1	$\log \tan \frac{\beta-\gamma}{2}$	9'968 740 4	$C = a \sqrt{1-e^2} (-\frac{1}{2} k^4)$
$\frac{1}{2}(\beta+\gamma)$	88° 23' 13''·849	$\frac{1}{2}(\beta-\gamma)$	42° 56' 23''·14	$b = a \sqrt{1-e^2}$
$\beta+\gamma$	176° 46' 27''·70	$\beta-\gamma$	85° 52' 46''·28	$\log k^4 = 4'095 986 - 10$
$2\gamma =$	90° 53' 41''·42			$k^4 = 0'000 001 247$
$\gamma = (180 -)$	45° 26' 50''·71			$1+k^2 = 1'001 116 85$
$=$	134° 33' 09''·29 = Az: At Colorado River.			$\frac{13}{4} k^4 = 0'000 004 05$
$\beta = (180 +)$	131° 19' 36''·99			sum 1'001 121 0
$=$	311° 19' 36''·99 = Az: At Lake Tahoe.			$\log \text{sum} = 0'000 486 6$
				$\log b = 6'803 223 8$
				$\log A = 6'803 710 4$

$$\sin a \sin \gamma = \sin c \sin \alpha$$

$$\log \sin c = \log \cos u_1 = 9'891 085 5$$

$$\log \sin \alpha = \log \sin \hat{\omega} = 8'970 867 9$$

$$8'861 953 4$$

$$\log \sin \gamma = 9'852 850 1$$

$$\log \sin a = \log \sin \sigma = 9'009 103 3$$

$$\sigma = 5^{\circ} 51' 40'' \cdot 18 = 5^{\circ} 56' 16'' \cdot 1$$

$$s = A\sigma + B \cos(2\Sigma - \sigma) \sin \sigma + C \cos(4\Sigma - 2\sigma) \sin 2\sigma$$

$\log \sigma$	0'767 983 6	$\log B$	3'852 674
$\log \text{rad in } ^{\circ}$	1'758 122 6	$\log \cos(2\Sigma - \sigma)$	8'985 98
	9'009 861 0	$\log \sin \sigma$	9'009 10
$\log A$	6'803 710 4		1'847 75
$\log \text{1st term}$	5'813 571 4		
<i>meters.</i>		<i>meters.</i>	
650 985·7		+ 70'429	
$s = 651 056 \cdot 33 = 651 056 k m = 404 551 \text{ st. miles}$			

$$\log s = 2'813 618 5$$

$$\log \text{factor} = 9'793 355 0$$

$$\log s (\text{st. miles}) = 2'606 973 5$$

$$s = 404 551 \text{ statute miles}$$

Check. According to the property of the geodetic line

$$\cos \mu \sin \alpha = \cos \mu_1 \sin \alpha_1;$$

$$\text{hence for the terminal points}$$

$$\cos \mu' \sin \alpha' = \cos \mu_1 \sin \alpha_1 \quad \left\{ \begin{array}{l} \alpha' = 45^{\circ} 26' 50'' \cdot 71 \\ \alpha_1 = 131^{\circ} 19' 36'' \cdot 99 \end{array} \right.$$

$$\log \cos \mu' = 9'913 848 6 \quad \log \cos \mu_1 = 9'891 085 5$$

$$\log \sin \alpha' = 9'852 850 0 \quad \log \sin \alpha_1 = 9'875 613 1$$

$$9'766 698 6 \quad 9'766 698 6$$

$$k^2 = 0'001 116 85$$

$$3k^4 = 0'000 003 7$$

$$\text{sum} = 0'001 120 6$$

$$\log \text{sum} = 7'049 450 6$$

$$\log b = 6'803 224$$

$$\log B = 3'852 674$$

$$-\frac{1}{2} k^4 = 0'000 000 16$$

$$\log(-\frac{1}{2} k^4) = 3'204 12 - 10_n$$

$$\log b = 6'803 22$$

$$\log C = 0'007 34_n$$

$$2\Sigma = - 78^{\circ} 34' 57'' \cdot 4$$

$$-\sigma = - 5^{\circ} 51' 40'' \cdot 2$$

$$2\Sigma - \sigma = - 84^{\circ} 26' 37'' \cdot 6$$

$$\text{double} = - 168^{\circ} 53' 15''$$

$$\log C = 0'007 34_n$$

$$\log \cos(4\Sigma - 2\sigma) = 9'991 78_n$$

$$\log \sin 2\sigma = 9'307 85$$

$$9'306 97$$

$$\text{meters.}$$

$$+ 0'203$$

The angle of intersection of elliptic arcs through their respective normals and the opposite terminal

point $I = c^2 \cos^2 \mu \sin 2\alpha \sin^2 \frac{c}{2}$

where c = length of line, μ at the southern point = μ' , at the northern = μ_1

For southern or Col-
orado point.

log cos μ' 9'827 70
log e^2 7'830 50
log sin $2\alpha'$ 9'999 95
log sin $\frac{c}{2}$ 7'417 28

5'075 43

log sin I' 4'685 57
0'389 86

$I' = 2'' 454$

For northern or Tahoe
point.

log cos μ_1 9'782 17
log sin α_1 9'996 42
7'417 28

5'026 37

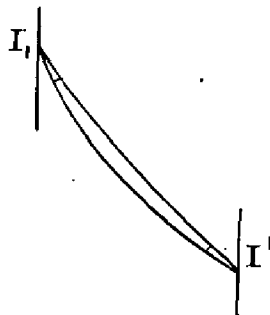
4'685 57
0'340 80

$I_1 = 2'' 192$

$\alpha' = 45^\circ 26' 8''$ | $\alpha_1 = 131^\circ 19' 6''$
 $2\alpha' = 90^\circ 53' 6''$ | $2\alpha_1 = 262^\circ 39' 2''$

$c = 5^\circ 51' 40''$

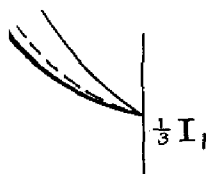
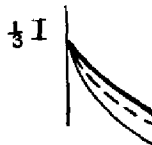
$\frac{c}{2} = 2^\circ 55' 50''$



Deviation of geodetic line from elliptic arc

$\frac{1}{3} I' = 0'' 82$

$\frac{1}{3} I_1 = 0'' 73$



Azimuth of elliptic arc at
Tahoe point
 $311^\circ 19' 36'' 17$

Azimuth of elliptic arc at
Colorado point
 $134^\circ 33' 08'' 56$

N. B.—Dalby's theorem may be applied to locate points of longitude in the arc. It is an approximate expression, still very close for any directly measurable line. (See Clarke's Geodesy, p. 106.) The formula answers to the chord method and does not specify the special nature of the connecting

line. Applied to our case, we have $\tan \frac{1}{2} (\alpha + \alpha') = \frac{\cos \frac{1}{2} (\varphi' - \varphi)}{\sin \frac{1}{2} (\varphi' + \varphi)} \cot \frac{\omega}{2}$

For elliptic arcs.	For geodetic line.		
$\alpha = 45^\circ 26' 51'' 44$	$45^\circ 26' 50'' 71$	$\frac{1}{2} (\varphi' - \varphi) = 2^\circ$	log cos $\frac{1}{2} (\varphi' - \varphi)$ 9'999 735 4
$\alpha' = 311^\circ 19' 36'' 17$	$311^\circ 19' 36'' 99$	$\frac{1}{2} (\varphi' + \varphi) = 37^\circ$	log sin $\frac{1}{2} (\varphi' + \varphi)$ 9'779 463 0
$\alpha + \alpha' 176^\circ 46' 27'' 61$	$176^\circ 46' 27'' 70$		0'220 272 4
$\frac{1}{2} (\alpha' + \alpha) 88^\circ 23' 13'' 805$	$88^\circ 23' 13'' 85$	$\frac{1}{2} \omega = 2^\circ 40' 37'' 35$	log cot $\frac{\omega}{2}$ 1'330 151 3
log tan $\frac{1}{2} (\alpha' + \alpha) 1'550 420 3$	1'550 422 2		log term 1'550 423 7

To get a closer accord it would be necessary to change $\frac{1}{3} I'$ and $\frac{1}{3} I_1$ to their more correct values, but it is useless to enter further into this subject in connection with the present state of things.

D. OBLIQUE BOUNDARY BETWEEN CALIFORNIA AND NEVADA—COMPUTATION FOR LENGTH AND AZIMUTH OF GEODETIC LINE BETWEEN LAKE TAHOE (T₀) AND COLORADO RIVER TERMINAL (C₀).

APRIL 17, 1894.

$$T_0 \begin{cases} \varphi_1 = 39^\circ \\ \lambda_1 = 120^\circ \end{cases} \text{ and } C_0 \begin{cases} \varphi' = 35^\circ \\ \lambda' = 114^\circ 37' 52'' \cdot 02 \end{cases}$$

Referring in part to my computation of January 4, 1890, we have with the present data:
Diff. of long. $\omega = 5^\circ 22' 07'' \cdot 98$

$$\begin{aligned} \sin \mu_1 \sin \mu' &= 0.359 \ 402 \ 0 \\ \cos \mu_1 \cos \mu' \cos \omega &= 0.635 \ 366 \ 9 \\ \cos \sigma_0 &= 0.994 \ 768 \ 9 \\ \log \sin \sigma_0 &= 9.009 \ 253 \ 5 \end{aligned}$$

$$\delta \omega = + \quad 41'' \cdot 756$$

$$\begin{aligned} \sigma_1 - \sigma_0 &= + \quad 24'' \cdot 408 \\ \hat{\omega}_1 = \omega + \delta \omega &= 5^\circ 22' 49'' \cdot 736 \\ \sigma_1 &= 5^\circ 52' 11'' \cdot 908 \end{aligned}$$

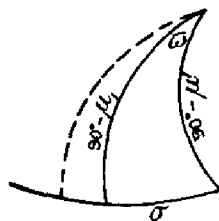
$$\begin{aligned} \log \cos \mu_1 \cos \mu' & 9.804 \ 934 \ 1 \\ \log \sin \hat{\omega}_1 & 8.972 \ 060 \ 1 \\ \log \operatorname{cosec} \sigma_1 & 0.990 \ 246 \ 4 \\ \log \cos U & 9.767 \ 240 \ 6 \\ U = 54^\circ 11' 20'' \cdot 21 \\ \log \sin U & 9.908 \ 994 \ 6 \\ \log e^2 & 7.830 \ 502 \ 6 \\ \log \cos^2 U & 9.534 \ 481 \ 2 \\ e^2 \cos^2 U = 0.002 \ 317 \ 31 & 7.364 \ 983 \ 8 \end{aligned}$$

$$\begin{aligned} \Sigma &= -39^\circ 14' 46'' \cdot 0 \\ 2 \Sigma &= -78^\circ 29' 32'' \cdot 0 \\ \sigma_1 &= 5^\circ 52' 11'' \cdot 9 \\ 2 \Sigma - \sigma_1 &= -84^\circ 21' 43'' \cdot 9 \end{aligned}$$

$$\begin{aligned} \log \sin \omega & 8.971 \ 125 \ 6 \\ \log \cos \omega & 9.998 \ 090 \ 5 \\ \log \cos \mu_1 & 9.891 \ 085 \ 5 \\ \log \cos \mu' & 9.913 \ 848 \ 6 \\ \log \cos \mu_1 \cos \mu' \cos \omega & 9.803 \ 024 \ 6 \\ \log \cos \sigma_0 & 9.997 \ 722 \ 1 \\ \sigma_0 & 5^\circ 51' 47'' \cdot 5 \\ \log \sec \sigma_0 & 0.002 \ 277 \ 9 \\ \log \sec^{\frac{1}{2}} \sigma_0 & 0.000 \ 76 \\ \log e^2 \operatorname{cosec} 2'' & 2.843 \ 90 \\ \log \cos \mu_1 \cos \mu' \sin \omega & 8.776 \ 06 \\ \log \delta \omega & 1.620 \ 72 \\ \log \operatorname{cosec} \sigma_0 & 0.990 \ 75 \\ \log (\sigma_1 - \sigma_0) & 1.387 \ 53 \end{aligned}$$

$$\begin{aligned} \log e^2 & 7.830 \ 502 \ 6 \\ \operatorname{co-log} 4 & 9.397 \ 940 \ 0 \\ \log \sin^2 U & 9.817 \ 989 \ 2 \\ \log (\frac{1}{2} e^2 \sin^2 U) & 7.046 \ 431 \ 8 \\ \log (1 + e^2 \cos^2 U) & 0.001 \ 005 \ 2 \\ \log K^2 & 7.047 \ 437 \ 0 \\ K^2 & 0.001 \ 115 \ 42 \end{aligned}$$

$$\begin{aligned} \log \sin \mu_1 & 9.797 \ 979 \ 95 \\ \log \sin U & 9.908 \ 994 \ 6 \\ \log \cos \Sigma & 9.888 \ 985 \ 3 \end{aligned}$$



$$\begin{aligned} \log e^2 & 7.830 \ 503 \\ \log \cos \mu_1 \cos \mu' & 9.804 \ 934 \\ \log \sin \hat{\omega}_1 & 8.972 \ 060 \\ \log \operatorname{cosec} 2'' & 5.013 \ 395 \\ \log N & 1.620 \ 892 \\ \log \sec^{\frac{1}{2}} \sigma_1 & 0.000 \ 76 \\ 1.621 \ 65 + 41'' \cdot 846 & \\ 7.054 \ 5 & \\ 8.676 \ 2 + 0.047 & \\ - 0.002 & \end{aligned}$$

$$\begin{aligned} \log \cos \sigma_1 & 9.997 \ 716 \ 8 \\ \log \sec \sigma_1 & 0.002 \ 28 \\ \log \sec^{\frac{1}{2}} \sigma_1 & 0.000 \ 76 \\ \log N & 1.620 \ 9 \\ \log \cos (2\Sigma - \sigma_1) & 8.992 \ 3 \\ \log \frac{1}{2} K^2 & 6.746 \ 4 \\ & 7.359 \ 6_n \end{aligned}$$

$$\begin{aligned} \hat{\omega} = \omega + 41'' \cdot 891 &= 5^\circ 22' 49'' \cdot 871 \\ 90 - \mu_1 &= 51 \ 05 \ 42 \cdot 442 \\ 90 - \mu' &= 55 \ 05 \ 28 \cdot 911 \end{aligned}$$

[illegible]

E. REPORT OF ASSISTANT C. A. SCHOTT.

COMPUTING DIVISION, COAST AND GEODETIC SURVEY,
March 8, 1894.

Dr. T. C. MENDENHALL.

SIR: The Office computation of the triangulation connecting Needles, Cal., and Fort Mohave, Ariz., was completed some time ago, but the report was delayed by the meetings of the conference.

This triangulation was made in 1893 by Subassistant W. B. Fairfield, and the computations by the observer and by Mr. Courtenay, aided by Mr. Kummell. The main figure was adjusted by least squares, and the results proved quite satisfactory. The base was measured by a 100-meter steel tape

and has a length of 1.7 kilometers (about). The triangulation extends over 14 statute miles nearly, and fixes the position of 38 points, all of which have been inserted in the registers.

The astronomic data are as follows: The latitude is that observed at Von Schmidt's 35° latitude post of 1873, viz, $35^{\circ} 00' 15'' .02 \pm 0'' .08$ (C. H. Sinclair, May, 1893). The azimuth is that observed at the same station, viz, Azimuth of mark $142^{\circ} 41' 56'' .0$ (C. H. Sinclair and W. B. Fairfield, June, 1893). The longitude is that determined telegraphically at Needles, viz, $114^{\circ} 36' 11'' .04$ (C. H. Sinclair and R. A. Marr, May and June, 1889). * * *

The triangulation connecting two astronomic latitude stations brought to light a large local differential deflection in the meridian, viz, between Von Schmidt's 35° post and Needles.

$$\begin{aligned} \text{Difference latitude, astronomic, } 35^{\circ} 00' 15'' .02 \pm '' .08 - 34^{\circ} 50' 17'' .90 \pm '' .14 &= 9' 57'' .12 \pm '' .16 \\ \text{Difference latitude, geodetic, } 35^{\circ} 00' 15'' .02 - 34^{\circ} 50' 08'' .71 &= 10' 06'' .31 \end{aligned}$$

Differential local deflection

9'' .19

which is at the rate of 0'' .92 per minute (nautical mile) if supposed equally distributed.

This large deflection, which relative to the vertical at Needles, indicates an attraction of the plumb-line northward as we approach the Mohave end, or boundary end, has an important bearing on the determination of the southeastern terminus of the California and Nevada boundary.

Instead of taking a mean latitude for the geodetic latitude, as usual, the retention of the 35° post latitude was preferred for the triangulation for the reason that it is nearer to the parallel of 35°, hence only demands a small reduction for differential deflection, viz, one-fourth of 0'' .92 or 0'' .23, i. e., 7.1 meters (about 23 feet). This, of course, assumes a uniform change of deflection, but it is the only assumption we can make in the absence of direct observational test of the actual astronomic latitude of 35° as demanded by law for the southern limit of the boundary. This parallel is therefore $15'' .02 + 0'' .23$ or $15'' .25$ or 470 meters south of Von Schmidt's 35° latitude post.

The longitude of the terminus of the boundary is defined physically, i. e., the mid-channel of the Colorado River where it is intersected by the parallel of 35°. Owing to the meanderings of the river this point is ever changing, but if we take the middle point on the parallel of 35°, between the more stable gravel bluffs on both sides, we shall get a definite position for the terminus of the boundary, as follows:

$$\begin{array}{rcl} \text{Longitude of Sinclair's } 35^{\circ} \text{ post on western shore,} & 114^{\circ} 39' 21'' .30 & \\ \text{Longitude of Sinclair's } 35^{\circ} \text{ post on eastern shore,} & 114^{\circ} 36' 20'' .69 & \\ \hline \text{Difference} & 3' 00'' .61 & \end{array}$$

3' 00'' .61 in latitude 35° equals 4 580 meters.

Distance of western post from foot of bluff 83 meters, and of eastern post 135 meters, sum 218 meters, which subtracted from 4 580 gives 4 362 meters for width of river bed between the bluffs. Half of this (2 181 meters) added to 135 meters, or 2 316 meters converted into angular measure equals $1' 31'' .33$, hence longitude of center or of mid-channel $114^{\circ} 37' 52'' .02$; the latitude of the same is $34^{\circ} 59' 59'' .77$ as expressed in our coordinates. Call this point C.

Mr. Sinclair established two stations in the line, as near as this could be done in the field, and it will be necessary to ascertain how near they are to their correct position. Position of southeast line post is in latitude $35^{\circ} 01' 23'' .06$ and longitude $114^{\circ} 39' 34'' .64$. The difference of this line post and the above center is difference of latitude, $1' 23'' .29$ or 2 566.7 meters, and difference of longitude $1' 42'' .62$ or 2 602.0 meters, hence $\tan \alpha = 44^{\circ} 36' 32''$, and the azimuth C_o to the southeast line post $134^{\circ} 36' 32''$, but the true azimuth of the boundary is (as near as can be ascertained) $134^{\circ} 28' 41'' .0$. This shows the southeast line post to be too far north by 11.69 meters (0'' .38), hence by laying off this amount due south of the southeast line post the first point C₁ in the boundary line will have been established. Nothing further seems to be demanded at this end of the line. The northwest line post would have to be shifted in the same direction but for a somewhat greater distance; however, this is not required in the prosecution of the work. The Von Schmidt iron boundary monument of 1873 was washed over the bluff, but was hauled up again and put farther back, its position is therefore of no further value, but it shows that the boundary of 1873 was about 850 meters distant (to the west and south) from the site now proposed. The reason for this is that Von Schmidt took the mid-channel of

the river as he found it in 1873, and as it was again in 1889 in latitude 35° , the latter of course is but a curious coincidence.

The position of C_1 as here determined ($\varphi = 35^\circ 01' 22''.89$, $\lambda = 114^\circ 39' 34''.64$) may be taken as known with as much precision as the case admits of under our hypothesis.

It will also be of interest to compare the position of the Fort Mohave flagstaff as assigned by the United States engineers and by this Office. Captain Wheeler* found, by connection with the above iron boundary monument, the latitude $35^\circ 02' 09''$ and the longitude $114^\circ 35' 54''$, elevation 756 feet; the survey of 1893 gave latitude $35^\circ 02' 31''.6$ and longitude $114^\circ 37' 13''.9$. Mr. W. Minto in 1889 made it latitude $35^\circ 02' 39''.2$, starting from Needles, hence $35^\circ 02' 30''.0$ when starting from latitude station of 1893 or present data and longitude $114^\circ 37' 14''.5$. Mr. Minto's determination rests on an independent triangulation.

Yours, respectfully,

CHAS. A. SCHOTT.

F. COMPUTATION OF THE TERMINI OF THE CALIFORNIA AND NEVADA BOUNDARY LINE.

1. LAKE TAHOE TERMINUS OF THE LINE.

The astronomic station Lake Tahoe, southeast end, occupied in August, 1893, near Lakeside Tavern, $61\frac{1}{2}$ feet south and 33 feet west of Von Schmidt's second granite monument, is in—

Latitude $38^\circ 57' 19''.76 \pm 0''.06$

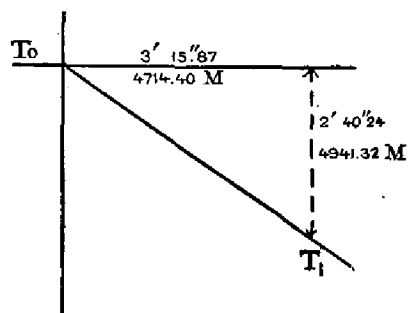
Longitude $119^\circ 56' 44''.13$ or $7^h 39^m 46^s.94$,

hence also the above granite monument;

Latitude, V. S. second granite monu-

ment $38^\circ 57' 20''.368$

Longitude $119^\circ 56' 43''.712$ or $7^h 59^m 46^s.914$



The position of the boundary in Lake Tahoe is defined as in (astronomical) latitude 39° and in longitude 120° , and it remains to determine how far the 1893 astronomic station is off the true boundary. We have in latitude $38^\circ 58' 9$,

1" in meridian = 30.837 meters,

1" in parallel = 24.069 meters,

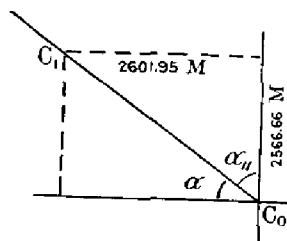
hence $\tan \alpha = \frac{4941.32}{4714.40}$ $\alpha = 46^\circ 20' 46''.5$.

Now the azimuth of the boundary line, as near as that can be had without a geodetic connection, is about $311^\circ 15' \pm 1'$, hence the angle α should be $41^\circ 15' 0$ instead of $41^\circ 20' 8$. In other words, the astronomic station, southeast end of Lake Tahoe, 1893, is too far south, and we have to go north in the meridian 806.39 meters or $26''.150$, hence the latitude of the point T_1 becomes $38^\circ 57' 19''.76 + 26''.150 = 38^\circ 57' 45''.91$ nearly, and its longitude as above $119^\circ 56' 44''.13$.

The new computation of the geodetic line, herewith appended (April 17, 1894, p. 238), makes the azimuth at $T_0 = 311^\circ 14' 36''.6$ or α should be $41^\circ 15' 38''.2$ (mean

* Table of geographical positions, etc., Washington, D. C., 1885.

of forward and back azimuth $\frac{41^{\circ} 14' 36'' \cdot 6}{41^{\circ} 16' 38'' \cdot 8} = 41^{\circ} 15' 37'' \cdot 7 \pm 1$, or we have to go north in the meridian of the 1893 astronomic longitude station $4\ 941 \cdot 32 - 4\ 136 \cdot 17 = 805 \cdot 15$ meters, which will bring us in latitude $38^{\circ} 57' 19'' \cdot 76 + 26'' \cdot 11$ or T_1 latitude is $38^{\circ} 57' 45'' \cdot 87$. The distance T_0 to T_1 is $6\ 271 \cdot 7$ meters.



2. THE COLORADO TERMINUS.

At the Colorado end of the line the azimuth at C_0 should be $134^{\circ} 28' 41'' \cdot 0$ instead of the approximate value $134^{\circ} 29' 48''$.

We have $\delta \lambda = 1' 42'' \cdot 62 = 2\ 601 \cdot 95$ meters
and $\varphi = 35^{\circ} 01' 23'' \cdot 06$

$$- 34^{\circ} 59' 59'' \cdot 77$$

$$\delta \varphi = 1' 23'' \cdot 29 = 2\ 566 \cdot 66 \text{ meters}$$

$$\text{hence } \tan \alpha_{11} = \frac{2\ 601 \cdot 95}{2\ 566 \cdot 66}, \alpha_{11} = 45^{\circ} 23' 28''$$

$$\alpha_{11} = 44^{\circ} 36' 32'' \text{ or azimuth} = 134^{\circ} 36' 32''$$

$$\text{but it should be } 134^{\circ} 28' 41''$$

$$\text{hence new abscissa is } 2\ 601 \cdot 95 \tan 44^{\circ} 28' 11'' \cdot 55 \left(\frac{44^{\circ} 28' 41'' \cdot 0}{44^{\circ} 27' 42'' \cdot 1} \text{ mean of forward and}$$

$$\text{backward azimuth} \right) = 2\ 554 \cdot 24 \text{ meters, which equals } \frac{2\ 554 \cdot 24}{30'' \cdot 816} = 82'' \cdot 89, \text{ hence } C_1 \text{ is in}$$

latitude $35^{\circ} 01' 22'' \cdot 89$ astronomic, $2\ 566 \cdot 66 - 2\ 554 \cdot 24 = 12 \cdot 42$ meters ($0'' \cdot 40$) south of Sinclair's line post. Distance C_0 to C_1 is $3\ 646 \cdot 1$ meters.

G. PREFACE TO OFFICE COMPUTATION OF AZIMUTH AT T_1 .

The station called "Turning Point 1894," by Assistant Sinclair, is identical with my station T_1 when computing its position in April, 1894; it is a point in the boundary line and from it starts the transit line marking out the boundary. T_1 stands for first point of line at Lake Tahoe. The astronomic position is—

$$\varphi = 38^{\circ} 57' 45'' \cdot 87$$

$$\lambda = 119^{\circ} 56' 44'' \cdot 13$$

The geodetic position is quite different ($\varphi = 38^{\circ} 57' 36'' \cdot 13$ as actually laid out on the ground), it is less by $9'' \cdot 74$; this large deflection of the vertical in the meridian has been known for some time.

The Office computation makes the astronomic azimuth of Folsom triangulation station.....	171	16	26.2 ± 1.0
Geodetic azimuth.....	171	16	23.0
The angle laid off from Folsom to back azimuth of boundary (so-called initial point T_1).....	39	59	28.7
Hence actual starting azimuth of boundary T_1 to C_1	311	16	54.3
Astronomic azimuth of same (Report April 20, 1894).....	311	16	39.8
Hence deviation at starting, $14'' \cdot 5$.			

C. A. SCHOTT.

H. RESULTS OF THE ASTRONOMIC MEASURES AT T_1 AND C_1 .

COMPUTING DIVISION, COAST AND GEODETIC SURVEY,

April 20, 1894.

Dr. T. C. MENDENHALL,

Superintendent Coast and Geodetic Survey.

SIR: The results of the astronomic measures taken in connection with the fixation of the end points of the California and Nevada oblique boundary line have been reported. I herewith present the final results for the positions of the initial monuments at either end, based upon a recomputation of the whole geodetic line and upon a more exact computation of these points than could be had before. Below, the letters T and C refer to the Tahoe and the Colorado end of the line, respectively. These results are:

Total length of geodetic line T_0 to C_0 = 652 020 meters, or 405.146 statute miles.

	Meters.	Statute miles.
T_0 to T_1	6 272	3.897
C_0 to C_1	3 646	2.266
Distance T_1 to C_1	642 102	398.983

Azimuth of line at T_1 , $311^\circ 16' 39''$.8.

Azimuth of line at C_1 , $134^\circ 27' 42''$.1.

The point T_1 is 805.15 meters north of the astronomic station of 1893 and very near to the point marked "Turning point" on Assistant Sinclair's map of that year. The point C_1 is 12.42 meters south of Assistant Sinclair's line post of 1893. Here no further notice of effect of local deflection could be taken, since it would not be safe to carry a supposed law of change beyond the actual parallel of observation.

A line of sight in which the forward and backward azimuth at any point in the line shall always lie 180 degrees apart can now be traced out from T_1 toward C_1 , starting with the above azimuth at T_1 . This line when transited through to the opposite end should pass through C_1 , and any deviation from it will have to be corrected proportionately along the whole line. * * *

I append a copy of the computation showing the dependence of the points T_0 and T_1 , and C_0 and C_1 .

Yours, respectfully,

CHAS. A. SCHOTT, *Assistant.*

Astronomic data.—Position computation, secondary triangulation.

α	C_0 to C_1		° / "	
$\Delta\alpha$				
			134 28 41.0	
			58.9	
α'	C_1 to C_0		180	
			314 27 42.1	

φ	° / "	$s = 3\ 646^m.108$	λ	° / "
$\Delta\varphi$	35 00 00.00 + 1 22.89		$\Delta\lambda$	114 37 52.02 + 1 42.62
φ'	35 01 22.89	C_1	λ'	114 39 34.64

Astronomic data.—Position computation, secondary triangulation—Continued.

$\frac{1}{2}(\varphi + \varphi')$	$\begin{array}{c} ^{\circ} \quad ' \quad '' \\ 35 \quad 00 \quad 41 \end{array}$	$\begin{array}{c} s \\ \cos \alpha \\ B \end{array}$	$\begin{array}{c} 3.561827 \\ 9.845492 \\ 8.511226 \end{array}$	$\begin{array}{c} s^2 \\ \sin^2 \alpha \\ C \end{array}$	$\begin{array}{c} 7.124 \\ 9.707 \\ 1.250 \end{array}$
First term	-82.898	h	1.918545		8.081
Second term	$+ .012$				
$-\Delta\varphi$	82.89				

$\begin{array}{c} s \\ \sin \alpha \\ A \\ \sec \varphi' \end{array}$	$\begin{array}{c} 3.561827 \\ 9.853405 \\ 8.509242 \\ 0.086758 \end{array}$	$\begin{array}{c} \Delta\lambda \\ \sin \frac{1}{2}(\varphi + \varphi') \end{array}$	$\begin{array}{c} 2.0112 \\ 9.7587 \end{array}$
$\Delta\lambda$	$\begin{array}{c} 2.011232 \\ '' \\ 102.62 \end{array}$	$-\Delta\alpha$	$\begin{array}{c} 1.7699 \\ '' \\ 58.9 \end{array}$

α	T_0	to T_1	$\begin{array}{c} ^{\circ} \quad ' \quad '' \\ 31.7 \quad 14 \quad 36.6 \\ + \quad 2 \quad 03.2 \end{array}$
α'	T_1	to T_0	$\begin{array}{c} 180 \\ 131 \quad 16 \quad 39.8 \end{array}$

$\begin{array}{c} \varphi \\ \Delta\varphi \\ \varphi' \end{array}$	$\begin{array}{c} ^{\circ} \quad ' \quad '' \\ 39 \quad 00 \quad 00.00 \\ - \quad 2 \quad 14.13 \\ 38 \quad 57 \quad 45.87 \end{array}$	$\begin{array}{c} T_0 \\ s = 6 \quad 271^{m.7} \\ T_1 \end{array}$	$\begin{array}{c} \lambda \\ \Delta\lambda \\ \lambda' \end{array}$	$\begin{array}{c} ^{\circ} \quad ' \quad '' \\ 120 \quad 00 \quad 00.00 \\ - \quad 3 \quad 15.87 \\ 119 \quad 56 \quad 44.13 \end{array}$
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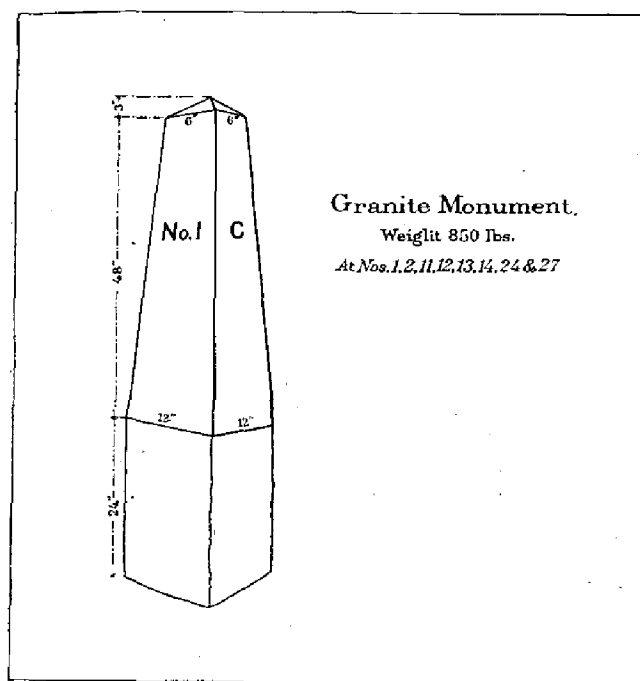
$\frac{1}{2}(\varphi + \varphi')$	$\begin{array}{c} ^{\circ} \quad ' \quad '' \\ 38 \quad 58 \quad 53 \end{array}$	$\begin{array}{c} s \\ \cos \alpha \\ B \end{array}$	$\begin{array}{c} 3.797385 \\ 9.819057 \\ 8.510927 \end{array}$	$\begin{array}{c} s^2 \\ \sin^2 \alpha \\ C \end{array}$	$\begin{array}{c} 7.595 \\ 9.752 \\ 1.313 \end{array}$
First term	$+134.08$	h	2.127369		8.660
Second term	$+ .05$				
$-\Delta\varphi$	$+134.13$				

$\begin{array}{c} s \\ \sin \alpha \\ A \\ \sec \varphi' \end{array}$	$\begin{array}{c} 3.797385 \\ 9.876168_n \\ 8.509146 \\ 0.109269 \\ 2.291968_n \end{array}$	$\begin{array}{c} \Delta\lambda \\ \sin \frac{1}{2}(\varphi + \varphi') \end{array}$	$\begin{array}{c} 2.2920 \\ 9.7987 \\ 2.0907 \\ '' \end{array}$
$\Delta\lambda$	$\begin{array}{c} 195.87 \end{array}$	$-\Delta\alpha$	123.2

VII. DESCRIPTION OF STATIONS ON THE RANDOM AND CORRECTED LINES CALIFORNIA AND NEVADA OBLIQUE BOUNDARY.

No. 1 (initial 1894).

This station was established in 1894 on the shore of Lake Tahoe, and marked by a granite stone with a copper bolt in it. The stone projects about 14 inches above ground, and was not disturbed when a granite monument was placed alongside it in June, 1899. The monument was set in concrete, and the hole was enlarged so as to include the old stone in the concrete mass. Being the first stone in the oblique boundary, it was called "No. 1."



The monument is of granite 6 feet long, 12 by 12 inches at the base and 6 by 6 inches at the top; weight about 850 pounds. (See illustration.)

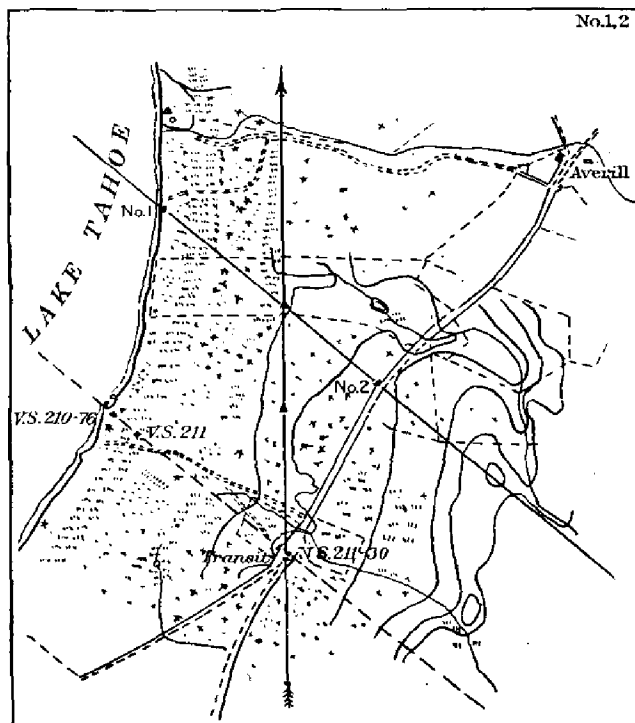
The boundary monuments are designated as No. 1, No. 2, etc., the marks on the random line as T 1, T 2, etc., counting from Lake Tahoe.

The monument has "C" cut on the California side, "N" on the Nevada side, and "No. 1" marked on the northwest face in black paint.

The old "T₁" (turning point and azimuth station, 1894), was not disturbed, but it is not called a line mark, as it is too close to "No. 1" and "No. 2" (at the road), which are about 834 meters apart. It is marked by a copper bolt in a granite block projecting 12 inches above ground, as described in the work of 1894.

No. 2.

This is a line station and is on the north side of the road that runs from Glenbrook to Bijou. It is about one-half mile northeast of the Lake Side Hotel. Δ is marked by a granite post, 10 inches by 10 inches by 6 feet, set in ground just outside the fence line. Stone projects above ground 1 foot, and a copper bolt in top marks the station.



This point was marked by a granite monument, like the one at "No. 1," placed alongside the granite block with copper bolt, which was not disturbed. The monument has "C" cut on the California side, "N" on the Nevada side, and "No. 2" painted in black on the northwest face. A large pine tree, 3 feet in diameter, stands about 6 feet southeast of monument on line. A triangular blaze was cut on this tree on the northwest side and one at the southeast side.

T 3.

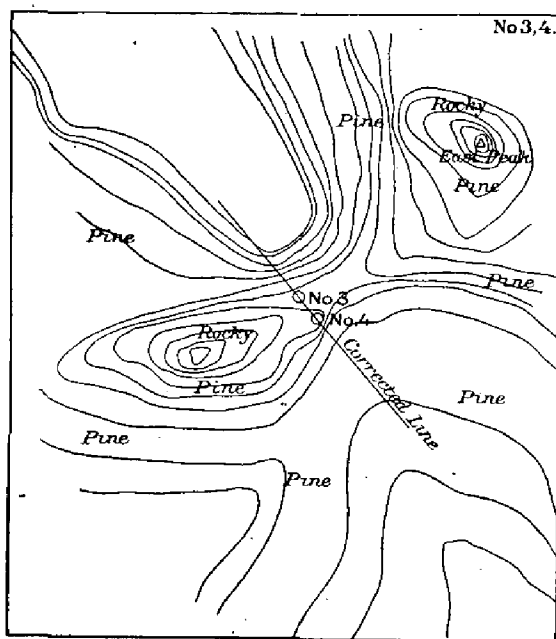
This station is located on the northern slope of a spur putting out northwest from the main range and about 300 yards northwest of the first summit. The slope is rocky, bare of grass, and covered with tamarack and yellow pine timber. The station overlooks Lake Tahoe to the northwest and Castle Rock to the north. The country road on east side of lake is about 2 miles northwest, and Kingsbury grade crosses summit of range about 3 miles northeast of this station.

The signal rests on a rock, $3\frac{1}{2}$ by 7 feet, that projects 1 foot from above surface of ground. A 1-inch hole drilled into the rock marks the triangulation station.

The point on the corrected line, called "No. 3," was placed 90° from line to the eastward 0.82 meters, thence 0.5 meter northwest in the direction of the line. Marked by drill hole in solid rock. A pine post, marked "C. N. 3," was set up over hole and a cairn built around post.

T 4.

Located about 100 yards northwest of the summit of first ridge southeast of Lake Tahoe; ridge bears nearly north and south. This station is nearly 300 yards southeast of station "T 3" and overlooks Lake Tahoe on the northwest. The ground slopes to



north and is sandy and rocky, and the timber is tamarack. Station is on a granite rock, 5 by 5 feet, that projects 2 feet above the surface of ground, and is marked by a drill hole in said rock.

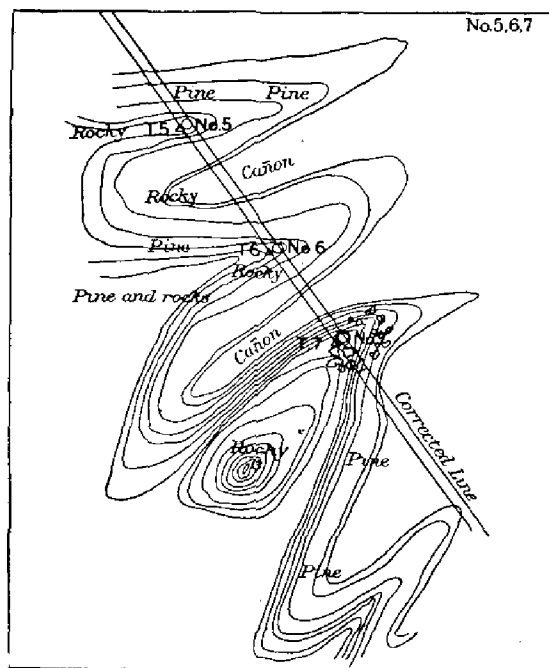
The point on the corrected line, "No. 4," was put in at right angles to the line from the above station, to the eastward, distant 0.88 meter, and was marked by a drill hole in the same rock. A pine post marked "C. N. 4," and a cairn around it marks the station.

T 5.

This station is located on crest of main ridge between Lake Tahoe and Carson Valley. Course of ridge is nearly north and south, and the summit is a regular backbone of large rocks, some of them projecting 20 feet high. The station overlooks Carson

Valley on the east and southeast and the mountains beyond. It is about 6 miles south of the crossing of the summit by the Kingsbury Grade. Trail follows up ridge, passing to the northwest of flume reservoir $4\frac{1}{2}$ miles after leaving Kingsbury Grade. Station is on a large granite rock, marked by a drill hole, and a cairn 5 feet high and 5 feet at base was built on line 6 feet northwest of station.

The point on the corrected line, to be called "No. 5," should be at right angles to this station, to the eastward, and distant 111 meters. At the time this station was visited, in June, 1899, the snow was 15 feet deep over the station, and it was not practicable to put in the corrected point.



T 6.

This station is located on the rocky crest of spur that extends northeast from main ridge and is about 100 feet lower than the crest at station "T 5." Can be reached most easily by following around side of ridge to southeast from station "T 5." It overlooks Carson Valley to the east and southeast.

The station is on a large rock, marked by a drill hole, and a cairn 5 feet high and 5 feet at base was built on line 6 feet northwest of station.

The point on the corrected line, to be called "No. 6," should be at right angles from the line at this station, to the eastward, distant 126 meters. When the station was visited in June, 1899, it was not found practicable to put in the corrected point, as the snow was 15 feet deep over the station, even the signal pole being out of sight.

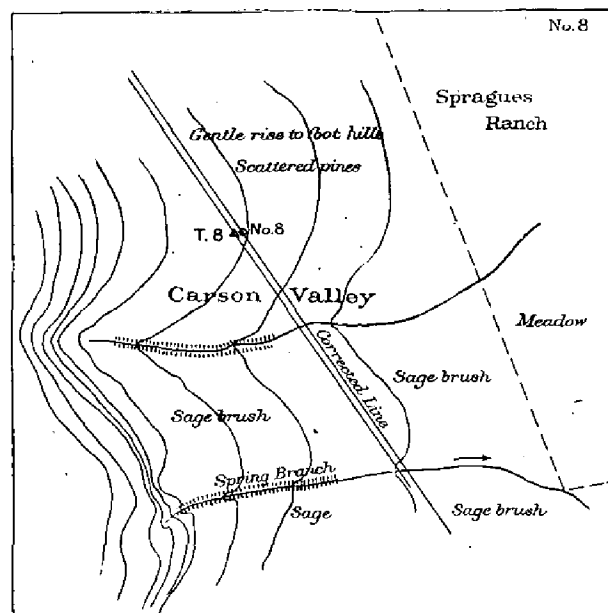
T 7.

This station is located on a bold, rocky spur that puts out from the main range in a northeasterly direction. The point of intersection with the main range is a high peak, known as "Monument Peak." From this station a fine view can be had of Carson Valley to the east and southeast, and the mountains beyond. The road along the west side of Carson Valley runs along foot of mountain, about 2 miles below the station. It can be reached most easily by following along east side of ridge from station "T 5." Station is on a large granite rock that projects about 10 feet above the general surface of the spur, and is marked by a hole drilled in the rock. A rock, 25 feet higher than station, is 15 feet southwest of same.

The point on the corrected line, "No. 7," was put in at right angles from the line, to the eastward, distant from triangulation station 1'41 meters, and was marked by a drill hole, the hole being about 1 foot from the north edge of rock. A pine post, marked "C. N. 7," was placed in center of rock 1'4 meters south of drill hole, and around post was built a cairn, the station being too near the edge of the rock to admit of the cairn being built over it.

T 8.

This station is located on the brow of a low spur projecting eastward from the main range, and from which the line leaves the foothills and enters Carson Valley. The



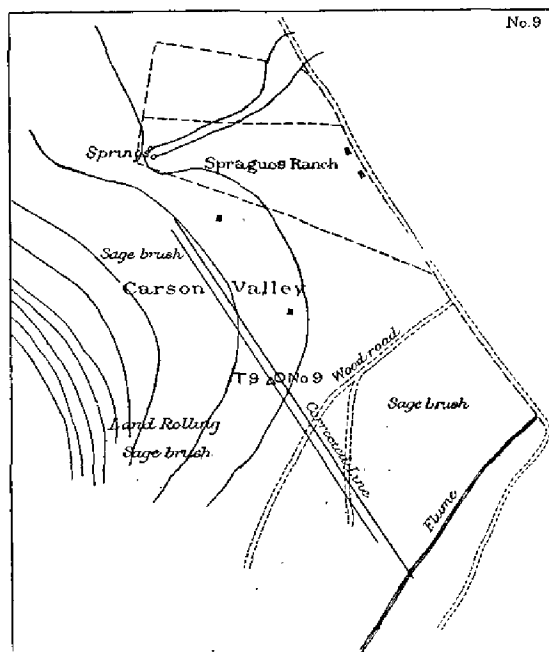
county road along west side of Carson Valley runs one-half mile east. Station was marked by a pine stake driven down to the surface of ground.

Point on corrected line, "No. 8," put in at right angles from line, to eastward, distant 3'15 meters, marked by a drill hole in a granite rock, and by a pine post 8 inches in

diameter and 7 feet high, marked "C. N. 8," placed over drill hole. A sand mound $5\frac{1}{2}$ feet high and 12 feet in diameter was thrown up around post. A circular trench was made outside of the mound.

T 9.

This station is located at the edge of the foothills on the west side of Carson Valley, just west of the Sprague ranch, and about a quarter of a mile west of the county road that runs along the west side of Carson Valley. It is in the sagebrush, ground rolling and sandy, marked by a pine stake 5 inches in diameter, driven within 5 inches of the surface of the ground.



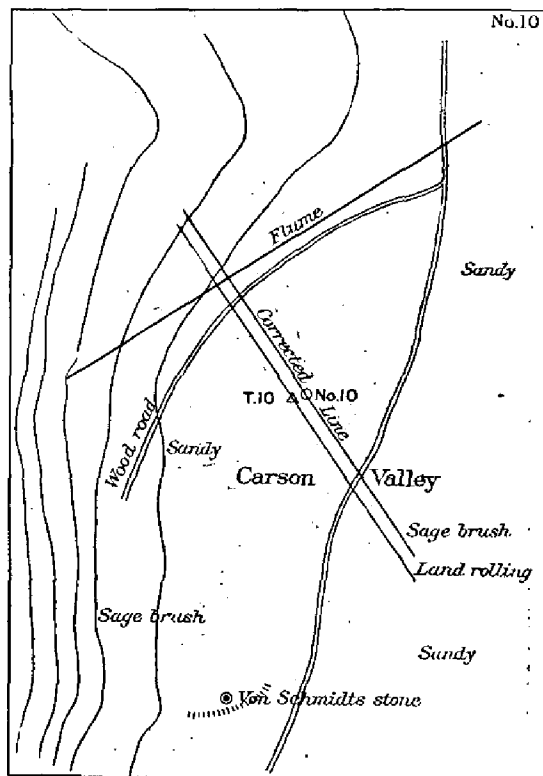
Point on corrected line, "No. 9," put in at right angles to line, to the eastward, distant from triangulation station 357 meters, and marked by drill hole in granite rock. Over hole was placed a cedar post 8 inches in diameter and 7 feet long, marked "C. N. 9." A sand mound 10 feet in diameter and 5 feet high was thrown up around post. A circular trench outside of mound.

T 10.

ANGLES.

	°	'
Station "T 7".....	259	57
Gable of Sprague's east barn	282	45
Cupola of Fay's red barn	320	56
Cupola of schoolhouse.....	2	43
North chimney of Baldwin's house.....	67	55
Von Schmidt's cairn, west of Baldwin's house	90	50

This station is located about a quarter of a mile east of the Fairview ranch house (Fay's) and about 500 yards west of the main road on the west side of Carson Valley. The land is rolling and covered with sagebrush. A grove of small, scattered cottonwood trees is about a hundred yards west of this station, and the ground immediately surrounding the station is covered with rocks and boulders. The triangulation station is on one of these rocks, and is marked by a hole drilled in the rock.



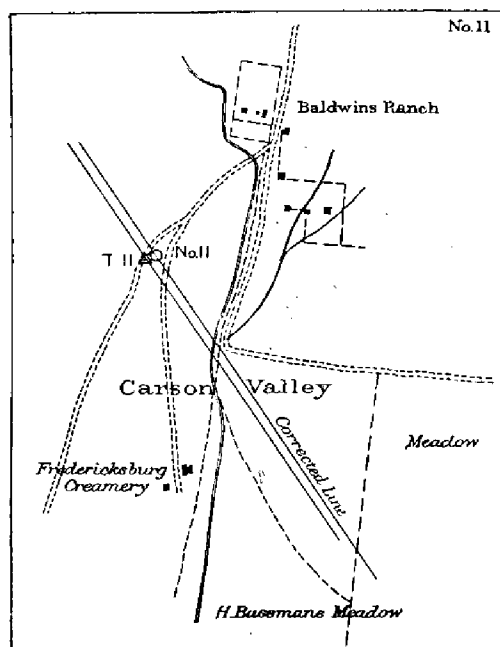
Point on the corrected line, called "No. 10," was put in at right angles from the line, to eastward, distant from triangulation station 3.91 meters, marked by drill hole in a flat granite stone, and by a cedar post 8 inches in diameter and 7 feet long, marked "C. N. 10." A cairn 5½ feet high and 6 feet in diameter at base was built around cedar post.

T 11.

ANGLES.

	°	'	"
Station "T 7".....	0	00	00
Genoa cone.....	332	13	30
Northeast chimney of Baldwin's house (center).....	299	56	30
Southeast gable of Baldwin's barn.....	283	51	15
Northeast cupola, dairy (Wilson's).....	153	35	15

This station is located about 300 yards southwest of Baldwin's house and about 200 yards northeast of Fredericksburg creamery, at the forks of the county road, one road going to the creamery and the other bearing higher up on the higher ground



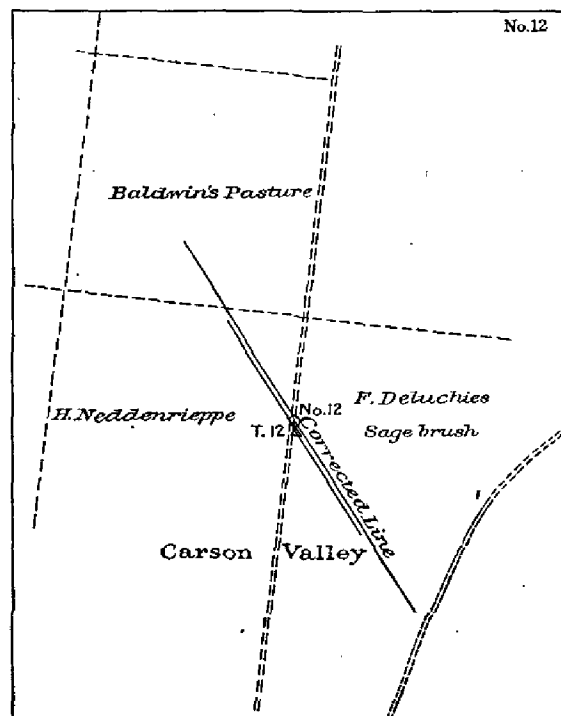
along the west side of the Carson Valley. The ground surrounding is rolling and sandy, covered with sagebrush. The triangulation station is marked by a pole 5 inches in diameter, around which was built a cairn 6 feet high and 4 feet at base.

Point on corrected line, "No. 11," put in at right angles to line, to eastward, distant 4'23 meters from triangulation station; marked by a cut granite monument, similar to the one at "No. 1," on the lake shore. The top of monument was broken off and fastened together again with hoop iron. "C" cut on California and "N" on the Nevada side. A cairn was built up around the monument, and some stones were left around the old triangulation station; "No. 11" painted on northwest face.

T 12.

This station is located east of the county road, on the F. Deluchies' ranch, about one-fourth mile from West Branch of Carson River. The ground surrounding station is nearly level and covered with sagebrush, and the soil is sandy, covered with small bowlders, projecting here and there, scattered over the surface. Station was marked by a post 6 inches in diameter, projecting 8 inches from the ground.

Point on corrected line, "No. 12," put in at right angles to line, to eastward from triangulation station, distant 4'77 meters, thence 3'35 meters to northwest parallel to



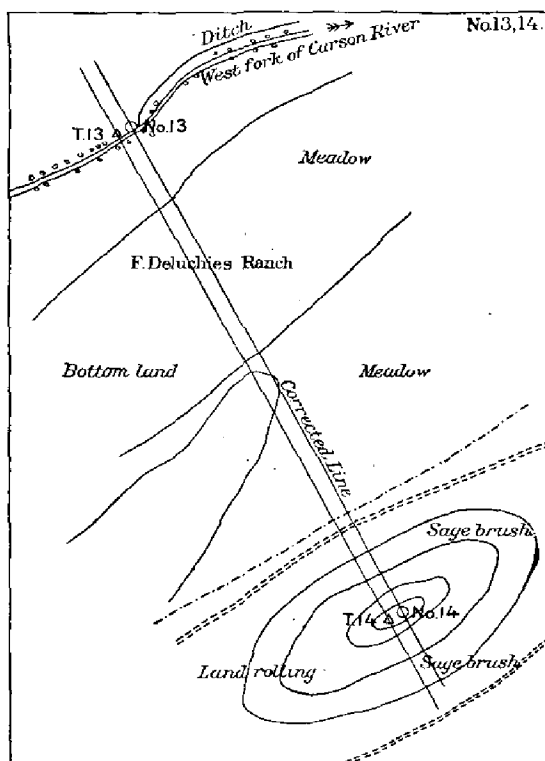
line, so as to place it 18 inches from the east fence line and in the road. Marked by cut granite monument, similar to No. 1. "C" cut on the California side, "N" on the Nevada side, and "No. 12" painted on the northwest face.

T 13.

This station is located about one-fourth mile south of F. Deluchies' house, on the west bank of West Branch of Carson River. Ground is rolling and sandy, with some projecting bowlders. An irrigation ditch leaves the river near the station, and the dam

for the same here crosses the river. Station was marked by a post 6 inches in diameter, projecting 6 inches above the ground.

Point on corrected line, "No. 13," put in at right angles to line from old station, to eastward; distant 4.90 meters, marked by a cut granite monument, similar to the one at No. 1. It is on the west side of the West Fork of the Carson River, about 8 feet from the edge of trees. "C" cut on California side, "N" on Nevada side, and "No. 13" painted in black paint on northwest face.



T 14.

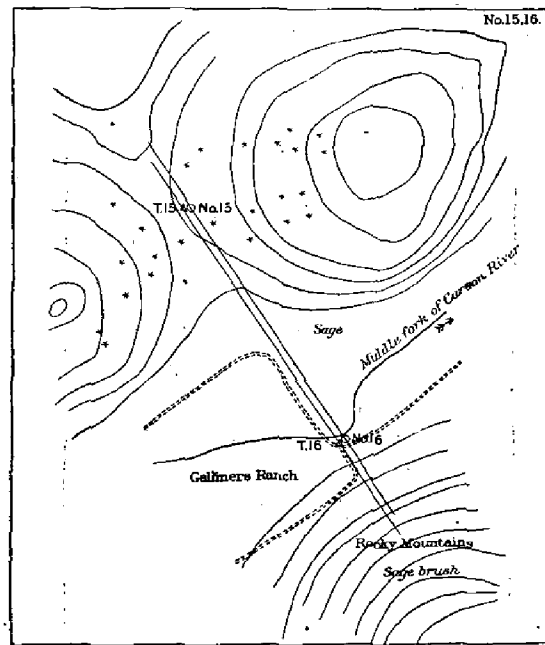
This station is located on the first low ridge on the east side of Carson Valley, about three-fourths mile from the crossing of the West Branch of Carson River and about 200 yards east of the road on east side of valley that goes to Diamond Valley. The land surrounding the station is rolling and covered with sagebrush, and the soil is sandy, with some gravel, rocks, and boulders.

Point on corrected line, "No. 14," put in at right angles to the line, to the eastward

from old station, distant 5'14 meters, marked by a cut granite monument similar to the one at No. 1. "C" cut on the California side, "N" on the Nevada side, and "No. 14" painted in black on northwest face.

T 15.

This station is located on summit of the low divide between Diamond or Dutch Valley and the valley of the West Branch of the Carson River. It is about three-fourths mile north of Mr. George Galliner's house and about one-fourth mile northwest of the road on west side of Dutch Valley. The land at triangulation station is rocky



and is covered with sagebrush and scattering scrub cedars and pine. Station marked by a post 4 inches in diameter, projecting 6 inches above ground.

Point on corrected line, "No. 15," put in at right angles from old station, to the eastward, distant 5'76 meters, marked by a drill hole in a stone, and a pine post, 2 inches by 4 inches by 4½ feet, marked "C. N. 15." Around post was built a cairn 5 feet high.

T 16.

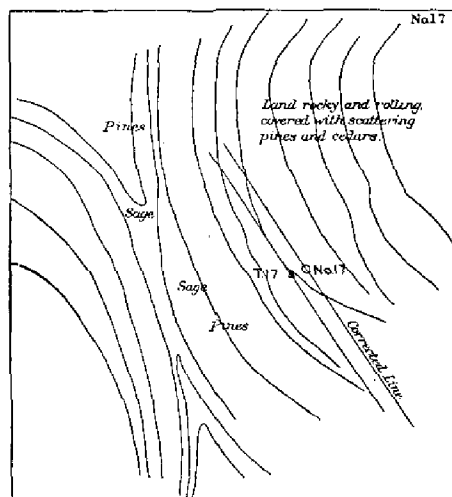
This station is located on the east side of the Middle Fork of Carson River, 50 feet from the bank of the stream and 50 feet from the road running down the valley. It is about 200 feet north of the north fence of Galliner's ranch and about one-half mile

north from his farm buildings. Station was marked by a post $5\frac{1}{2}$ feet high and 7 inches square, marked "U.S.C. & G.S." on northwest, "Cal." on southwest, "1894" on southeast, and "Nev." on northeast. The land around station is sandy and covered with sagebrush.

Point on corrected line, "No. 16," put in at right angles to line from old station, to the eastward, and distant 5.94 meters, marked by a drill hole in a stone and a post marked "C. N. 16." Around post a cairn was built $4\frac{1}{2}$ feet high.

T 17.

This station is located on the summit of the divide between the Middle and East forks of the Carson River, about a mile southeast of the Middle Fork and about one-fourth mile north of the county road running from the Middle Fork to the East Fork, and about $1\frac{1}{2}$ miles northeast of George Galliner's house. The land at station is rocky, and there are scattered, stunted pine trees. Triangulation station is marked by



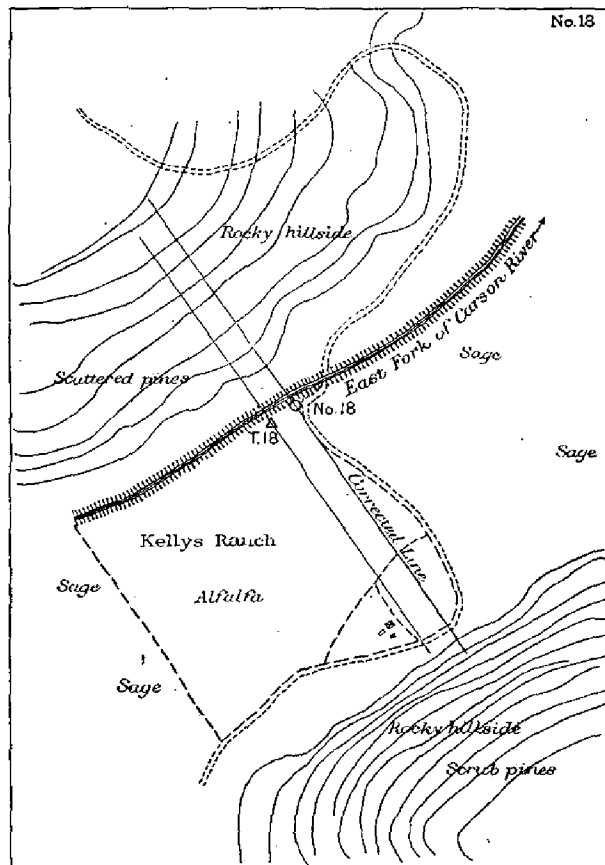
a hole drilled in a rock, projecting 8 inches above surface of ground. A 65-foot pole was erected at this triangulation station in order to be seen from Rock Cliff triangulation station, and rocks were piled around the foot of it.

Point on corrected line, "No. 17," put in at right angles to line from old point, to the eastward, and distant 6.33 meters, marked by a drill hole in flat rock and a pine post marked "C. N. 17." Around post there was built a large cairn.

T 18.

This station is located on the east bank of the East Fork of the Carson River, on the Kelley ranch, just south of the wire fence on the north side of the ranch and about one-

fourth mile northwest of Kelley's house. Land around station is rolling, soil sandy and covered with sagebrush. Triangulation station was marked by a post 5 by 8 inches and 6 feet high, "Nev." on northeast, "U.S.C. & G.S." on northwest, "Cal." on

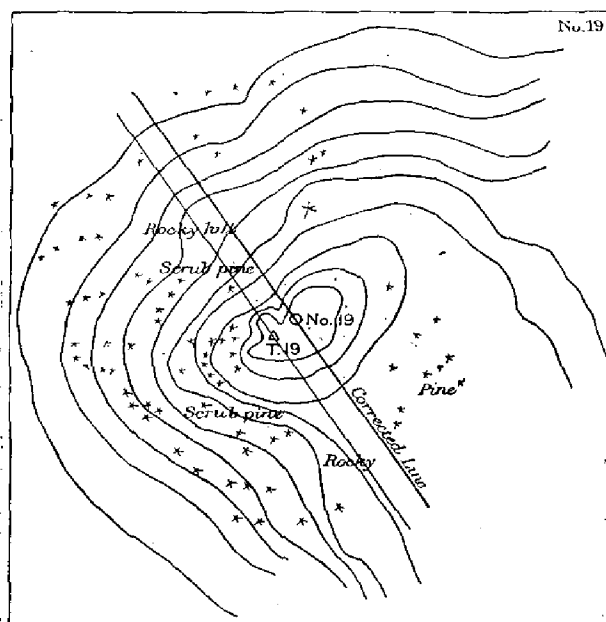


southwest, and "1894" on southeast. A cairn 5 feet high and 4 feet base was built around post. The road from Diamond Valley to Kelley's ranch runs 50 feet north of station.

Point on corrected line, "No. 18," put in at right angles to line from old station, to the eastward, and distant 679 meters, marked by drill hole in a circular stone and a pine post marked "C. N. 18." Around post was built a cairn. Point is on the fence line, on the north side of the Kelley ranch.

T 19.

This station is located on the first ridge east of the East Fork of the Carson River, about one-half mile southeast of the Kelley ranch, from which the pole that marks it can be seen. A trail to station leaves the road at Kelley's ranch. The station is on a rocky part of the ridge, there being many large rocks and boulders projecting from the

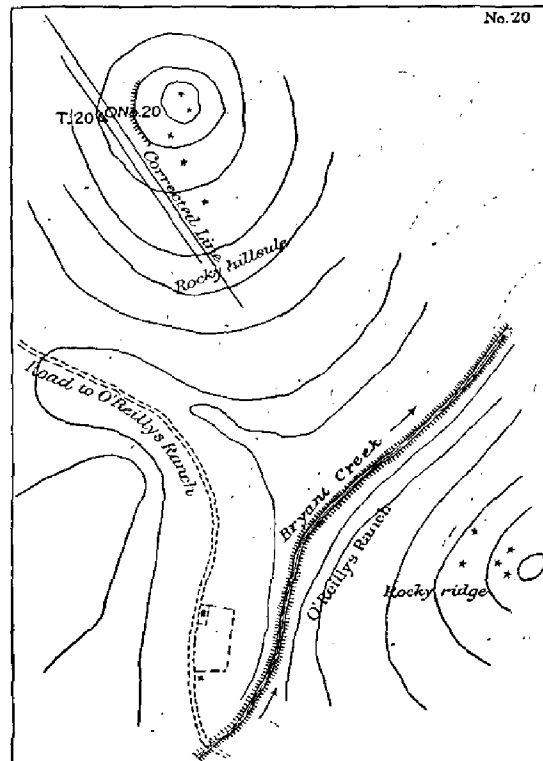


ground, on one of which the triangulation station is marked by a hole drilled in the rock. The northwest side of ridge is covered with second-growth pine timber; on the summit the timber is more scattering.

Point on corrected line, "No. 19," put in at right angles to line from old station, to eastward, distant 7.08 meters, marked by drill hole in stone and pine post marked "C. N. 19." Around post there was built a large cairn. The pole at the old station was left standing.

T 20.

This station is located on the south side of a low rocky butte that is on the west side of Bryant Creek and just west of Barney O'Reilly's ranch. Triangulation station is about a mile west of O'Reilly's house and about one-fourth mile from the road running from east fork of Carson River to O'Reilly's. Triangulation station is about 100 feet lower than the highest point of the butte. Land is rocky, slopes to the south, and is

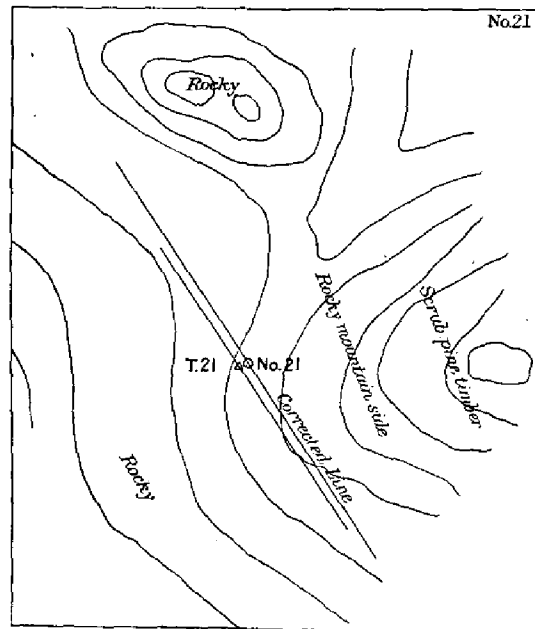


covered with scattered sagebrush, with a few small pines. Triangulation station is marked with a 4-inch pine pole, around which is built a cairn 4 feet high and 4 feet base.

Point on corrected line, "No. 20," put in at right angles to line from old point to the eastward, and distant 7'35 meters, marked by a drill hole in a stone, and a pine post marked "C. N. 20." Around post was built a large cairn.

T 21.

This station is located on the north side of Bryant Creek, on the southwest slope of a steep bluff, almost bare of vegetation and covered with small bowlders and loose rock. It is about 400 feet above the bed of the creek and more than that below the summit of the ridge. It is about $1\frac{1}{2}$ miles up the creek from O'Reilley's house. The triangulation station is marked by a 5-inch dry pine pole, around which was built a cairn 5 feet high and 4 feet base.

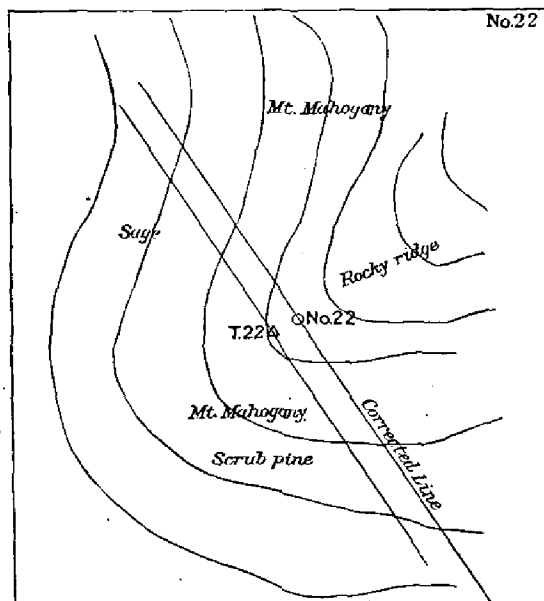


Point on corrected line, "No. 21," put in at right angles to line from old station to the eastward, and distant 8.02 meters, marked by drill hole in stone. A pine pole 5 feet long, marked "C. N. 21," and around pole a cairn was built.

T 22.

This station is located on the summit of the main ridge between Carson River Valley and the west fork of Walker River, on the brow of the ridge and about half a mile north of Bryant Creek Cañon, and overlooking Carson and Walker River valleys. Station is about 2 miles southwest of Mountain House, on the Carson and Bodie road, and is reached from there by a pack trail going up first cañon to the northwest of Mountain House, about a mile to foot of ridge, thence south up the ridge to flat on mountain, thence west on flat and low ridge to main ridge, thence along side of main

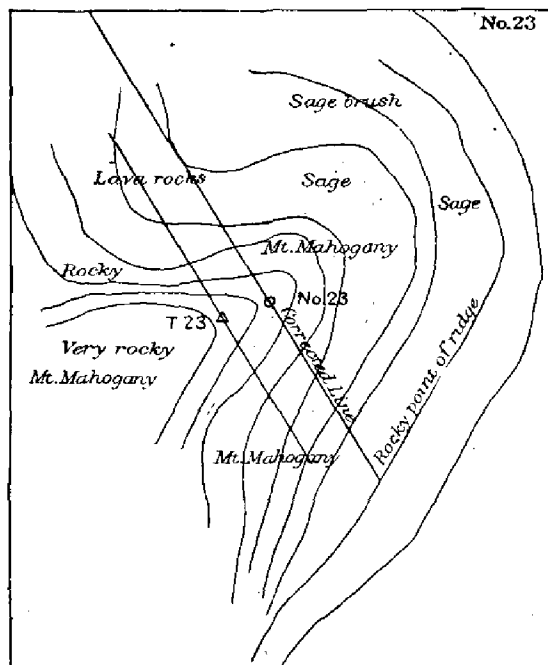
ridge to station on point of mountain. Land at triangulation station is rocky, with some sagebrush, mountain mahogany, and small pines. Station is marked by a hole drilled in solid rock, a pole 6 inches in diameter, and a cairn around same, 6 feet high and 5 feet base.



Point on corrected line, "No. 22," put in at right angles to the line from old station, to the eastward, and a mountain mahogany post 6 feet long, marked "C. N. 22." Around post there was built a large cairn.

T 23.

This station is located on the summit of the first ridge to east of the main divide between Carson and Walker River valleys, is about a mile southeast of Knoll triangulation station, and is 300 or 400 feet higher than that station. It overlooks the valley of Walker River and Alkali Lake. It is easily reached from Mountain House, by trail to flat on mountain, thence $1\frac{1}{2}$ miles southeast by easy ascent round ridge to station.

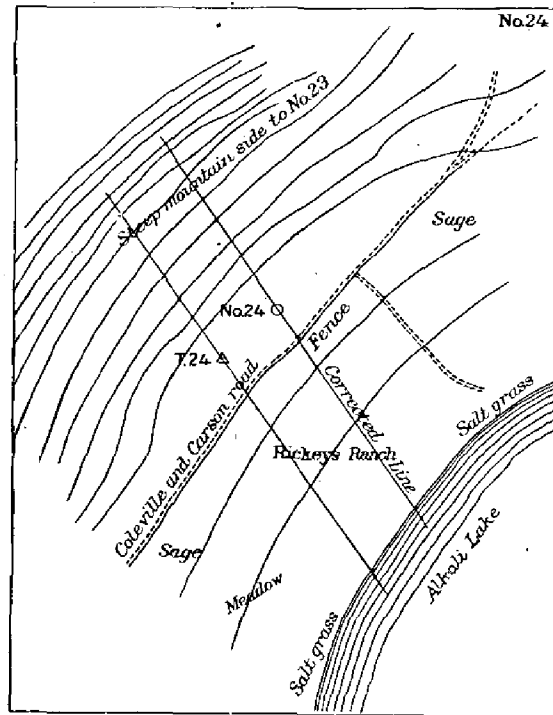


The land at station is rocky and covered with thicket of mountain mahogany. Triangulation station is marked by a hole drilled in rock, projecting above ground. A pole 6 inches in diameter was erected, and cairn 5 feet high and 4 feet base built.

Point on corrected line, "No. 23," put in at right angles to line, from old station to the eastward, and distant 10.07 meters, marked by a drill hole in stone and a pine post marked "C. N. 23." Around post a large cairn was built.

T 24.

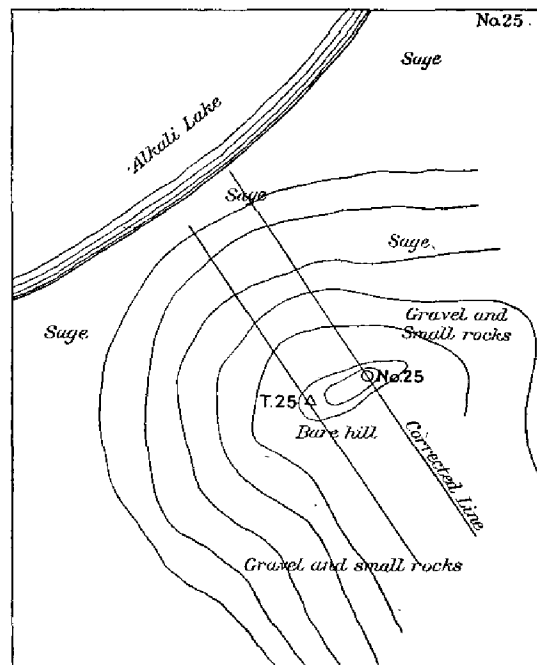
This station is located on northwest side of Alkali Lake, about one-fourth mile from same, and just west of the Carson City and Coleville road, at the foot of steep side of mountains. Station was marked by a pole, with cairn 4 feet high and 4 feet base built around it.



Point on corrected line, "No. 24," put in at right angles to line from old station, to eastward, distant 1079 meters, and was marked by a cut-granite monument similar to the one at "No. 1." "C" is cut on California side, "N" on Nevada side, and "No. 24" painted in black on the northwest face. A cairn was built around monument

T 25.

This station is located on the summit of the first hill southeast of Alkali Lake, about one-fourth mile from the edge of the lake and about the same distance north of the wire fence on the north side of Thomas Rickey's hay meadows, and about 3 miles from ranch buildings. Triangulation station is just in Antelope Valley, on the north side, and is some 4 miles from Mountain House.



Point on corrected line, "No. 25," put in at right angles to line from old station, to the eastward, and distant 11'34 meters; marked by drill hole in stone and pine post marked "C. N. 25." Around post was built a large cairn.

T 26.

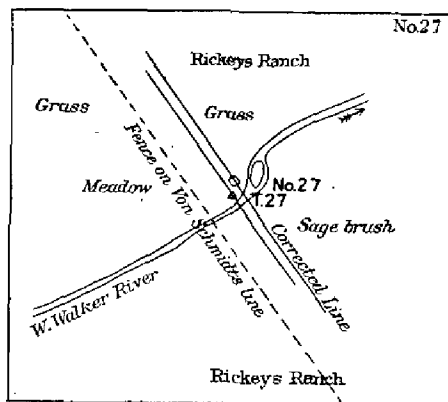
This station was only used as a temporary one in 1894.

T 27.

This station is located on the west side of west branch of Walker River, in the hay meadow of the Rickey ranch, about 2 miles below the ranch house, and about a mile southeast of the main road of the ranch running up valley. The triangulation station is marked by a post 6 inches diameter, projecting 6 inches above ground. Here the valley

of the West Walker River is called Antelope Valley; is owned almost entirely by Thomas Rickey, and is a great cattle ranch, and a large quantity of hay is grown.

Point on corrected line, "No. 27," put in at right angles to line from old station, to eastward, distant 12'21 meters, thence 39'37 meters in a northwest direction parallel to the line to get on good ground on the bank of West Walker River. Point was marked



by a cut granite monument, similar to the one at "No. 1." A circular ditch, 12 feet in diameter, was cut around monument, and a mound of earth 4 feet high thrown up. "C" cut on California side, "N" on Nevada side, and "No. 27" painted in black on the northwest face.

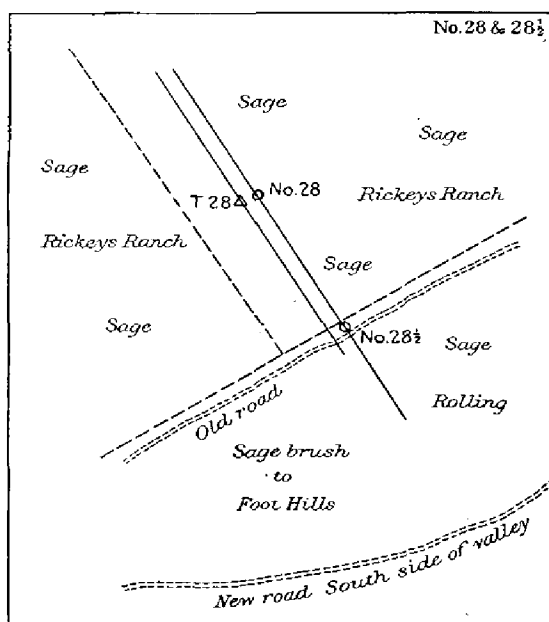
T 28.

This station is located on the southeast side of the west branch of Walker River, Antelope Valley, about 2 miles southeast of the stream and about 1 mile northwest of the edge of the foothills. The wire fence on east side of Rickey's ranch is one-fourth mile southeast of station. An old road running through the valley north and south is just outside of this fence, and the new road is about one-half mile to the southeast of this road, and runs along at the edge of the foothills. Station was marked by a post projecting 6 inches above the ground.

Point on corrected line, "No. 28," put in at right angles to line, from old point, to the eastward, and distant 13'09 meters. Station marked by a cedar post 7 feet long and 8 inches in diameter, set in the ground and marked "C. N. 28." Southeast of post and touching it was placed a large stone with drill hole in it. A circle of stones was laid around post 6 feet in diameter and a mound of gravel thrown up around post and stone. Station is about 2 miles south of the Rickey ranch house.

No. 281.

This station was lined in from stations "No. 27" and "No. 28," and the distance measured from "No. 28" with a steel tape. It is 494.5 meters southeast of "No. 28," 15 feet southeast of the wire fence, on east side of Rickey's ranch, and 15 feet northwest of the old road through Antelope Valley, north and south from Rickey's ranch to Wellington. One-half mile southeast of this road is the new road through the valley from Coleville to Wellington, running along at the edge of the foothills and clear of the Rickey ranch. Station was marked by a cedar post 7 feet long and 8 inches in diameter, marked "C. N. 28²," set in the ground 2 feet. A stone with drill



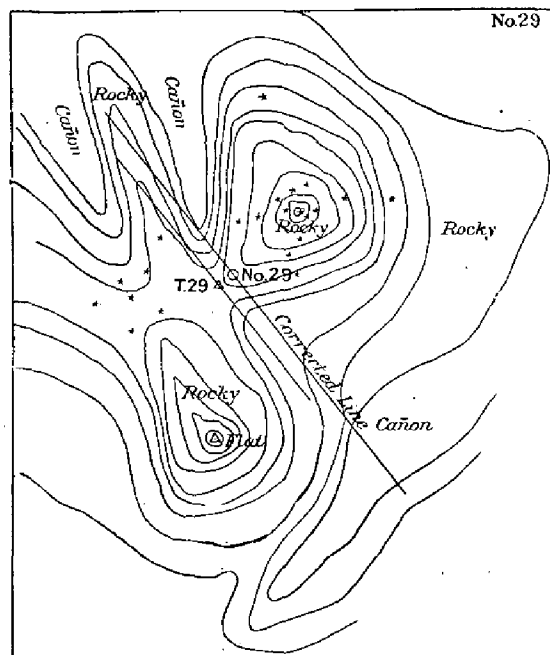
hole in it was placed southeast, touching post. A circle of stones 6 feet in diameter was laid around post and stone, and a mound of gravel thrown up about them.

T 28.

This station is located on the first wooded ridge to the west of the main range between the Sweetwater and West Walker river valleys. It is in a saddle and about 300 yards to the north of the bare peak on which is located triangulation station Flat. The land at the station is rocky and covered with scrub piñon timber. The triangulation station is about 7 miles east of Topaz, or the Rickey ranch, and is reached from there by following up their wood road into the mountains about 4 miles, thence up pack trail through ravine to top of ridge and station. Triangulation station

marked by a hole drilled in a rock. A pole 5 inches diameter was erected and cairn built around it. The trail up to the station is very steep and rocky.

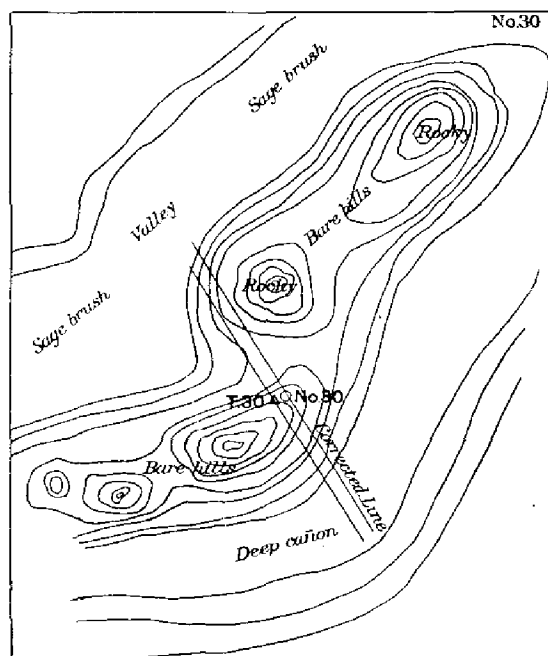
Point on corrected line, "No. 29," put in at right angles to line, from old point, to the eastward, distant 14.97 meters, thence 5.39 meters northwest in the direction of



the line, in order to place point on top of ridge. Marked by drill hole in solid rock; over this is a nut-pine pole, marked "C. N. 29;" and around pole a cairn. Triangulation station is not on the highest part of hill, but on the southwest slope, about 200 yards from the summit. Point very rough and rocky, covered with nut pine.

T 30.

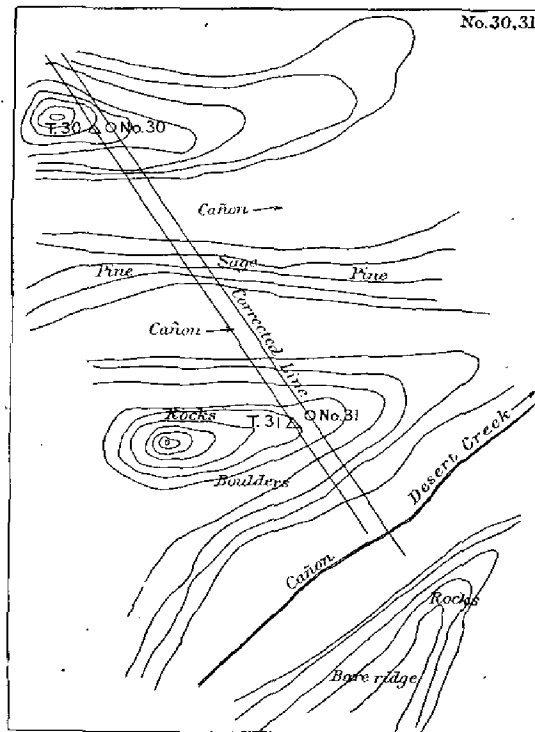
This station is located on the second prominent ridge, to the west of the main range, between the Sweetwater and West Walker river valleys. The ridge is nearly bare of vegetation, covered with gravel or small bowlders, and its course is nearly north and south. Triangulation station was marked by a hole drilled in a rock on summit of ridge, and a pole 5 inches diameter erected over same.



Point on corrected line, "No. 30," put in at right angles to line from old station, to the eastward, and distant 15'84 meters, thence 6'30 meters southeast in the direction of the line, to place the station on top of ridge. Marked by a drill hole in stone set in place and a birch post marked "C. N. 30," and around post a cairn and gravel. Triangulation station is not on the highest point of the ridge, but on the northeast slope and some 200 yards from the summit.

T 31.

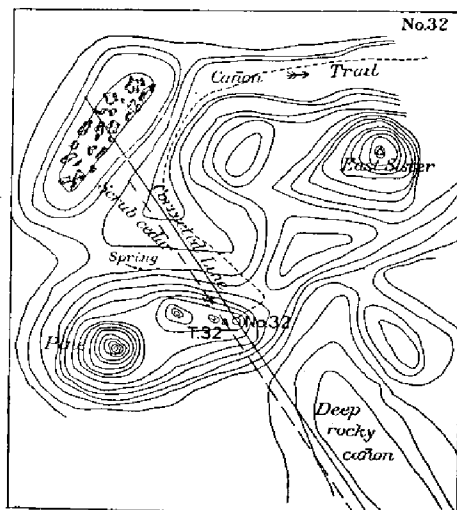
This station is located on the second highest ridge between the Sweetwater and West Walker river valleys, and is the first prominent ridge west of the main ridge and extends nearly parallel with it. It is bare of vegetation and covered with gravel, small rocks, and boulders. Triangulation station was marked by a hole drilled in rock on summit of ridge, and a pole 6 inches diameter erected over same.



Point on corrected line, "No. 31," put in at right angles to line from old station, to the eastward, and distant 16'31 meters, thence 3'83 meters northwest in the direction of the line, to place station on a solid rock. Marked by a drill hole in solid rock, over this a pine post marked "C. N. 31," and a cairn around post. Station is on the first high ridge west of Desert Creek, where the line crosses; not on the highest point, but on the north slope, some 400 yards from summit, in a small sag.

T 32.

On the summit of the main range of the Sweetwater Mountains, on the middle of one of the three peaks known as the "Three Sisters." Triangulation station is not on the highest part of the peak, but about 300 feet below it, on the north side of same. The peak is rocky and bare of vegetation. Triangulation station is marked by a hole drilled in the solid rock, and a pole 6 inches diameter was erected above same. This peak is difficult of access, as it is very steep on all sides and high, being over 11 000

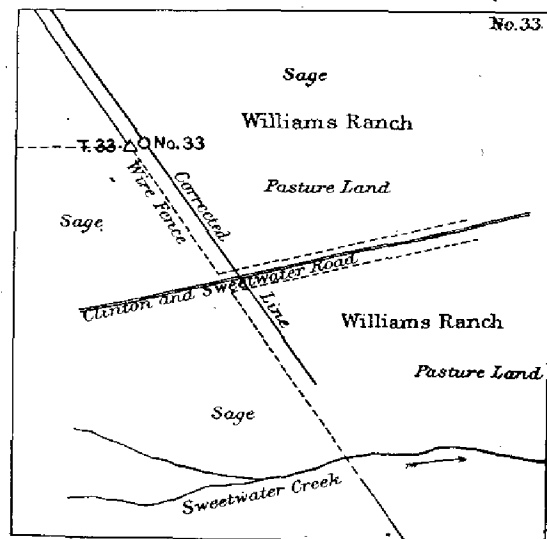


feet above sea level. It may be reached from the Williams ranch, in Sweetwater Valley, by climbing on foot the steep slope from the east side, or by leaving the Bodie road one-half mile south of Dalzells Station, and following a pack trail around north and west side of mountain to within one-half mile of station, thence up steep west slope of Middle Sister to station.

Point on corrected line, "No. 32," put in at right angles to the line from old station to the eastward, distant 17.77 meters, thence southeast 7.76 meters in direction of line, to put station on ridge. Marked by drill hole in stone set in place, and a nut-pine pole marked "C. N. 32," and a cairn 6½ feet high around post. Station is on the north slope, about 350 feet from the summit.

T 33.

In the Sweetwater Valley, on the Williams ranch, about $1\frac{1}{2}$ miles west of the Sweetwater post-office, and about one-half mile northwest by the line from the road from Clinton to Sweetwater post-office. Triangulation station is at the corner of a wire fence, and is marked by a post projecting 6 inches above ground. Station is easily reached from Sweetwater post-office by following the Clinton road for $1\frac{1}{2}$ miles, thence northwest along wire fence to station.



Point on corrected line, "No. 33," put in at right angles to line from old station to the eastward, distant 19'75 meters, thence 14'40 meters southeast in direction of line, to place station on highest ground. Marked by a drill hole in solid rock and a willow post marked "C. N. 33," and a cairn around pole. Station is 50 feet east of the fence corner. Ground covered with sagebrush, rocks, and small boulders.

T 34.

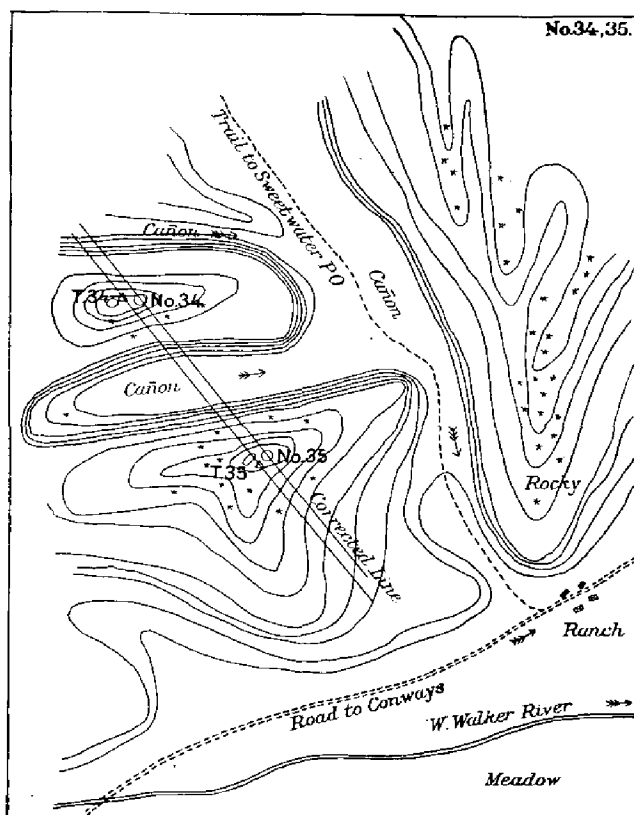
Station is on one of the low ridges lying on the west side of West Walker River, and about 1 mile from the same. Ridge is rocky and wooded with scattering second-growth pine. Triangulation station is marked by hole drilled in rock and a pole 5 inches diameter erected over same, and cairn. Station is reached by following wood road southwest from Roache's ranch (in Sweetwater Valley) 2 miles to ridge, thence southeast on ridge to station.

Point in corrected line, "No. 34," put in at right angles to line from old station to the eastward, distant 20'99 meters, thence southeast in direction of line 13'70 meters to place station on top of ridge. Station is marked by a drill hole in stone, set in place,

and a nut-pine pole marked "C. N. 34," and a cairn around pole. Station is on the second ridge northwest from the West Walker River, and only 621 meters from No. 35, which is separated from it by a deep cañon.

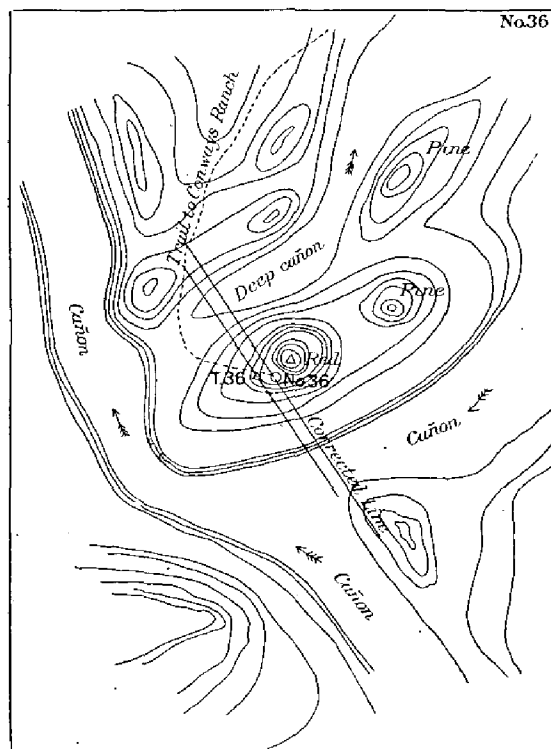
T 35.

On the first low ridge to the west of West Walker River, overlooking and about one-half mile from same, and also from Bridgeport road, which runs through the valley. Ridge is wooded with second-growth pine timber. Triangulation station is marked by a hole in rock, and a pole 5 inches diameter erected over same. Station is reached from Bridgeport road at Fulston's ranch by ascending a slope one-half mile west to station.



Point on corrected line, "No. 35," put in at right angles to line from old station to eastward, distant 21'14 meters, thence 8'65 meters northwest in direction of the line to place station on top of ridge. Marked by a drill hole in solid rock; over this a cedar post marked "C. N. 35," and a cairn around post. Ridge covered with nut pine and some cedar. Just northwest of this station there is a deep cañon separating T 34 from this station.

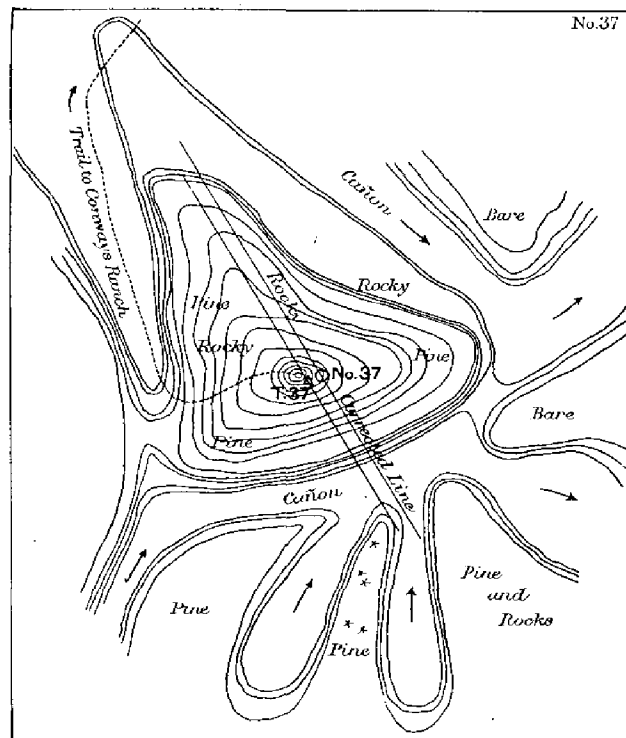
Point on corrected line "No. 36," put in at right angles to line from old station to the eastward, distant 22.45 meters, thence southeast in direction of the line 11.37 meters to place station on highest part of ridge and on a solid rock. Marked by drill hole in the rock; over this a cedar post, marked "C. N. 36," and a cairn around post.



Station is about $3\frac{1}{2}$ miles south of Conway's ranch, on a high, conical, heavily wooded hill, very rocky on top and on the north side. The peak is the first high peak east of the peak known as Masonic Peak, distant about $1\frac{1}{2}$ miles. From the reddish color of the soil as seen from a distance this peak is known in this locality sometimes as Red Peak. A trail and wood road from Conway's ranch goes to within three-fourths of a mile of station, which is on the western slope, about 150 feet from summit. Road ends on east side of hill. Triangulation station Red, and a Von Schmidt post, 4 feet southeast of Red Station, are on the summit.

T 37.

This station is located on a high, wooded peak 1 mile northwest of the main divide between West Walker River and the Bodie Creek depression. The sides of this peak are rocky and covered with nut-pine timber. This is one of the most prominent peaks of what are known locally as the Red Hills, and from it a view can be had of the Sweetwater and West Walker River Valley. It can be reached most easily from West Walker River by following a wood road from the Compton ranch south and southwest along a ridge heading the cañon; thence southeast, following trail in cañon to station

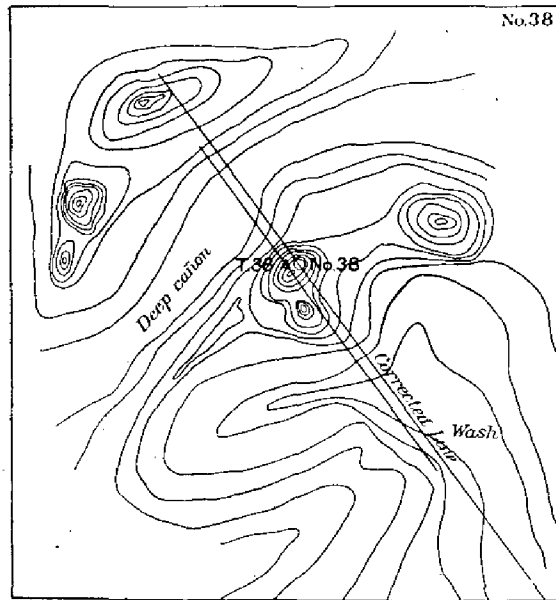


on peak. Station is not on highest part of peak, but on the northeast slope, about 100 feet below the summit. Marked by drill hole in rock, pole, and cairn.

Point on corrected line "No. 37," put in at right angles to line from old station to eastward, distant 23.43 meters; thence 1.97 meters southeast in direction of line to place station on a solid rock. Marked by drill hole in the solid rock, and willow post marked "C. N. 37," and a cairn around post. Station is on the northeast slope of the peak, about 150 yards from the summit and some 125 feet below it.

T 38.

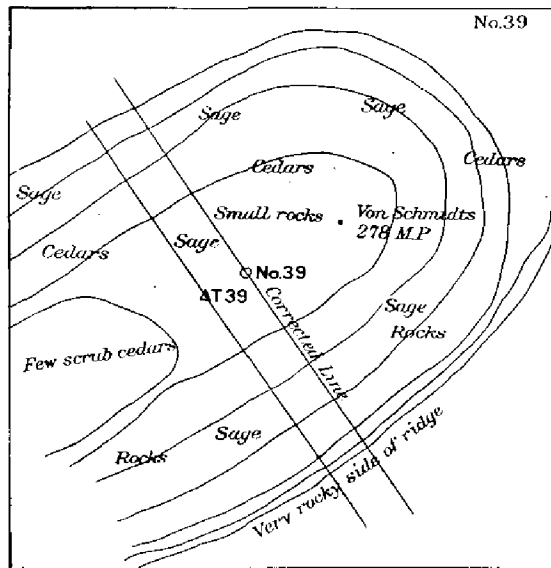
On a rocky ridge which forms part of the main divide between the West Walker Valley and the Bodie Creek watershed. It is about 4 miles northwest of the Gregory ranch, and can be reached from there by following pack trail to Chinese wood choppers' camp; thence northwest up side of ridge to station. Ridge at station is very rocky, and there are a few scrub cedars growing on summit of ridge east of station. Station is not on the highest part of ridge, but about 60 feet southwest of summit. Marked by drill hole in solid rock and pole over same.



Point on corrected line, "No. 38," put in at right angles to line, from old station, to the eastward, distant 24'03 meters, thence southeast in direction of line 6'57 meters to place station on top of peak. Station marked by drill hole in solid rock; over this a birch post marked "C. N. 38" and a cairn around pole. Peak at station is very rocky, being composed of large boulders. Station is on the northern edge of the summit, about 20 feet north of the station "T 38 Ecc." About 400 yards south of this peak is another rocky peak on the same ridge and about the same height.

T 39.

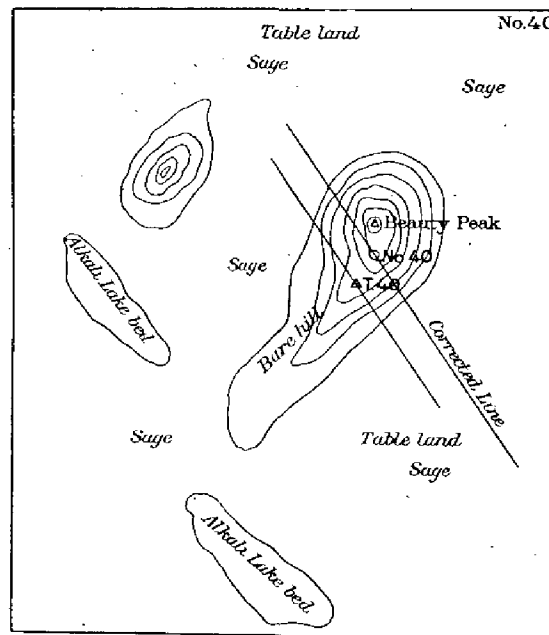
About $1\frac{1}{2}$ miles northwest of Gregory's ranch, on Rough Creek, on flat, rocky ridge, the course of which is nearly east and west. Ridge at station is bare of vegetation except a few scattered scrub cedars, and stunted sagebrush. Station marked by a drill hole in rock, 4-inch pole, and cairn. Von Schmidt's "278 M. P." is about 190 yards north of this triangulation station.



Point on the corrected line, "No. 39," put in at right angles to line, from old station, to eastward, distant 25.19 meters, marked by a drill hole in a solid rock, and a pine pole over same, marked "C. N. 39," with a cairn around pole. Station is located on the flat ridge or table-land that is just north of Rough Creek, and is about $1\frac{1}{2}$ miles northwest of the Gregory ranch. A trail from ranch goes up the southeast slope from Rough Creek. The station is east of the place where the trail tops the ridge or flat, and the cairn is visible from this point.

T 40.

This station is located on "Beauty Peak," a peak that rises from the table-land west of Bodie Creek, and is about $1\frac{1}{2}$ miles northwest of Bodie Creek at Sunshine, and about 3 miles east of Gregory's ranch. Beauty Peak triangulation station is about 200 yards north of this station, on same peak. The ground at station is lava rock, almost void of vegetation; and station is marked by a hole drilled in the lava rock, with pole and cairn. Station is reached from Gregory's ranch by following a trail east



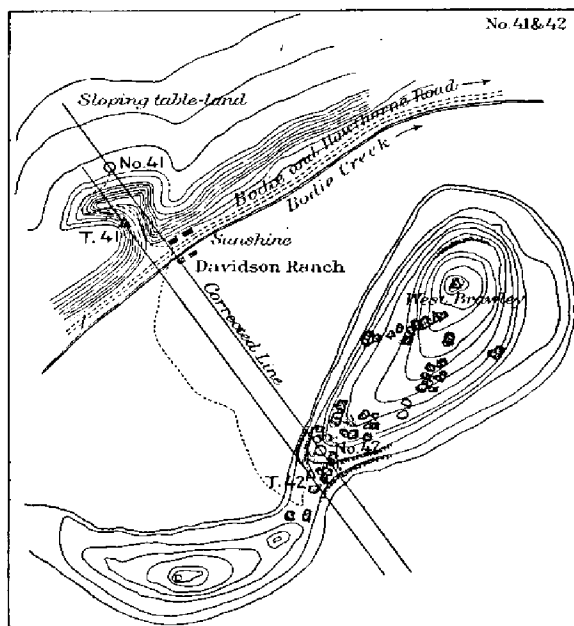
2 miles to top of table-land, thence a mile to foot of peak, thence up side of peak to station. This is the highest and most prominent peak rising from the table-land, and is northeast about 1 mile from two large alkali lakes.

Point on corrected line. "No. 40," put in at right angles to line, from old station, to the eastward, distant 26'52 meters; thence northwest in direction of the line 18'04 meters to place station on top of ridge. Marked by a drill hole in a large rock; over this a birch pole marked "C. N. 40," and a large cairn around pole. Station is on the south slope of the peak. The main road from Gregory's ranch to Bodie passes 1 mile to south of peak, near an alkali lake.

T 41.

On the top of the high, rocky bluff just north of Bodie Creek, and near Sunshine, or Davidson's ranch, on the Aurora and Bodie road, and can be seen from the road that runs along the valley at foot of bluff. Station marked by pole and pile of stone, and drill hole in stone.

Point on corrected line, "No. 41," put in at right angles to line, from old point, to the eastward, distant 27'03 meters, thence 90'0 meters northwest in direction of line, in order to place station on the north side of the small cañon that separates this point from the old station. This cañon enters the valley at the Davidson ranch, the ranch house being visible from the station. There is a trail, or old wood road, about three-fourths of the way up the cañon, but very steep. The cañon comes to an end on the table-land, about 200 yards southwest of the station. Station marked by a drill hole in a solid rock; over this a pine pole marked "C. N. 41" and a cairn around pole.



T 42.

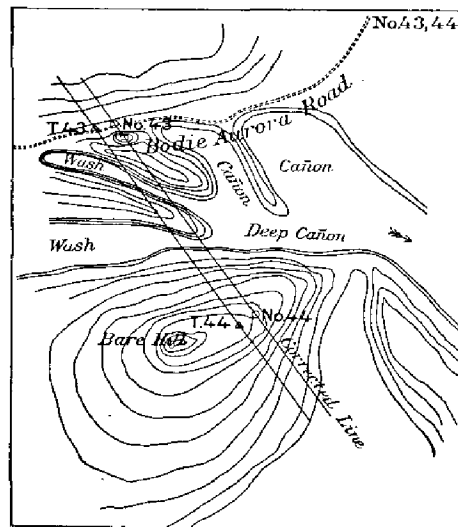
In sag on summit of Brawley Mountain, 2 miles southeast of Sunshine, or Davidson ranch, on Bodie and Hawthorn road. Ridge at station is rocky and bare of vegetation. Triangulation station is marked by a drill hole in solid rock, a pole erected over this and a cairn around same. Brawley Mountain is one of the most prominent elevations between the Sweetwater and White Mountains. Station can be reached from Bodie road at Davidson ranch by following trail from there up the side of mountain 2 miles to top of mountain to gap, thence up steep rocky side 200 feet to station.

Point on the corrected line, "No. 42," put in at right angles to line from old station to eastward, distant 27'90 meters, thence northwest in direction of line 8'81 meters in order to place station on top of ridge and on a solid rock. Marked by drill hole in the solid rock. Just southeast of drill hole and 2 feet from it was placed a pine post marked "C. N. 42," and around post and boulder was built a cairn. Ground near station covered with very large boulders and rocks.

T 43.

On east side of Brawley Mountain, about $1\frac{1}{2}$ miles from summit, at the Bodie and Aurora road, about 4 miles south of Aurora. The land at station is sandy and rocky, some sagebrush and scattered pines and scrub cedars. Station is marked by a hole drilled in a rock about 2 feet in diameter and pole erected over same.

Point on the corrected line, "No. 43," put in at right angles to line from old station to eastward, distant 28'53 meters, marked by drill hole in stone set in place; over this a cedar post marked "C. N. 43," and a cairn and gravel thrown up around post. Station is 75 feet northwest of the Bodie and Aurora road, about 4 miles south of Aurora. A short distance beyond the station, to the west, the road dips down into a deep cañon. On the east side of road and not more than 150 yards from it, in Nevada, rises a small knoll covered with scrub cedars, this knoll being some 50 feet higher than the station.



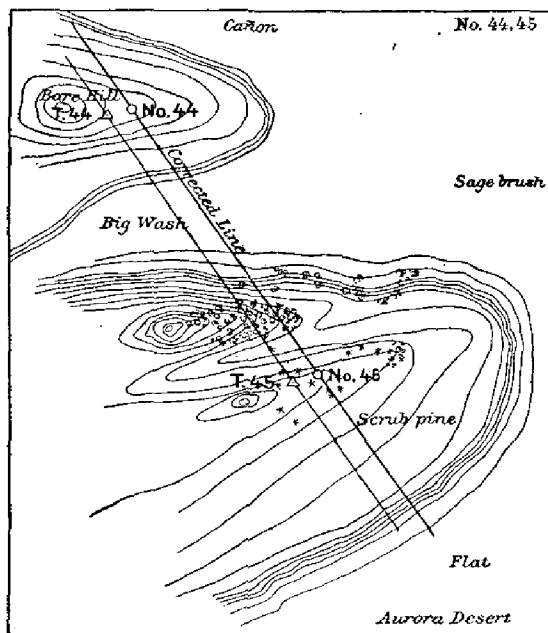
T 44.

On a peak of lava rock nearly bald that stands almost isolated about 5 miles south of Aurora and about 3 miles east of Mono Lake. Station is not on highest part of peak, but about 100 feet below it on east slope. Ground at station is very rocky, and there is some scattered sagebrush, two scrub cedars, and pines. Station is marked by hole drilled in a rock, a pole erected, and a cairn built. Station is reached by following the Bodie road south from Aurora 3 miles, thence taking the old road to Mono Lake 2 miles to north side of peak, thence up peak to station.

Point on the corrected line, "No. 44," put in at right angles to line, from old station, to eastward, distant 29'20 meters. Marked by a drill hole in set stone, over this a pine pole marked "C. N. 44," and a cairn around pole. Station is on the northeast slope, about 200 yards from the summit.

T 45.

On a double-peaked wooded mountain that stands 3 miles east of Mono Lake and about 3 miles west of the Aurora and Benton road. Station is on southeasterly one of two peaks and about a quarter of the distance from the summit to the foot, from the summit, on the east slope of same. The land at station is rocky and sandy and covered with piñon timber. Station marked by a hole drilled in a rock and a pole 5 inches in diameter erected over same. Station is reached from Aurora by following out the



Benton road about 9 miles, thence 2 miles west to foot of north ridge of mountain, thence by trail to near top of west peak of mountain, thence across ravine to east peak and station.

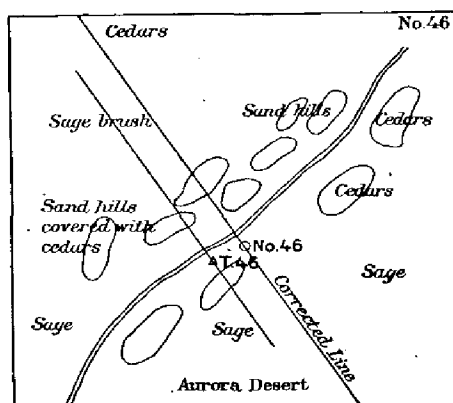
Point on corrected line, "No. 45," put in at right angles to line, from old point, to eastward, distant 30'24 meters, thence northwest in direction of line 20'42 meters in order to place station on top of ridge and on a large boulder some 10 or 15 feet high. On the northeast side it is perpendicular, and the station is on top, within 1 foot of the edge. Marked by a drill hole. Seven feet west of hole and on top of boulder was placed a pine post marked "C. N. 45," and around post was built a cairn.

T 46.

On the desert at the crossing, by the line, of the Benton and Aurora road, about 12 miles from Aurora. Station stands about 100 feet east of road. Ground at station is sandy and covered with scattered scrub junipers. Station is marked by a post 4 inches in diameter, driven into the ground to within 3 inches of its top, and a cedar pole 10 inches in diameter was erected over this. Station is reached from Aurora by following out the Benton road 12 miles.

APPENDIX NO. 3. BOUNDARY LINE BETWEEN CALIFORNIA AND NEVADA. 419

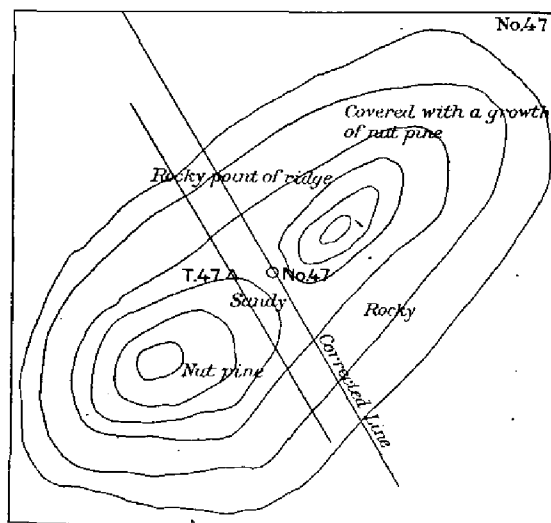
Point on corrected line, "No. 46," put in at right angles to line, from old point, to eastward, distant 31'97 meters, marked by a cedar post marked "C. N. 46," firmly set in the ground. Southeast of post and touching it was placed a stone with drill hole



in it; a mound of earth was then thrown up around the post and stone. Station is about 150 feet southeast of road at crossing of line.

T. 47.

On the summit of a rocky wooded ridge about 1 mile southeast of the Benton and Aurora road. Where the line crosses it the summit of ridge is rocky and covered with

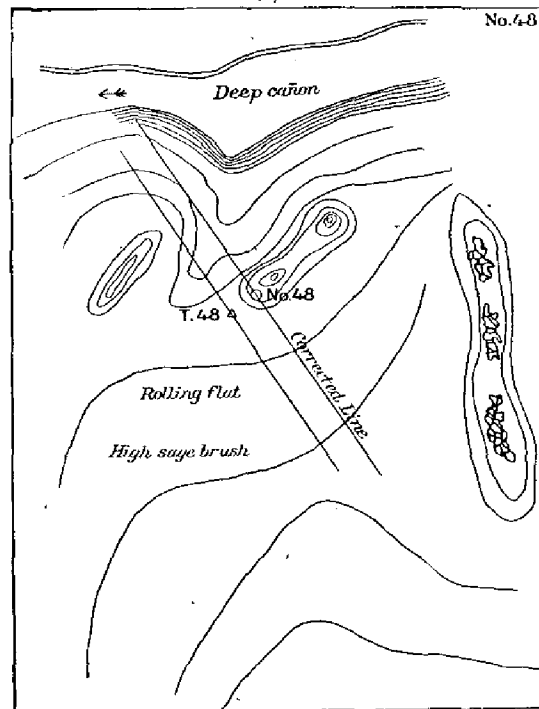


piñon timber. Station was marked by a drill hole in rock, pole over it, and a cairn. Station is reached from Aurora by following out the Benton road 12 miles, thence southeast 1 mile to foot of ridge, thence up the northwest point of ridge to station.

Point on corrected line, "No. 47," put in at right angles to line from old point, to the eastward, distant 32.83 meters, thence southeast in direction of the line 31.04 meters, in order to place station on the crest of the ridge. Marked by a nut-pine post, marked "C. N. 47," firmly planted in the ground. Southeast of post and touching it was placed a stone with drill hole in it; a cairn of stones and gravel was then built around post and rock. Station is on the east slope, some 200 feet from the highest point.

T 48.

On the high table-land to the east of the Aurora and Benton road, on the desert, and about 4 miles from the same. It is reached by following the Aurora and Benton road from Aurora about 14 miles, thence east 1 mile to cañon, thence up cañon



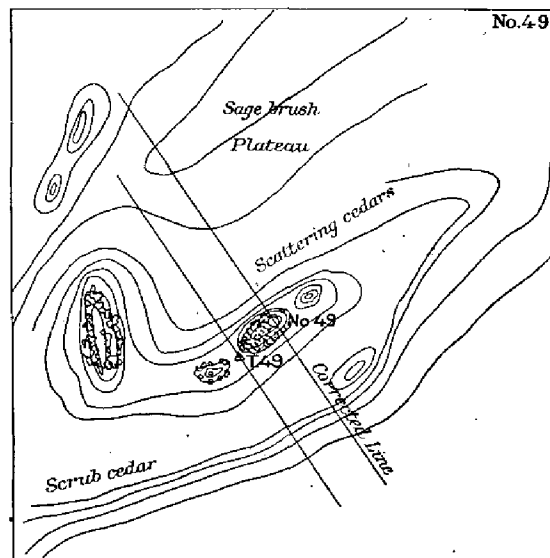
2 miles to near its head, thence southeast up sides of mountain to station. Ground at station is sandy, with some lava ledges projecting, and is covered with sagebrush 3 or 4 feet high. Station marked by hole drilled in rock projecting 1 foot above ground. A pole 4 inches in diameter was erected over same.

Point on corrected line, "No. 48," put in at right angles to line, from old point, to eastward, distant 33.86 meters, thence 8.51 meters northwest in direction of line, to put station on top of ridge and upon a solid rock. Station marked by drill hole in solid rock; over this a cedar post marked "C. N. 48," and a cairn around pole. Station is on the western edge of one of the small lava knolls.

T 49.

On the same high plateau as station T 48, near the eastern edge, and some 1 040 meters southeast of that station. It can be reached from the Aurora road by following up the cañon to station T 48, thence across plateau to station T 49. Station is located on a projecting lava ledge, and is marked by a hole drilled in the lava rock. A pole 6 inches diameter was erected over same. The ground at station is rocky, and below the lava ledge is sandy and covered with sage brush.

Point on corrected line, "No. 49," put in at right angles to line, from old point, to eastward, distant 34'11 meters, thence 0'57 meter northwest in direction of line, to



place station on a solid rock. Marked by drill hole in the rock; over this a cedar post marked "C. N. 49," and around post a cairn. Station is on the northern end of the northern of two small lava peaks or ledges rising from the eastern edge of the plateau.

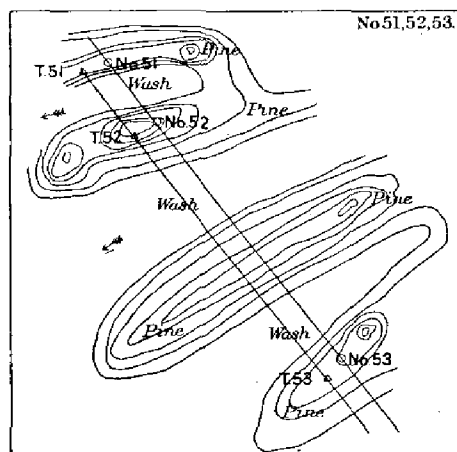
T 50.

This station is 6 730 meters southeast of T 49, and 4 203 meters northwest from T 51. It is on the top of a small round hill that lies a short distance southeast of the trail through Hontoun Valley.

This point, that should be "No. 50," was omitted on the corrected line; but it would fall at right angles to the line to the eastward, distant, 35'69 meters. The point can be put in whenever the line is marked.

T 51.

Point on corrected line, No. 51, put in at right angles to line from old station, to eastward, distant 36.67 meters, marked by a drill hole in solid rock; over this a nut-pine pole marked "C. N. 51," and around pole a cairn. Station on the north edge of a large flat ridge heavily wooded with nut pine. A small, round, wooded hill is about one-fourth mile east of station. Station reached most easily from Bertrand's ranch, to T 54, then following the line northwest to T 52, thence to station.

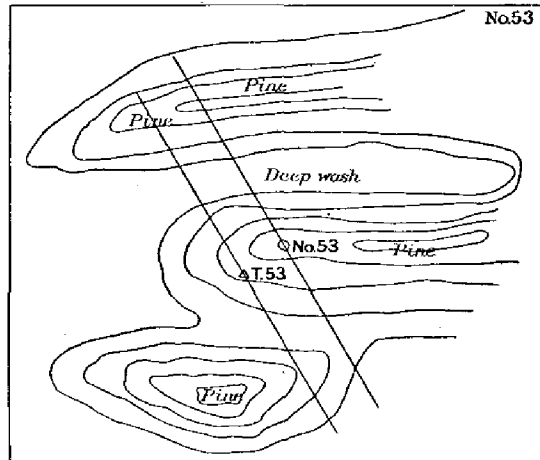


T 52.

Point on corrected line, No. 52, put in at right angles to line from old station, to eastward, distant 36.86 meters. Marked by a drill hole in a solid rock; over this a nut-pine pole marked "C. N. 52," and around pole a cairn of rocks. Station is on the eastern slope of a small, round, heavily wooded hill, the timber being nut pine. About one-half mile to the north is another wooded hill, somewhat higher, and on the ridge that runs off from the hill to the southwest is located T 51. The distance between T 51 and T 52 is only 812 meters. A deep wash is between the two stations. Best way to reach station is from Bertrand's ranch, following along the line northwest from T 54. The whole stretch of country from T 49 to T 58 is a rough, broken country, cut up by deep, rocky cañons, with high hills and heavily wooded ridges running in all directions, and with no house nearer than Bertrand's. Adobe meadow lies just to the west of this mass of hills.

T 53.

Point on corrected line, No. 53, put in at right angles to line from old station, to eastward, distant 37.70 meters, thence northwest in direction of line 5.92 meters to place station on solid ledge and crown of ridge. Marked by drill hole in solid rock; over this a nut-pine pole marked "C. N. 53," and around pole a cairn. Station is on the west-



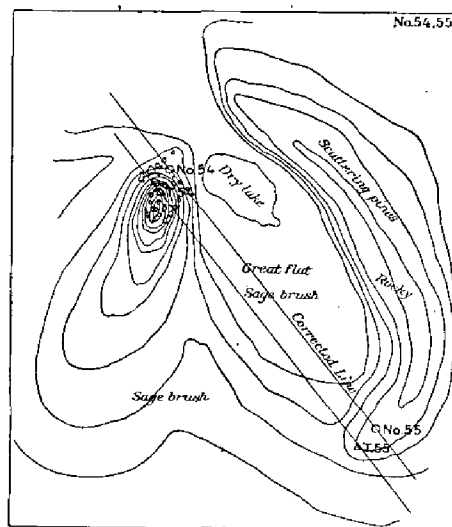
ern slope of a high wooded hill, on the top of which is located Trail triangulation station. Shaw's ranch and the south end of the northern lake in Adobe Meadow are in line and bear S. 41° W (mag.). The whole of Adobe Meadow is visible from this station.

The best way to reach this station is from Bertrand's ranch, via the Dry Lake and T 54, thence northwest along the line to the hill on which the station is located. There are cattle trails all over this section, but no roads or well-marked trails.

T 54.

Point on corrected line, No. 54, put in at right angles to line from old point, to eastward, distant 39'13 meters, thence northwest in direction of line 11'38 meters to place station on crest of ridge. Marked by a drill hole in solid rock; over this a nut-pine pole marked "C. N. 54," and around pole a cairn. Station is about 6 miles northwest of the Bertrand ranch, on the rocky point just west of the Dry Lake. A trail leads from Bertrand's ranch to the Dry Lake (a water place for cattle) and to within a quarter of a mile of the station, which is visible from the lake. Station about 9 miles from Bertrand's by the trail.

The old station is higher up the hill, on the crest of ridge, and is marked by a drill hole in a large boulder. The whole point is very rocky and steep, with a few scattered scrub pines.

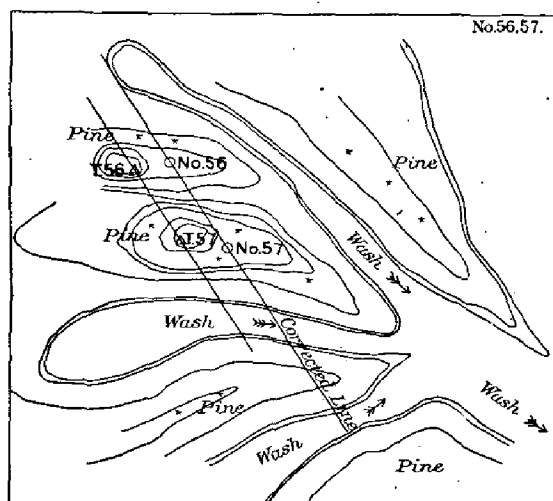


T 55.

Point on corrected line, No. 55, put in at right angles to line from old station, to eastward, distant 39'31 meters. Marked by a drill hole in stone set in place; over this a nut-pine pole, marked "C. N. 55," and around pole a cairn. Station is on the western slope of a rocky hill that is just east of the Dry Lake, about 6 miles northwest of Bertrand's ranch, and about 150 feet from the top of hill. A trail leads from Bertrand's ranch to the Dry Lake, and a trail from lake up onto the hill, on which T 55 is located. T 54 is on the northwest side of the same Dry Lake. This hill on which T 55 is located is almost bare of vegetation, there being only a few scattered nut pines.

T 56.

Point on corrected line, No. 56, put in at right angles to line from old station, to eastward, distant 39.55 meters; marked by drill hole in solid rock, over this a nut-pine pole marked "C. N. 56," and around pole a cairn. Station is on the eastern slope of a small wooded knob, covered with nut pine. About 200 feet south of station is a round bare hill some 50 feet higher than the ridge, and west of station about one-half mile is a sharp little hill some 400 feet higher than station, and with some few nut-pine trees on top. The best way to reach this station is from Bertrand's ranch, via the Dry Lake and T 55, the distance between T 55 and T 56 being only 1 057 meters.

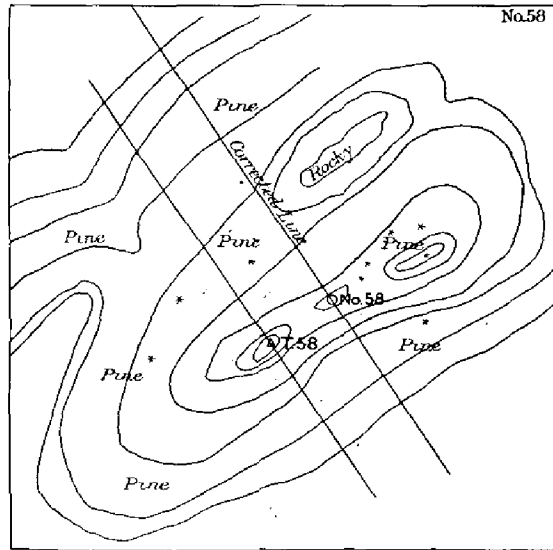


T 57.

Point on corrected line, No. 57, put in at right angles to line from old station, to eastward, distant 39.66 meters, thence southeast in direction of line 70.41 meters to bring point on top of ridge. Marked by drill hole in solid rock. Over this was placed a nut-pine pole marked "C. N. 57," and around pole a cairn was built. Station is on the east slope of a small rounded hill, partly covered with nut-pine timber, and only 452 meters southeast from the ridge on which T 56 is located. Station can be reached from Bertrand's ranch by trail to Dry Lake and T 55 and T 56, or from the ranch via station T 58. Bertrand's ranch, in the Benton Valley, is a very good place to stop, and in fact the only place from which the stations from T 51 to T 59½ can be reached readily. It is about 6 miles from the town of Benton, Cal.

T 58.

Point on corrected line, No. 58, put in at right angles to line from old station, to eastward, distant 40'22 meters, thence northwest in direction of the line to place the point on top of the ridge. Marked by a drill hole in solid rock; above this a nut-pine pole marked "C. N. 58," and around pole a large cairn was built. Station is on the



first high wooded ridge that the line crosses north of Benton Valley, and is about 3 miles north from the Bertrand ranch, from which it is easily reached by riding over the mesa, then climbing up the spur of the hill on the south side to the station. The point is well covered with a growth of nut-pine timber and is very rocky on the top.

T 59.

On northwest side of Carson and Colorado Railroad, and about 25 feet from the center of track, and some 1340 feet south of where the road from Bertrand's ranch to the Queen mine crosses the Carson and Colorado Railroad track. The station is also the south end of the White Mountain Base Line. Marked by a drill hole in large stone set in place, with pole and cairn. Ground slightly rolling, sandy, and covered with sagebrush. Six hundred and five meters east of this station is the stone monument, set some 50 feet south of the railroad track, to mark the crossing of the Von Schmidt line.

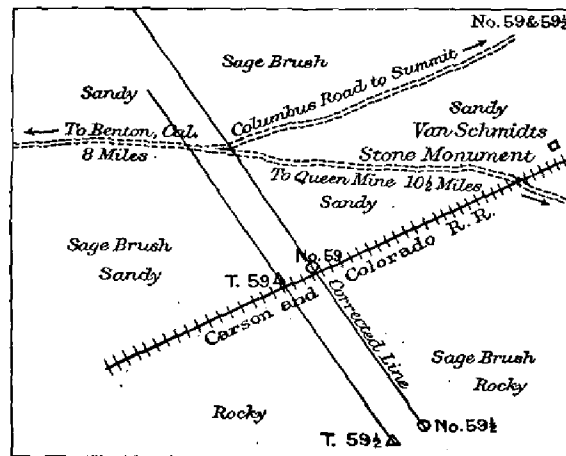
Point on corrected line, No. 59, put in at right angles to line from old station, to the eastward, distant 41'34 meters, thence northwest in direction of line 12'88 meters to place point far enough from the railroad track. Marked by a drill hole in a large stone set with its top level with the surface of ground. Over this was placed a

cedar post 7 inches in diameter and 6 feet long, marked "Cal. Nev. 59." Around post was built a large cairn. Station is 21'0 meters northwest from the center of the track of the Carson and Colorado Railroad, and about 3 miles east of Bertrand's ranch.

T 59 $\frac{1}{2}$.

Station is about 1 $\frac{1}{2}$ miles south of the Carson and Colorado Railroad, and on the sloping mesa at the foot of the White Mountains. Marked by a drill hole in bowlder with pole and cairn.

Point on corrected line, "No. 59 $\frac{1}{2}$," put in at right angles to line, from old station, to eastward, and distant 42'06 meters, marked by a large stone with drill hole in it.

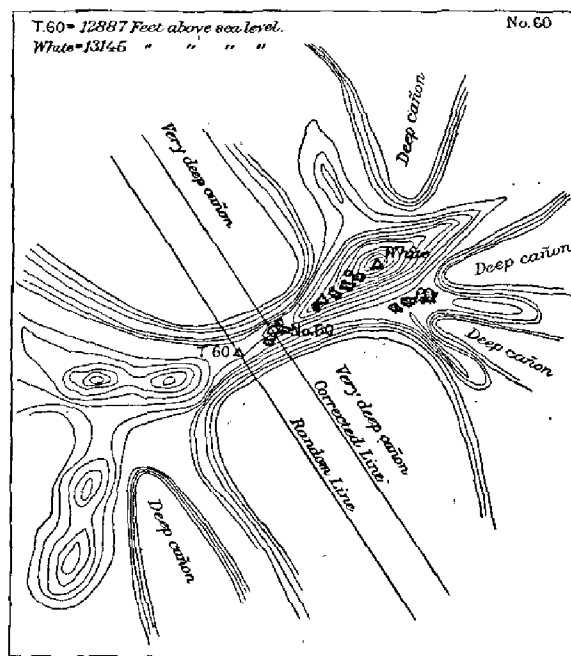


Above this a nut-pine pole, marked "C. N. 59 $\frac{1}{2}$." Around pole was built a cairn. Station is about one-half mile from the foot of the White Mountains, on the east side of the wash that comes down from the White Mountains, near station T 60. Some 150 yards northeast of station are a few small nut-pine trees. Ground at station rolling and rocky, covered with sagebrush.

T 60.

Is on the backbone of the White Mountains, between the two lofty peaks that form the north end of the range, and known as the "Montgomery Peaks," over 13 000 feet above sea level. Station is in lowest part of gap, marked by drill hole in stone, and a pole with pile of stones around it.

Point on corrected line, "No. 60," put in at right angles to line, from old station. to eastward, distant 43'72 meters; thence northwest in direction of line 12'5 meters to place station on crest of ridge. Station is now on the first rocky point east of the saddle



that is between the two high peaks at east end of White Mountains. This point is composed of high, sharp, needle-like rocks and very large boulders, and is a difficult place to get up on, being a sharp hogback. Station is on one of the large boulders, marked by drill hole, with a pine board above marked "C. N. 60" and a cairn around pole. "No. 60" is some 50 feet higher than the old station T 60. The station is a very difficult one to get to, the mountain being very steep and rocky, with snow on part of it the year round, and for the upper 5 000 feet there is no trail. It is reached most easily from the Queen Mine, 7 miles to the eastward.

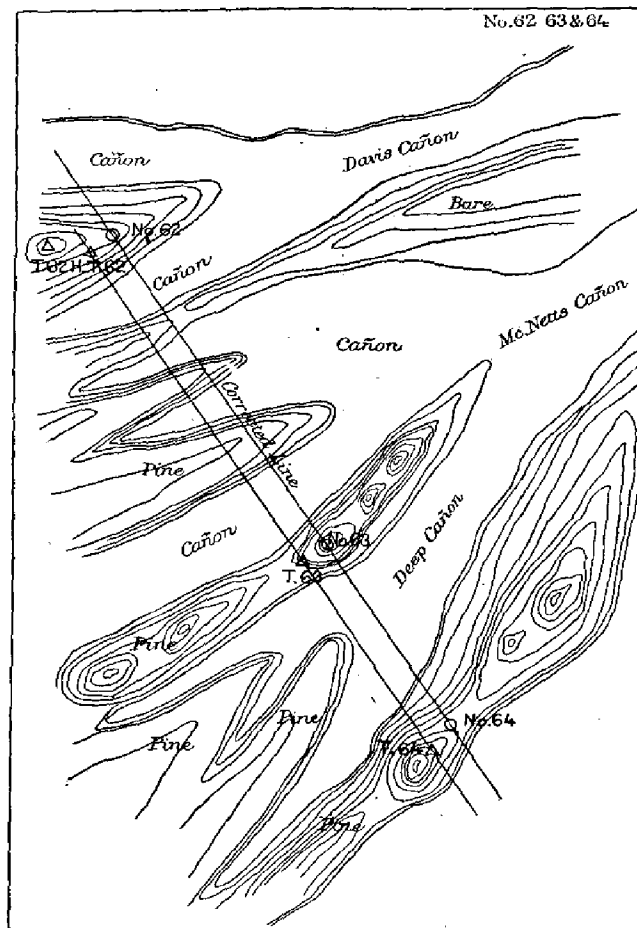
(No. 61 omitted.)

T 62.

On the northeast slope of a bare, high ridge that is just at the head of Davis Cañon, which divides at this ridge, one branch going in a northwest and the other in a southwest direction. The Davis ranch is visible from here down cañon to northeast to about

3 miles distant, and about 3 miles beyond can be seen part of the Fish Lake Valley. This ridge terminates in a round, sharp peak, and on this peak was located station T 62 High, marked by a drill hole, pole, and cairn. Station "T 62" marked by a drill hole in rock and pole.

Point on corrected line, "No. 62," put in at right angles to line, from old station, to eastward, distant 46.17 meters; thence northwest in direction of line 8.96 meters to



place station on crest of ridge. Marked by drill hole in solid rock; over this a birch pole marked "C. N. 62," and a cairn around pole. Station is some 75 feet south of a bluff or cropping out of large rocks. Ground covered with small stones and sagebrush. The best way to reach this station is from the Davis ranch, following up the Davis Cañon to where it forks, about 3 miles, then up bare ridge between the two branches to the station.

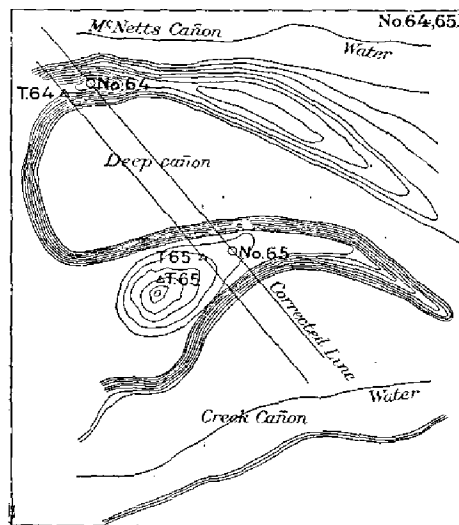
T 63.

On an isolated ridge dividing the two cañons which join and make the McNett or Indian Cañon, the water from which flows down to the McNett ranch. The station is on the ridge where it slopes to the south, about halfway from the summit on the north to the sag on the south. Marked by drill hole in granite rock, and pole. The ridge is sparsely covered with mountain mahogany and nut pine, and very steep on either side, going down precipitately into deep cañons.

Point on corrected line, "No. 63," put in at right angles to line, from old station, to eastward, distant 47'03 meters. Marked by drill hole in solid rock; over this a nut-pine pole marked "C. N. 63," and around pole a large cairn. Station on the south slope of ridge, about 50 feet south of the first little rocky knob north of the gap. The best way to reach station is from McNett's ranch, by following up the old wood road up cañon about 3 miles to where the cañon forks, then up the steep ridge between the forks to the station. Ridge very steep from the cañon up to station.

T 64.

Station is on the first high ridge that the line crosses, south of the McNett or Indian Cañon, and the second prominent ridge from the White Mountains southeast,



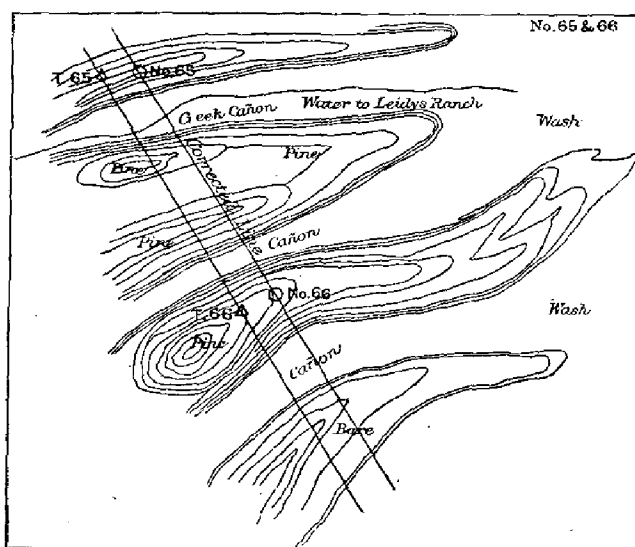
over which the line crosses. Station is in a small sag on the ridge, marked by a drill hole in stone, and pole. Ridge is covered on both sides with a stunted growth of nut pines.

Point on corrected line, "No. 64," put in at right angles to line, from old station, to eastward, distant 47'39 meters; thence northwest in direction of line 18'11 meters to place station on top of ridge. Marked by a drill hole in large stone set in place, top level with surface of ground; over this a nut-pine pole marked "C.N. 64," and around pole a cairn. Station is reached from Fish Lake Valley by going up the ridge just

north of the first cañon north of the Leidy, or Robinson Cañon; take the ridge at mouth of cañon and follow it up for about 4 miles to top, when the station will be found. Station T 64 High is on the same ridge, some 225 meters to the eastward. Ridge here is a simple hogback with deep cañons on either side. The whole of Fish Lake Valley is visible from this point.

T 65.

Station is on the high ridge (a spur of the White Mountains) that is just north of the cañon from which flows the water to Leidy's ranch, called Creek Cañon. The Robinson Cañon, just north, is between this station and station T 64. Station is on northeast slope, overlooking Fish Lake Valley. Marked by drill hole in rock, and



pole. Station is reached by going up the ridge on north side of Creek Cañon, following up point of ridge until station is reached. Very steep, rough, and rocky, and covered with nut pine.

Point on corrected line, "No. 65," put in at right angles to line, from old station, to eastward, distant 47'91 meters; thence 15'60 meters southeast in direction of line to place station on point of ridge. Marked by drill hole in a large, flat rock. Above this is a nut-pine post marked "C. N. 65," and around post a large cairn.

T 66.

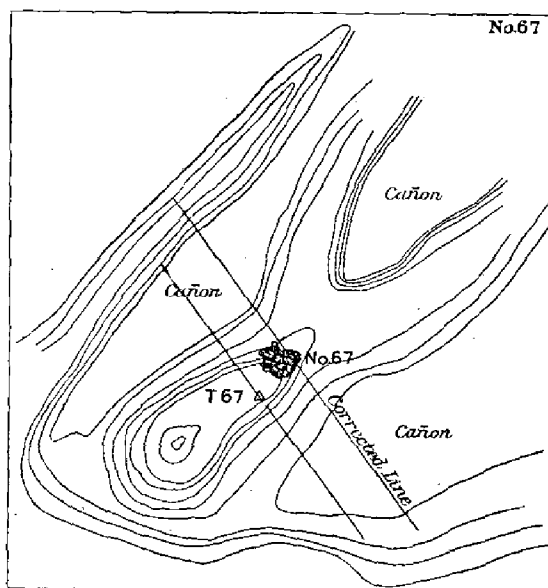
On the east slope of a hill or ridge sparsely covered with nut pines, and overlooking Fish Lake Valley to east and south. The hill is part of the first prominent ridge that the line crosses southeast of the cañon, from which flows the water that supplies the Leidy ranch, and is about three-fourths of a mile southeast of cañon. There are two more ridges to the southeast between this one and the final one, on which T 67 is located. Marked by a drill hole in stone set in place, and pole. This point used as a

triangulation point. Station is reached from Leidy's ranch by following the water course to mouth of cañon, thence up the ridge on south to station.

Point on the corrected line, "No. 66," put in at right angles to line, from old point, to eastward, distant 48'82 meters; thence 3'30 meters northwest in direction of line to place point on top of ridge. Marked by drill hole in stone set in ground; over this a nut-pine post marked "C. N. 66," and a cairn around post.

T 67.

On the last of the ridges or spurs of the White Mountains, over which the line crosses before entering Fish Lake Valley. Station is on the northeast slope of hill and about 300 yards from the summit. The hill is the first bare hill north of the cañon, from which flows the water that supplies Piper's lower, or north, ranch. Hill bare of all

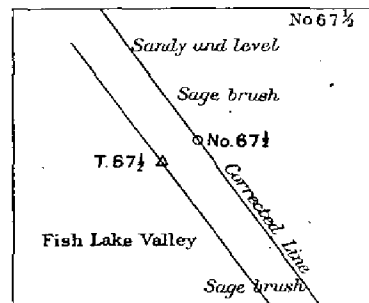


vegetation and covered with large rocks and boulders, with rocky ledges cropping out here and there. Marked by drill hole in rock, and pole, and was used as a triangulation point. Piper's lower ranch is due east, the Leidy-McAfee ranch about 30° north of east and the H. G. McAfee ranch 35° south of east. It is about 3 miles from Piper's lower, or north, ranch.

Point on the corrected line, "No. 67," put in at right angles to line, from old station, to eastward, distant 50'36 meters; thence 13'51 meters northwest in direction of line to place point on a very large granite boulder that stands up about 12 feet above the surface of ground. A mass of granite rocks crops out at this place on the ridge, and station is on the most eastern one, on the highest part and 2 feet from eastern edge. Marked by a nut-pine post and cairn around it, on top of rock.

T 67½.

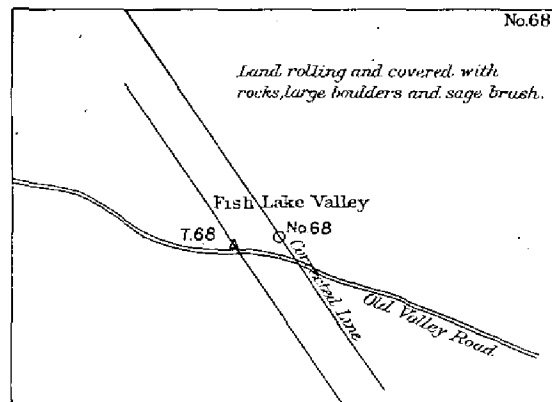
On the west side of Fish Lake Valley. The first station in the valley after the line leaves the foothills of the White Mountains. It is about 1 mile east of the mouth of the cañon from which flows the water that supplies the A. G. McAfee ranch, and a little over a mile south of the same ranch. Soil sandy, rolling, and covered with stones and sagebrush. Marked by a drill hole in rock, and a pole.



Point on the corrected line, "No. 67½," put in at right angles to line from old point, to eastward, distant 52.01 meters. Marked by drill hole in solid rock; over this a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 67½," and a large cairn around post. An old wood road from A. G. McAfee's ranch goes within a quarter of a mile of station to the north.

T 68.

On the west side of Fish Lake Valley, about 1 mile from the foothills, and south from A. G. McAfee's ranch about 2 miles; and the old valley road from McAfee's ranch



to Piper's ranch passes only a short distance south of station. It is on a rolling ridge between two washes coming down from the mountains, and the ground is covered with sagebrush and very large stones and boulders brought down from the mountains

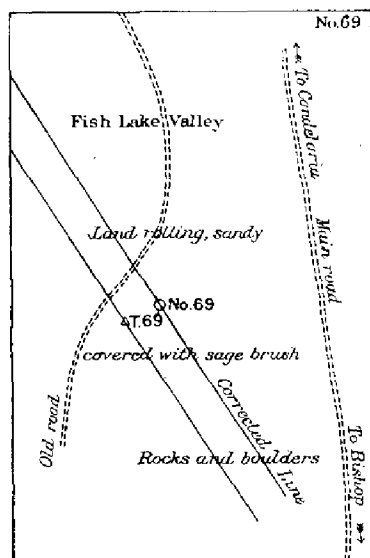
by the washes during a cloud-burst some few years ago. Marked by drill hole in stone set in place, and a pole.

Point on corrected line, "No. 68," put in at right angles to line from old station, to eastward, distant 52.80 meters, thence southeast in direction of line 2.37 meters to place point on a large solid rock. Marked by drill hole in rock; over this was placed a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 68," and a large cairn was built around post. Station is on the north side of the old valley road, and about 40 feet from it.

T 69.

On the west side of Fish Lake Valley, about 6 miles south of the A. G. McAfee ranch. Ground rolling and covered with sagebrush and large, loose boulders. Marked by drill hole in granite boulder, and pole.

Point on corrected line, "No. 69," put in at right angles to line, from old station, to eastward, distant 53.50 meters. Marked by a stone with drill hole in it, and set in



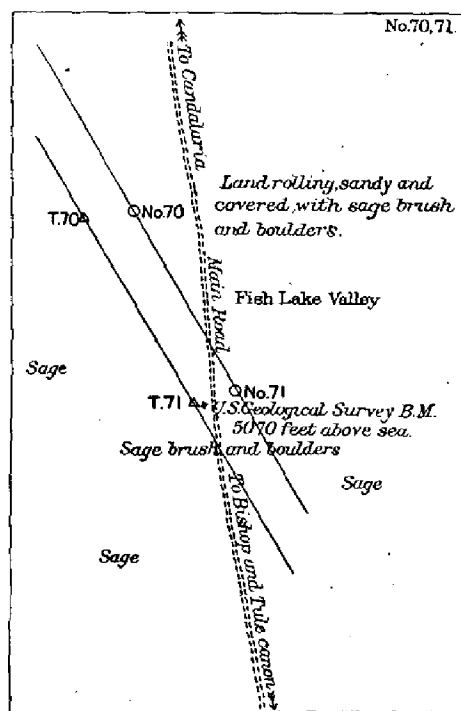
ground even with the surface. Just northwest of stone was set a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 69," and a mound of stones and dirt thrown up around post and stone. Station is north of the main county road through the valley, and about 75 meters south of the old road (not used at this time).

T 70.

On the west side of Fish Lake Valley, about 8 miles north of Piper's main (south) ranch and about 400 yards from the main road running through the valley on the northwest side. It is on a rolling ridge formed by two large washes coming from the

mountains to the westward; is covered with sagebrush and numerous large bowlders. The valley road crosses the line between the stations T 70 and T 71, nearest to T 71. Station T 70 was also a triangulation point, and was marked by a drill hole in lava rock, and a pole.

Point on corrected line, "No. 70," put in at right angles to line, from old point, to eastward, distant 53.86 meters, thence southeast in direction of line 12.34 meters to place station on the highest part of ridge. Marked by a drill hole in solid rock; over this a 4-inch by 4-inch by 5-foot pine post, marked "C. N. 70," and a large cairn.



T 71.

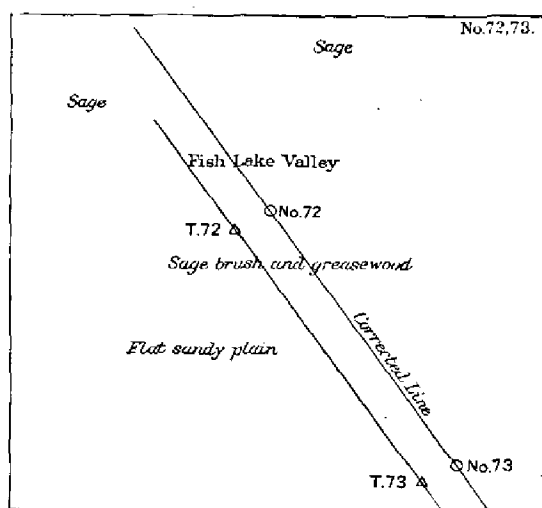
In Fish Lake Valley, about 7 miles north of Piper's main ranch, on the southeast side of the main valley road, and about 200 feet from it. Marked by a drill hole in stone, and pole. At this station there is a United States Geological Survey bench mark (iron pipe projecting 2 feet above the ground) giving the height above sea level as "5 070 feet, datum C. C."

Point on corrected line, "No. 71," put in at right angles to line, from old station, to eastward, distant 54.12 meters. Marked by a stone with drill hole in it, and a pine post 4-inches by 4-inches by 5½ feet set in the ground 2 feet. Post marked "C. N. 71;" a mound of stone and sand thrown up around post and stone. Land rolling and covered with sagebrush and small bowlders.

T 72.

Station is about in the center of Fish Lake Valley, from east to west, and some 4 miles north of Piper's main ranch. Land around station sandy, thickly covered with high sagebrush. Marked by stone with drill hole, and pole, with mound of sand.

Point on corrected line, "No. 72," put in at right angles to line, from old point, to eastward, distant 55.18 meters. Marked by stone with drill hole in it; above this a pine post 4-inches by 4-inches by 5 1/3-feet set in the ground, and a mound of stones and sand thrown up around post and rock. Post marked, "C. N. 72." Letters and numbers made with small nails driven into the post. All the posts along this corrected line were marked in a similar manner.



T 73.

In Fish Lake Valley, on the east side, a little east of north from Piper's main ranch, and about 1 1/2 miles distant from same, in level sandy flat, covered with large sagebrush; about one-fourth mile to east of station the land begins to rise gently toward the foothills to the east. Station is 2 800 meters northwest of the point where the road from Piper's main ranch to Silver Peak mining camp crosses the line. Station marked by drill hole in stone, and a pole.

Point on corrected line, "No. 73," put in at right angles to line, from old station, to eastward, distant 56.45 meters. Marked by a nut-pine post marked "C. N. 73"; set in the ground 2 feet was a stone with drill hole in it, placed just southeast and touching post. A mound of sand was then thrown up around post and stone.

T 74.

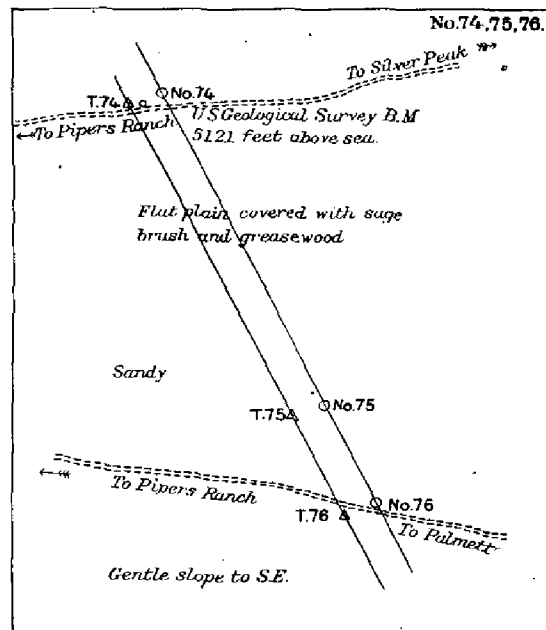
Station is in Fish Lake Valley, on east side and about one-half mile from the foothills on the east side of valley, just north of the road across the valley from Piper's main ranch to Silver Peak. Land level and sandy, and covered with sagebrush. Marked by stone with drill hole, and a pole, with mound of sand. At this station there is a

United States Geological Survey bench mark giving the height above sea level as "5121 feet, datum C. C."

Point on corrected line, "No. 74," put in at right angles to line, from old station, to eastward, distant 57.11 meters. Marked by a 4-inch by 4-inch by 5½-foot pine post marked "C. N. 74." Set 2 feet in ground, just southeast of post was placed a small stone with drill hole in it, and a mound of earth was thrown up around post and stone. Station is about 150 feet north of the road, and is practically the same level as the old station.

T. 75.

This station is in Fish Lake Valley, south end and east side, about three-fourths of a mile from foothills on east side and some 3 miles from foothills, where line leaves the valley, on the south; and is 4145 meters southeast from the road from Piper's



ranch to Silver Peak, or from T. 74. Land rolling and sandy and covered with sagebrush. Station marked by stone with drill hole in it, and a pole.

Point on corrected line, "No. 75," put in at right angles to line, from old station, to eastward, distant 58.08 meters. Marked by a large stone with drill hole in it, set in the ground, and a 4-inch by 4-inch by 5½-foot pine post marked "C. N. 75," and a mound of sand thrown up around post and stone.

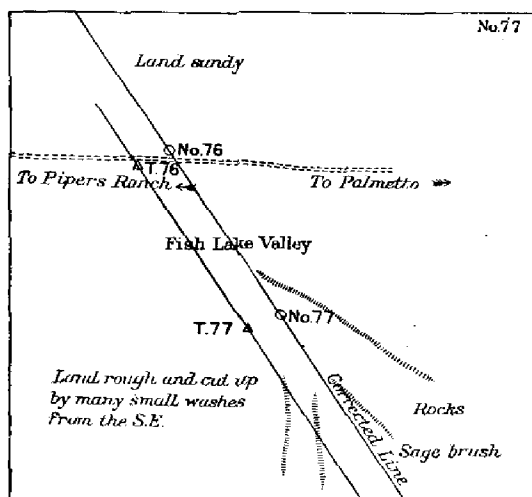
T 76.

Station is in Fish Lake Valley, east side and south end, and is some 75 feet south of the road from Piper's ranch to Palmetto, where it crosses the line. Land rolling and sandy and covered with sagebrush. Marked by cross in stone set in sand, and a pole.

Point on corrected line, "No. 76," put in at right angles to line, from old point, to eastward, distant 58'36 meters. Marked by a granite post set in ground, with drill hole in it. The stone at the old station was taken up and used at this station. Then a 4-inch by 4-inch by 4-foot pine post set in the ground to southeast, marked "C. N. 76," and a mound of sand thrown up around post and stone. Station is about 25 feet north of the Palmetto road. From T 76 to T 75 is 1 181 meters.

T 77.

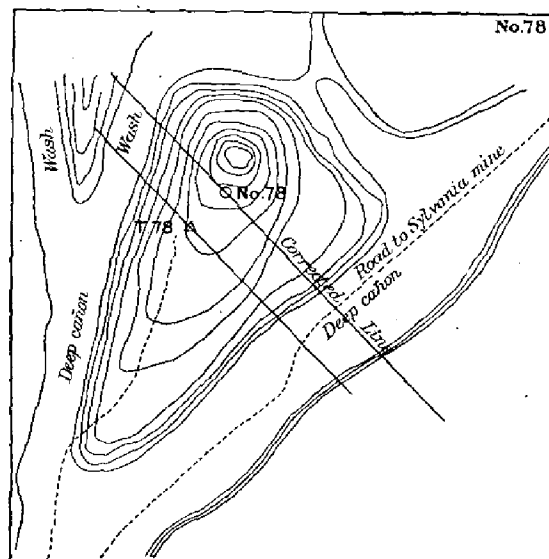
This is the last station in the Fish Lake Valley, in the eastern part and extreme southern end. The land at this point begins to rise to the Sylvania Mountains. Station is between two small washes that come down from the Sylvania Mountains. Land broken and rough from many washes; covered with small stones and bowlders and sagebrush. Station marked by drill hole in stone, and pole.



Point on corrected line, "No. 77," put in at right angles to line, from old station, to eastward, distant 58'82 meters. Marked by a large stone with drill hole in it, and a 4-inch by 4-inch by 5 1/3-foot pine post, marked "C. N. 77," set in the ground, and a cairn and earth thrown up around post and stone. This station is 1 968 meters southeast of the Palmetto road at line crossing, or from T 76.

T 78.

This station is on the first prominent ridge of the Sylvania Mountains that the line crosses after leaving Fish Lake Valley. It is a bare, gravelly ridge, with a few scattering palmetto trees on it. The point is on the ridge on the west slope. To the north and south are deep cañons, and the sides of the ridge are very steep. The best way to reach the point is by the old road from Piper's ranch to the Sylvania mining camp,



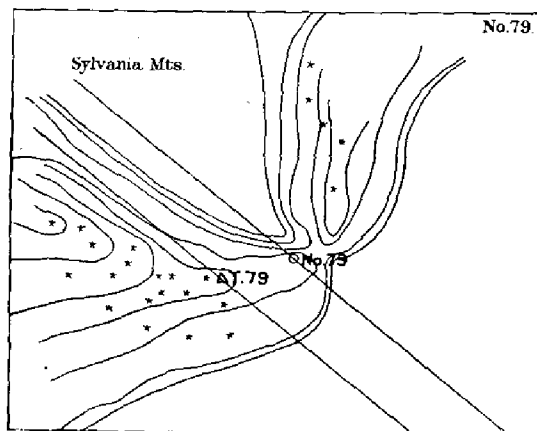
leaving the road about a mile from the mouth of the big wash, and going up the ridge to the north to the highest part, on which the station is located. Marked by stone with drill hole in it, and a pole.

Point on corrected line, "No. 78," put in at right angles to line, from old station, to eastward, distant 60.09 meters. Marked by a drill hole in stone, over which was placed a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 78," and a cairn of stone and gravel thrown up around them. Station is on the west slope, about 75 feet from the summit.

T 79.

Station is on the highest peak of the Sylvania Mountains, on the east slope, not far from the top. The mountain is covered with nut pine and a very little cedar. The point overlooks Fish Lake Valley and also Tule Cañon, which is the head or northern end of Death Valley. The old mining town of Sylvania is about 2 miles north of station, and the best way to reach station is from the old mining town, following up the ridges to the south until the highest one is reached. Nearly all of the ridges are timbered with nut pine. Station marked by a drill hole in granite rock, and a pole.

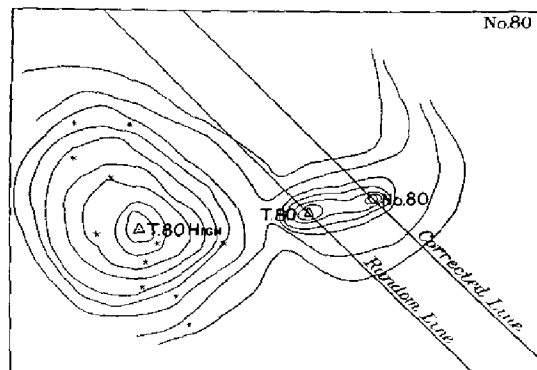
Point on corrected line, "No. 79," put in at right angles to line, from old station, to eastward, distant 61.29 meters; thence 23.23 meters to southeast in direction of line, to place station on crest of ridge. Marked by drill hole in solid rock; over this a



4-inch by 4-inch by 4-foot pine post, marked "C. N. 79," and a large cairn built around post. Station on east slope, about 400 feet from the summit. There are very deep cañons on both the north and south side of the ridge.

ST. 80.

Station is on the first prominent ridge of the Sylvania Mountains over which the line crosses, south of the main ridge of those mountains. Between these two ridges is a very deep cañon, opening to the west into the southern part of what is known as



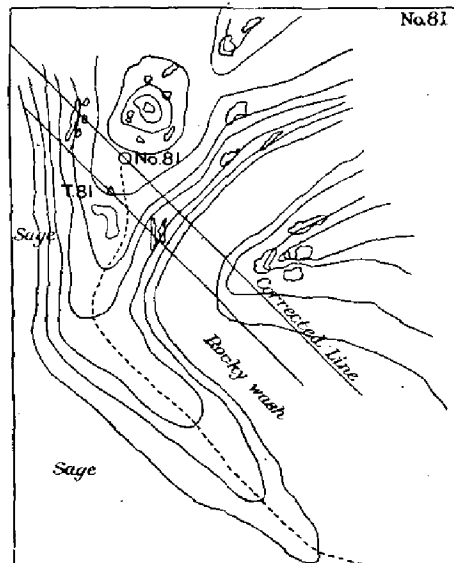
Fish Lake Valley. To the south the point overlooks the upper end of Death Valley, where the State line crosses the same. In the cañon to the north of this ridge and about three-fourths of a mile from station is a spring (Kokomongo). There is a pipe

leading from the spring, out of which flows a nice stream of cool, good water. This ridge, like the ridges of the Sylvania Mountains, is covered with nut pine. Station marked by hole in granite stone, and a pole.

Point on corrected line, "No. 80," put in at right angles to line, from old station, to eastward, distant 63.14 meters; thence 78.48 meters southeast in direction of line, in order to place station on top of hill. Marked by drill hole in solid rock; over this a nut pine post, marked "C. N. 80," and a cairn of stone and gravel around same. About one-half mile west is the highest point of this ridge, on the summit of which is located station T 80 High.

T 81.

Station is on one of the low red hills in the upper part of Death Valley, and about 1 mile northwest of the lower part of Tule Cañon, or where it spreads out into Death

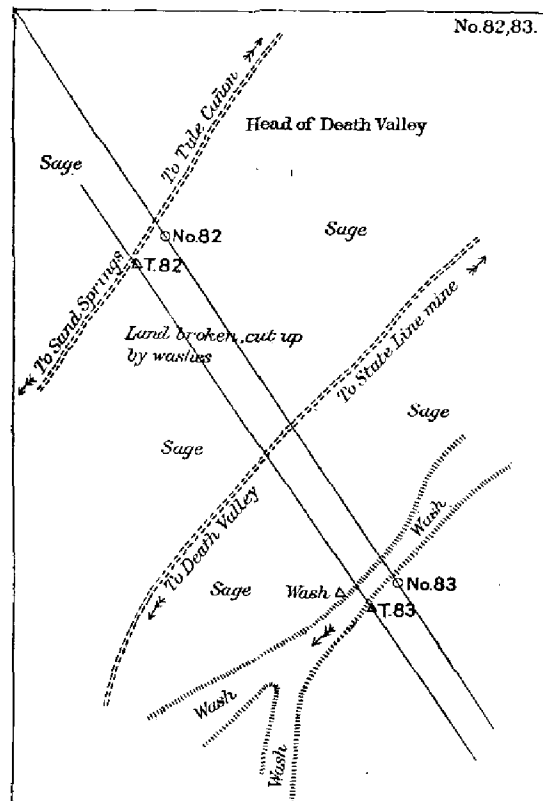


Valley. Station is on the southern end of these red hills, not the highest part, but on the southern slope, and is marked by a hole drilled in the solid rock, a small pole, and cairn.

Point on corrected line, "No. 81," put in at right angles to line, from old station, to eastward, distant 65.72 meters; thence 18.79 meters northwest in direction of line, to place point on crest of ridge. Marked by drill hole in large rock; over this a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 81," and a cairn around it. Station is on the second cluster of red hills north of the mouth of Tule Cañon, and on southwest end of said cluster.

T. 82.

Station is out on the level plain in the upper part of Death Valley. It is about 50 feet south of the road from Tule Cañon to Sand Springs, where the line crosses, and about 4 miles east from Sand Springs. Land level and sandy, cut up by washes and covered with sagebrush and greasewood. Station marked by boulder with drill hole in it, a pole and cairn.



Point on corrected line, "No. 82," put in at right angles to line, from old station, to eastward, distant 66.77 meters. Marked by a stone with drill hole in it; over this a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 82," and a cairn of stone and sand around post. Station is 180 feet southeast of road where the line crosses. Water at Sand Springs 4.2 miles to the west, in white sand hills.

T. 83.

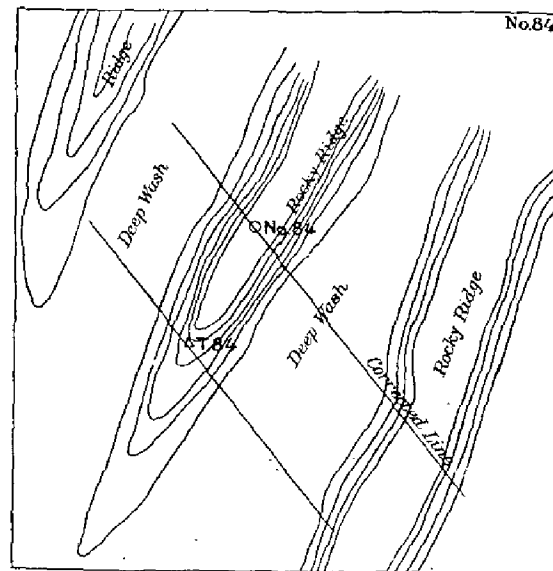
Station is on the east side of the upper part of Death Valley, on the south bank of the first big wash that enters the valley; south of the State Line or Oriental Wash, and about 2 miles south of the road going up that wash to the old mining camp of State

Line, and is some 5 miles south of the mouth of Tule Cañon. Land rolling and rising gently to the east. Very much cut up by washes from the hills to the east, covered with boulders, small rocks, and sagebrush and cacti. Triangulation station Wash is about 200 yards west of this station, on the north bank of same wash. Marked by drill hole in rock, pole, and cairn.

Point on corrected line, "No. 83," put in at right angles to line, from old station, to eastward, distant 68'44 meters, thence 44'01 meters southeast in direction of line to place point in best location. Marked by drill hole in solid rock; over this a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 83," and a cairn of stone and earth around post.

T 84.

Station is on the highest of the ridges that are just south of the upper part of Death Valley, where the line crosses, and is on the second ridge north of the great wash that flows into Death Valley from the high mountains to the east. Station is

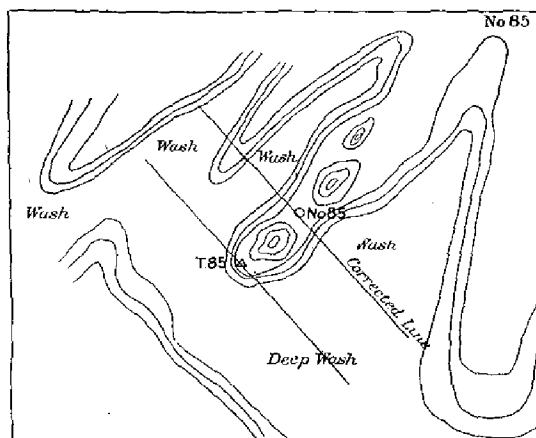


about 8 miles from Sand Springs, and can be seen from that place. Located on a bare, rocky ridge, with scattering sagebrush, greasewood, and cacti on it. Marked by drill hole in rock, pole, and cairn.

Point on corrected line, "No. 84," put in at right angles to line from old station, to eastward, distant 69'25 meters, thence southeast in direction of line 11'62 meters to place point on top of ridge. Marked by drill hole in a very large boulder, a pine post 4-inches by 4-inches by 4-feet, marked "C. N. 84," and a large cairn around post and boulder. Station is most easily reached from Sand Springs, where is to be found the only water within many miles.

T 85.

Looking along the line southeast from station T 82 there are seen two high, rounding, and prominent hills, some 9 miles distant, and beyond which nothing can be seen from this point. On the top of the highest and most eastern of these two is located station T 85 High. These hills form the divide between this part of Death Valley and a small valley to the southeast. This triangulation station is marked by drill hole, pole, and cairn.

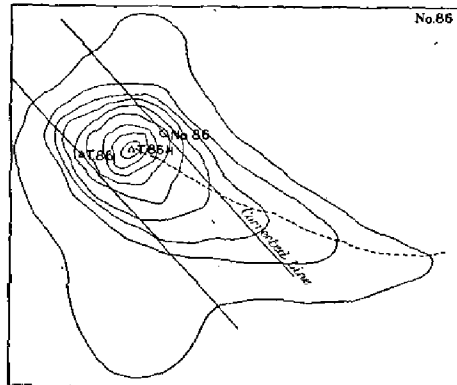


About three-fourths of a mile to the east, across a deep cañon and on the west slope of a small foothill, is located station T 85, visible from T 85 High. Hill bare, covered with small stones and some sagebrush. Marked by drill hole in rock, pole, and cairn.

Point on corrected line, "No. 85," put in at right angles to line, from old station, to eastward, distant 69.94 meters; thence 18.11 meters southeast in direction of line to place point on top of ridge. Station is now in saddle just east of the little sharp peak, and is marked by drill hole in stone, set in place, a pine post marked "C. N. 85," and a cairn of stones and gravel thrown up around post. Station most easily reached from Sand Springs.

T 86.

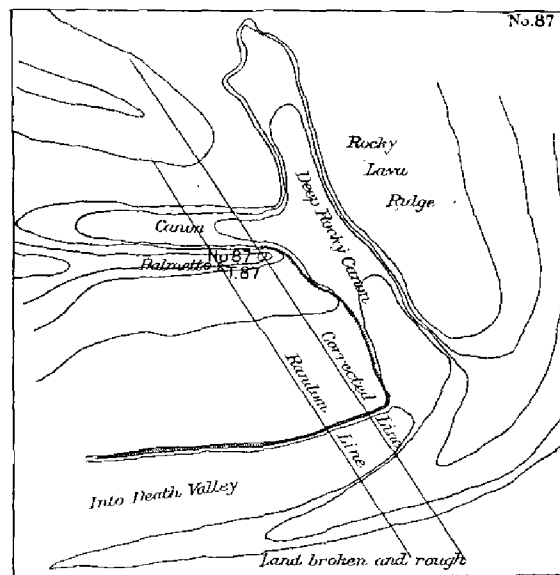
Station is on the west slope of a bare, sharp, and light-colored peak, 1 823 meters northwest of T 87, and easily reached from this station; some greasewood and large palmetto at the base of this peak. Station T 86 High is on the summit. Both stations were marked by drill holes in rocks, poles, and piles of stones.



Point on corrected line, "No 86," put in at right angles to line, from old station, to eastward, distant 71'55 meters; thence 16'22 meters to southeast in direction of line, in order to get station on top of ridge. Marked by drill hole in large rock; above this is a 4-inch by 4-inch by 4-foot pine post marked "C. N. 86," and a cairn around post. Station is on the northeast slope of peak, on a small flat, not much below nor far from the summit.

T 87.

Station is on the black lava foothills of the Grape Vine Mountains that are just north of the great wash through which the road goes that leads from Staininger's ranch to Thorpe's Mill, in the Ralston Desert. It is on the first high black ridge north of the road, is a very rough and rocky ridge, and difficult to get on. There are several deep, rocky cañons extending up to this ridge from the south and southwest side, one of which extends into Death Valley. Best way to reach the point is to follow out the road from Staininger to Thorpe Mill, some 5 miles, then strike across for the ridge. There

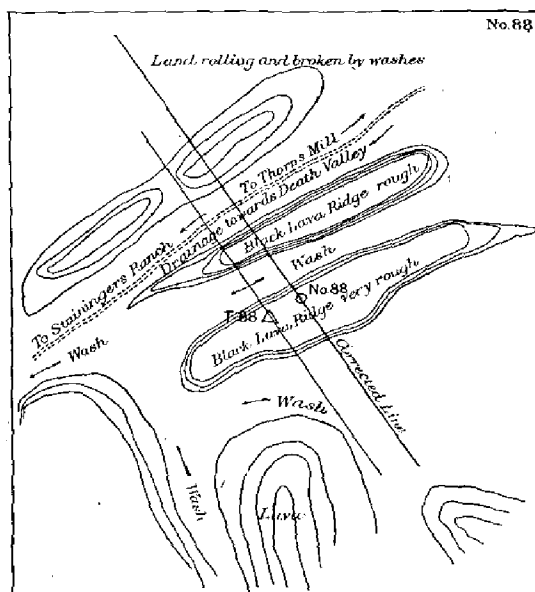


is a shorter way from Staininger's, but it is impossible to describe it. Station marked by drill hole in rock, pole, and pile of stones. It is about on highest point of ridge.

Point on corrected line, "No. 87," put in at right angles to line, from old point, to eastward, distant 71'98 meters; thence northwest in direction of line 29'18 meters, to place station on top of ridge. Marked by drill hole in rock; over this a 4-inch by 4-foot pine post marked "C. N. 87," and a cairn around post. To the north, east, and southeast of station there is a deep, rocky cañon around end of ridge.

T 88.

Station is on a black lava ridge, about 4 miles from Staininger's ranch, on the road to Thorpe's Mill and the Amargosa Desert. To the south of the road, and just before getting to the level desert, there is a long, level black-lava ridge, very rough and rocky, and some 400 feet high. One-half mile south of this ridge, across a deep cañon, is another similar ridge, and on this one is located station T 88, marked by drill hole in rock, pole, and cairn.

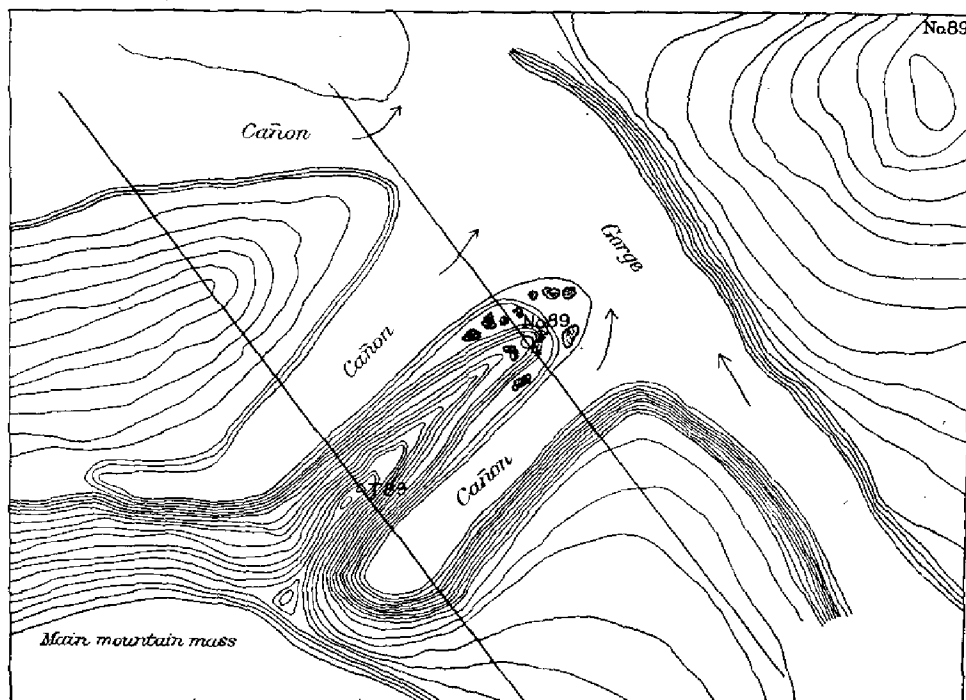


Point on corrected line, "No. 88," put in at right angles to line, from old point, to eastward, distant 74.04 meters. Marked by drill hole in solid rock; over this a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 88," and a cairn around post. A short distance west of station, on same ridge, there are two small lava peaks some 25 feet high. Station most easily reached from Staininger's ranch. Leave the road about 3 miles from the ranch, and turn up a big wash to the south. This wash heads up against the ridge on which station is located, and is about one hour's ride from ranch.

T 89.

Station is on the first prominent rocky ridge of the Grape Vine Mountains that the line crosses. The ridge is very steep and sharp, and the point can only be approached by going to the top of mountain of which ridge is part and descending down the point of ridge to station. Marked by drill hole in rock, pole, and small cairn.

Point on corrected line, "No. 89," was lined in from stations No. 86, No. 87, and No. 88, it being impossible to measure from the old point in any way. The station is about 15 feet back or west from the edge of a cliff that goes down perpendicularly for at



least 800 feet. Marked by drill hole in solid rock, a nut-pine pole, and a cairn; drill hole 3 feet north of pole. The only way to reach station is by coming down the spur of the ridge from old station, an extremely dangerous and hazardous undertaking, the spur being like a knife edge, composed of enormous granite rocks and cliffs, much cut up by cañons. It is at least seven hours' ride and climb to reach this point from Staininger's ranch, and is a very hard trip. On the summit of this ridge or mountain is located T 89 High station, marked by drill hole, pole, and pile of stones.

T 90.

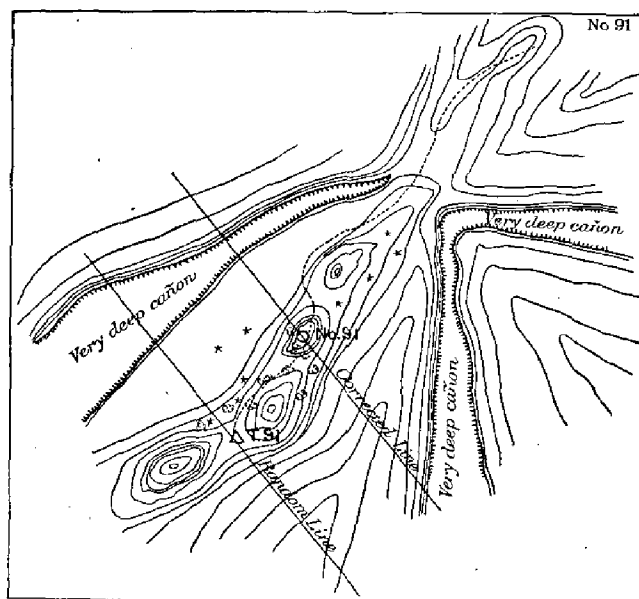
This station is on the southwestern slope of one of the main ridges of the Grape Vine Mountains. It is on a rocky bluff of the ridge, and from the point the mountain falls off nearly perpendicularly, 800 feet, into a cañon which opens into Death Valley. The

Sylvania Mountains can be seen from this point. The ridge is covered with a growth of nut pine, as are all of the mountains at the higher elevation. Station "Grape" is on the summit of this ridge.

The point on the corrected line, to be "No. 90," was omitted at this point, as it was found to be impossible to measure the offset, high, sharp, needle-like rocks and cliffs being to the northeast, with deep cuts between them, and there were no line points visible by which the station could be lined in, the stations to the northwest not being in at this time. The offset to the eastward to the line from old point is 77'70 meters. Old point marked by drill hole in solid rock.

T 91.

This station is on the third of the high ridges of the Grape Vine Mountains as the line crosses them, counting from the north. The point is on the summit of the ridge and on nearly the highest part. The ridge has a good growth of nut pine, and the



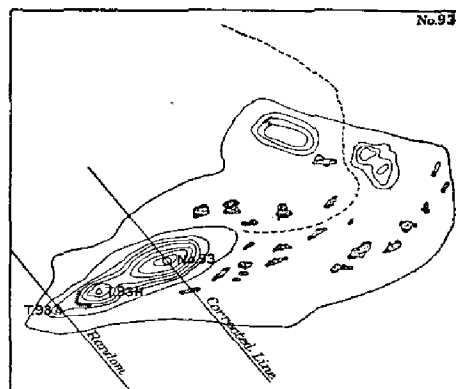
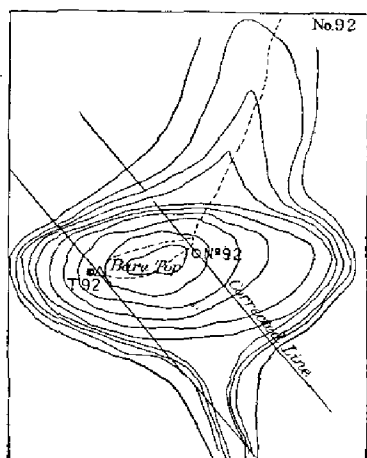
mountain is composed of shale rock, very loose and difficult to get animals over. The point is about one and three-fourths hours' ride from the Big Spring camp in the Grape Vine Mountains. Station marked by drill hole in solid rock and nut-pine pole.

Point on corrected line, "No. 91," put in at right angles to line from old station, to eastward, distant 79'53 meters, thence 97'05 meters northwest in direction of line to place the point on top of ridge. It is on the eastern slope, about 50 feet west of the saddle, and just under a very rocky point of sharp, jagged rocks. Marked by drill hole in large rock; over this a 4-inch by 4-inch by 4-foot pine post and a large cairn around post. To reach this point, follow up the cañon at the mouth of which the Big Spring is to the top of ridge; then follow the ridge around to the south to the point. One of the deepest cañons in the Grape Vine Mountains is just west of this point.

T 92.

Station is about 20 feet lower than summit and on south slope of a bare mountain. Top is covered with loose, brownish sandstone. It is the most easterly of the main ridges of the Grape Vine Mountains, and commands the line for 60 miles to the southeast. It overlooks one reach of Death Valley running north and south, and also a portion of that part which runs northwest and southeast. It is just east of a very rough and deep cañon that runs south and bends slightly to the west to enter Death Valley. A small outcropping of stones is at the station, which is marked by a drill hole in rock, pole, and pile of stone.

Point on corrected line, "No. 92," put in at right angles to line from old station, to eastward, distant 81'00 meters, thence 24'00 meters southeast in direction of line to place point on top of ridge. Station is on eastern slope, about 75 feet from the top. Marked by drill hole in large stone set in position and a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 92," with a cairn of stone and gravel thrown up around post. Station is about four hours' ride from the Big Spring, but a very hard ride and a very rough one for both man and beast.



T 93.

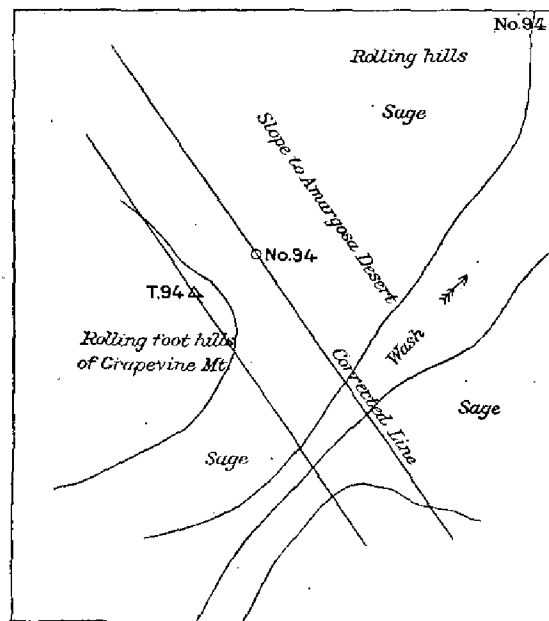
This station is about 1 mile east from Daylight Spring, on the high, bare, rocky peak on the south side of the cañon that extends from Daylight Spring to the Amargosa Desert. The whole top of this peak is a black lava rock, very rough, and with cliffs on three sides. Station is on the west side of the mountain, about 200 feet below the summit, and on the edge of a bold rocky cliff, a difficult place to reach. Cliff from top to bottom is about 300 feet. Marked by drill hole in solid rock, pole, and cairn. Station T 93 High is on the same peak, about 150 feet east and about 100 feet higher, still not on the summit. Marked by drill hole, pole, and pile of stones. It is on the top and edge of another cliff.

Point on corrected line, "No. 93," lined in from back stations, is on the highest point of the rocky peak, about in the center, marked by drill hole in the solid rock,

over which was put a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 93," and a large cairn built around post. This is a very prominent peak and mark, and the cairn can be seen for a long way out on the Amargosa Desert, and is plainly visible from Daylight Springs. This spring is on west side of Amargosa Desert, about 15 miles from Beatty's Ranch.

T 94.

This station is on the eastern slope of foothills of the Grape Vine Mountains, nearly down to the Amargosa Desert flat, and about $5\frac{1}{2}$ miles southeast from Station T 93. The slope is bare, with the exception of some scattered grease-wood brush and very few



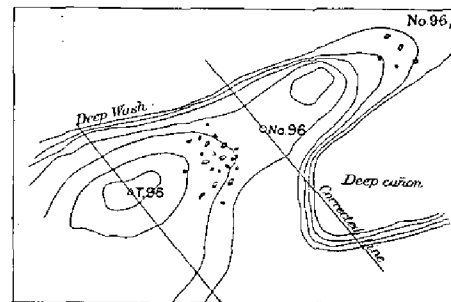
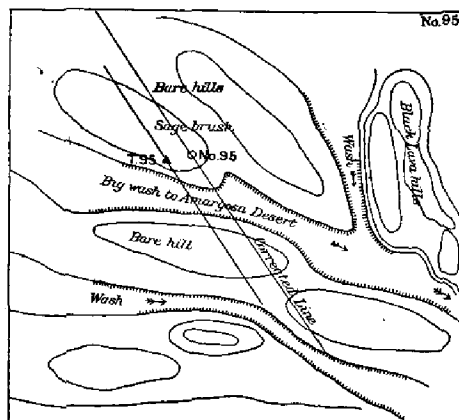
rocks. About three-fourths of a mile to the east there is a small white butte standing out in the desert. Detached hills 2 miles to southeast. Station marked by drill hole in rock and cairn.

Point on corrected line, "No. 94," put in at right angles to line at old station to eastward, distant 86.55 meters. Marked by a 4-inch by 4-inch by 4-foot pine post marked "C. N. 94." Set firmly in the ground just southeast of post, and touching it, a large stone with drill hole in it, and a cairn of stone and gravel thrown up around post and stone. The little white butte, the mouth of the Little Amargosa River, and the station are all in line. Stations T 94, 95, 96, and 97 were all put in from a dry camp in the Amargosa Desert, all the water being hauled from the spring at the mouth of the Little Amargosa River, about 2 miles below the Beatty Ranch.

T 95.

Station is on the southeast slope of the ridge of the foothills of the Grape Vine Mountains, along which the line runs, the slope leading down to the Amargosa Desert. The slope is well cut up by dry washes, and this point is on the divide between two of these washes, which extend down and pass south of a mass of detached hills out in the desert to the east. Station marked by drill hole in rock, pole, and pile of stones.

Point on corrected line, "No. 95," put in at right angles to line from old station to eastward, distant 87.26 meters; thence southeast in direction of line 14.38 meters to place station on top of ridge. Marked by drill hole in solid rock; over this a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 95," and a cairn around post.



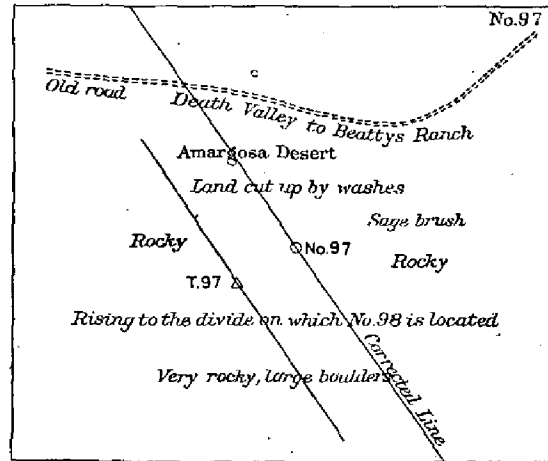
T 96.

This station is on the north slope of a prominent cone-shaped peak about the center of the group of low foothills of the Grape Vine Mountains, on the west side of Amargosa Desert; and the first prominent foothills north of the great wash between the Grape Vine and Funeral Mountains, up which a road goes from the desert over into Death Valley. Station is on the highest of this group of foothills, marked by drill hole in stone, pole, and pile of stones.

Point on corrected line was lined in from No. 95 and No. 98; it is on the same ridge as the old station, only some 40 feet lower, and is in a little saddle. Marked by drill hole in solid rock; over this a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 96," and a cairn around post. The road from the Little Amargosa River, across the desert to near T 97, passes to the east of this station about 2 miles.

T 97.

This station is on the open mesa. There is a pass between the Grape Vine and Funeral Mountains, through which a road goes from the mouth of the Little Amargosa River across the upper part of the Amargosa Desert and over into Death Valley, an old road not much used. The station is on the slope that rises from the Amargosa Desert up to this pass, is about 2 miles from the flat desert and some three-fourths of a mile



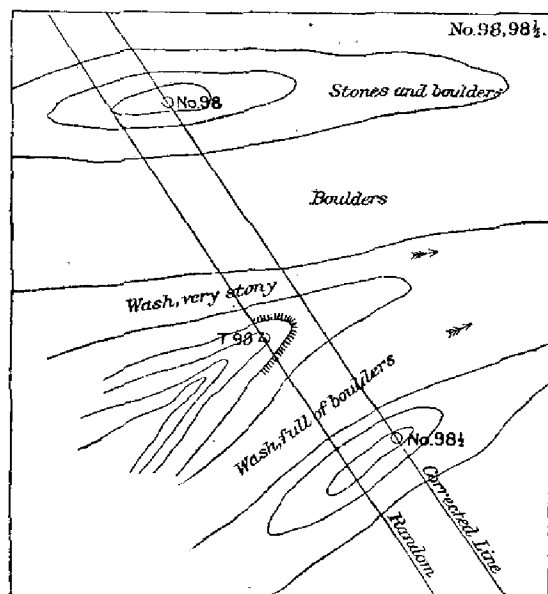
south of the road. Land at station rolling and rocky, cut up by many small washes and covered by sagebrush, grease wood, and cacti. Marked by drill hole in rock, pole, and cairn.

Point on corrected line, "No. 97," put in at right angles to line from old station to eastward, distant 90.94 meters; marked by a 4-inch by 4-inch by 4-foot pine post, set firmly in the ground and marked "C. N. 97." Around post there was thrown up a cairn of stone and gravel.

T 98.

Station is on a very rocky ridge (the extreme eastern slope and very near the end of the Funeral Mountains). This is the first and only place where the line touches the Funeral Mountains, and it enters just south on to the plain of the Amargosa Desert. About $1\frac{1}{2}$ to 2 miles from point is a group of detached hills, on one of which the station Funeral is located. Point marked by drill hole, pole, and cairn.

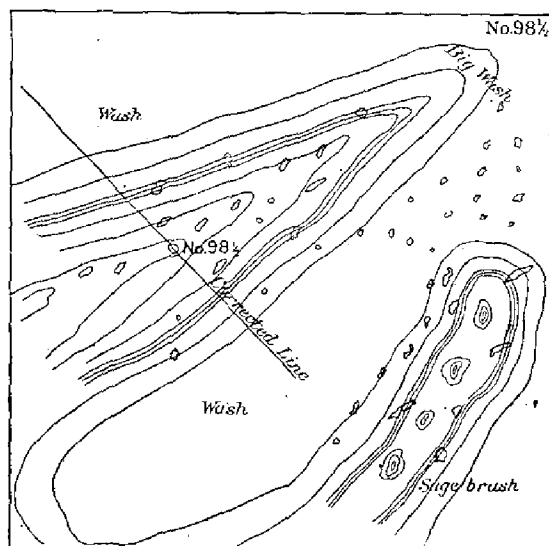
Point on corrected line, "No. 98," lined in from station No. 98 $\frac{1}{2}$. It is about 300 meters northwest of where the point on the corrected line at right angles to the old



station would fall. It is on the highest part of the divide, between the Funeral Mountains and group of detached hills to the eastward, and just north of a big wash that leads down into the Amargosa Desert to the south. Ground rough, rocky, and very much cut up by washes, with some sagebrush and grease wood. Point marked by drill hole in large boulder, a 4-inch by 4-inch by 4-foot pine post, marked "C. N. 98," and a cairn 6 feet high around post and boulder. This cairn is very prominent from the south.

No. 98½.

This station is on the point of the Funeral Mountains, southeast, and next to the point on which T 98 was located, and is about 200 meters southeast of where the point on corrected line at right angles from old station would fall, and is on the second black rocky point south of the divide on which No. 98 is located, about 100 yards from the end of the point of the rocky incline. Station was lined in from stations No. 99 and No. 100. A big wash comes down from the Funeral Mountains between this station

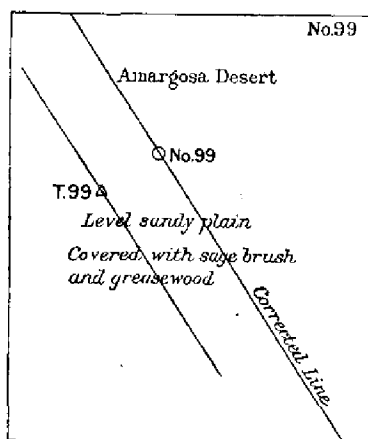


and the old station, T 98, and flows into the Amargosa Desert to the south. The rise from the desert to the top of the divide is very rough and rocky, cut up by numerous washes, all full of boulders. Sagebrush, grease wood, and cacti cover the ground.

Station marked by drill hole in solid rock. Over this a 4-inch by 4-inch by 4-foot pine post marked "C. N. 98½," and a large cairn around post. Just southeast of point are four small detached rocky knobs lower than No. 98½.

T 99.

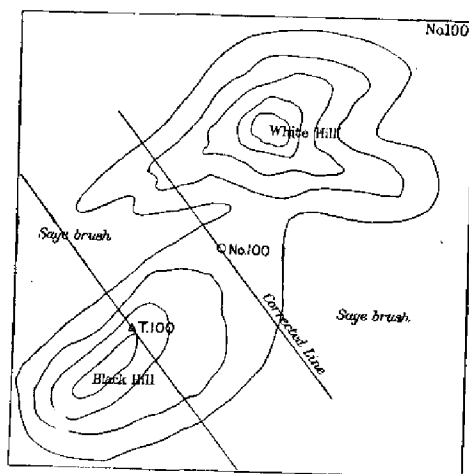
Point on corrected line, "No. 99," put in at right angles to line from old station to eastward, distant 94'17 meters, marked by a 4-inch by 4-inch by 4-foot pine post marked "C. N. 99," set firmly in the ground and a mound of sand thrown up around post. A



circular trench 12 feet in diameter was dug around mound. Land at station loose, sandy desert with scattering grease wood. This is the first station in the Amargosa Desert south of Funeral Mountains, and is about 9 400 meters from T 98.

T 100.

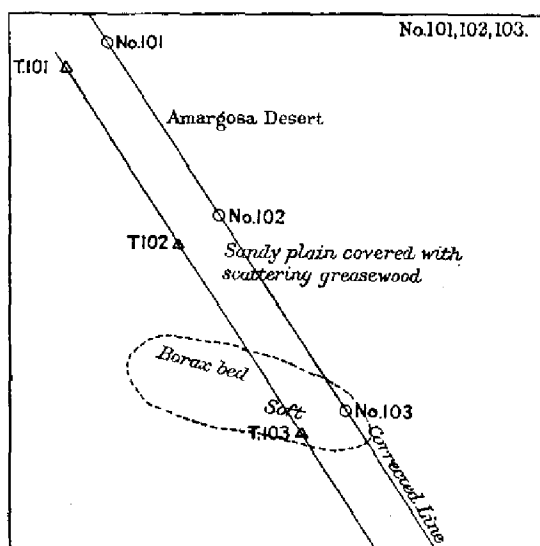
Station No. 100 is the second in the Amargosa Desert going southeast and is 7 589 meters from T 99. Put in at right angles to line from old station to eastward, distant 95'95 meters, marked by a nut-pine stick hewed roughly to about 1 ½ inches by 3 inches



by 6 feet long, marked "C. N. 100," a stone with drill hole in it placed southeast of pole and a cairn built around stone and pole. Station falls in a saddle between two low hills, the western one covered with dark colored lava rock and the eastern one rocky and light colored. Cairn shows well from both northwest and southeast.

No. 101.

Point on corrected line is at right angles to line from old station to eastward, distant 97.63 meters, marked by a 4-inch by 4-inch by 4-foot pine post marked "C. N. 101," and set firmly in the ground. A large stone with a drill hole in it was set just south-east of post, and a cairn of stone and sand built around post and stone. A circular trench was dug around cairn. Land is level, sandy desert, with scattered grease wood.



No. 102.

Point on corrected line put in at right angles to line from old station to eastward, distant 99.23 meters, marked by a 4-inch by 4-inch by 4-foot pine post marked "C. N. 102," firmly set in ground, and a mound of sand thrown up around post. A circular trench 12 feet in diameter dug around mound.

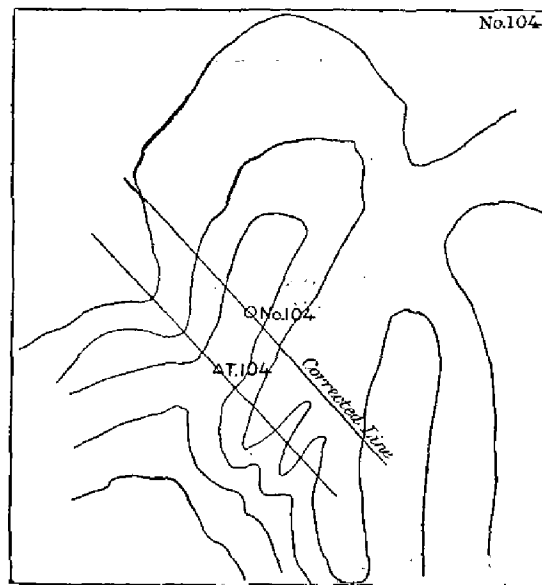
The old station was also the north end of the Amargosa Base Line, marked by a drill hole in stone. Ground level and sandy with some scattered grease wood.

No. 103.

Station on corrected line put in at right angles to line from old point to eastward, distant 100.68 meters, marked by a 4-inch by 4-inch by 4-foot fir post marked "C. N. 103," set firmly in the ground. Around the post was thrown up a mound of earth. This is the lowest line station in the Amargosa Desert, and is located on the eastern edge of a borax bed. Southeast side ground is soft and spongy.

No. 104.

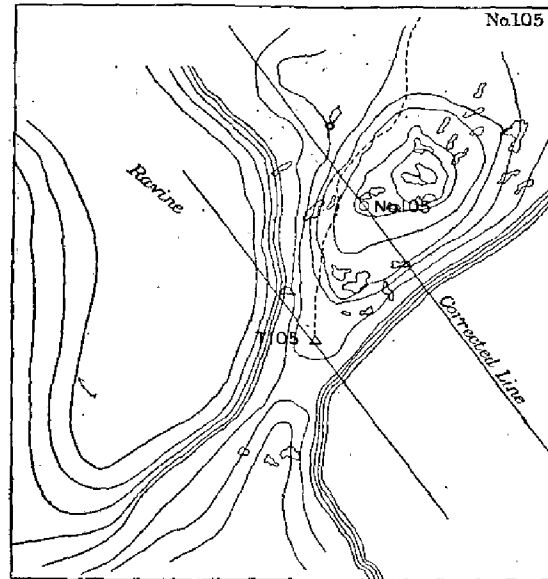
Station on corrected line put in at right angles to line from old point to eastward, distant 101.68 meters, thence northwest 50 meters in direction of line, marked by drill hole in stone set in position, over which was set a 4-inch by 4-inch by 4-foot fir post



marked "C. N. 104," and a cairn built around same. Station is on the rolling mesa, rising gently to the south. Gravel covered with sparse growth of sagebrush and grease wood. About 2 miles east from this station there is a range of bare hills, on the highest of which is located Station Hunch.

T 105.

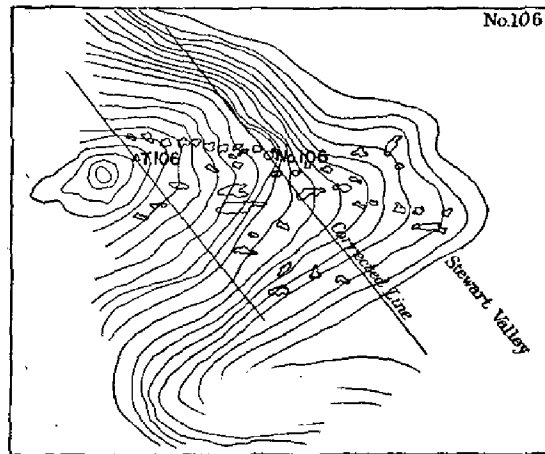
This station is on an eastern spur of the Chung Up Mountains, the dividing ridge between the Amargosa Desert on the north and Stewart and Pahrump valleys on the south. Station is well to the west, near to where the spur joins the main range of mountains, and in the first low sag east of the main summit. Station falls on eastern slope of sag 22 meters from the lowest part, marked by drill hole in solid rock and large cairn.



Point on corrected line, "No. 105," lined in from stations No. 106, No. 107, and No. 108. It is on the rocky peak, just east of low sag, about 1 mile east of the highest point of the northern part of the Chung Up Mountains. It is on the third rocky knob, on the first rise east of the sag and about 40 feet west of the summit, on a rocky ledge just west of some large projecting black rocks, marked by drill hole in solid rock. A 4-inch by 4-inch by 4-foot pine post marked "C. N. 105," with a large cairn around post. The whole of the Amargosa Desert and also Pahrump Valley are visible from this point. T 105 High is on the summit of the higher point, some 400 meters to the eastward, marked by a drill hole and cairn.

T 106.

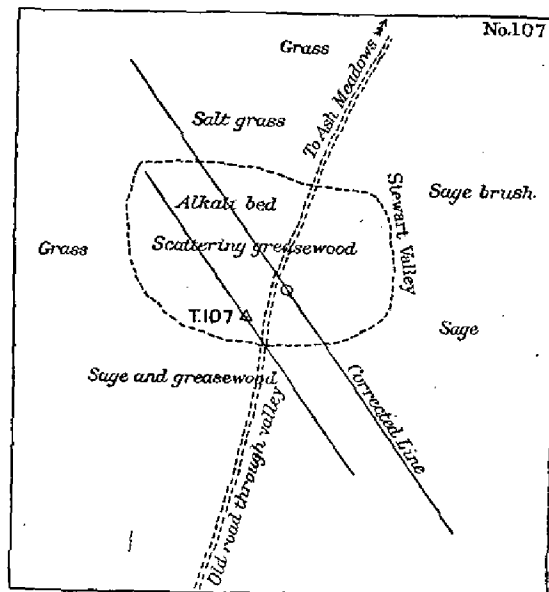
Station is on a rocky spur extending to the north from the Chung Up Mountains and about 3 miles southeast from "T 105." It is a sharp, black, very rocky ridge, rising abruptly from the west side of Stewart Valley. It is on the northeast slope, about one-third of the distance down from the summit.



Station "No. 106," lined in from stations No. 107, No. 108, No. 109, marked by drill hole in solid rock. Over this a 4-inch by 4-inch by 5-foot pine post marked "C. N. 106," and a cairn around post. This station overlooks the whole of Pahrump Valley clear to the State Line Mountains. This point can best be reached from the road going down through Stewart Valley, and is some 3 miles west of said road.

T 107.

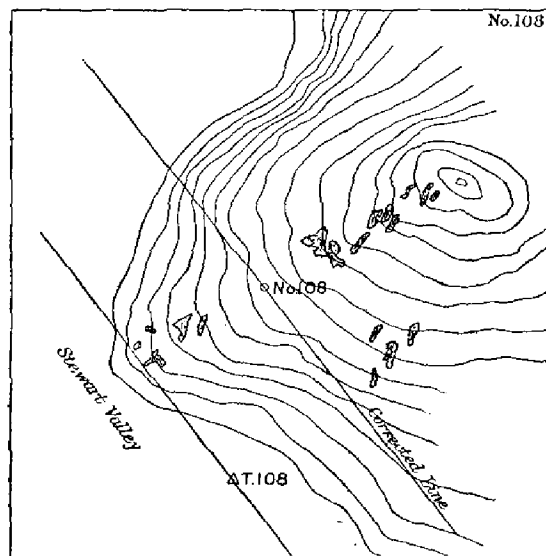
Station is about in the center of Stewart Valley, among the sagebrush on a hard, white alkali lake or flat, and about 1 mile south of the grassy part of the valley. It is about 300 feet west of the road that goes from the northeast end of this valley south to a pass, then over into Death Valley, marked by a mesquite stub 3 feet long set in the ground, a pole and mound of earth.



Point on corrected line, "No. 107," put in at right angles to line from old station to eastward, distant 105.59 meters, marked by a 4-inch by 4-inch by 5-foot pine post marked "C. N. 107," set in the ground, and a mound of earth thrown up around post. Station in hard, white alkali, and 50 feet east of road leading up valley. A deep trench encircles the mound.

No. 108.

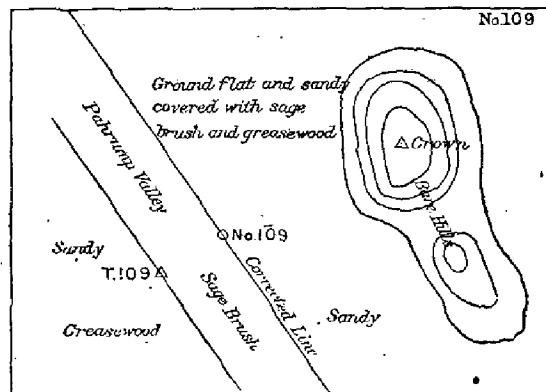
Station was lined in by the stations from No. 109 to No. 115, all of them falling exactly in line. Marked by drill hole in solid rock, over which was set a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 108." A cairn of stone was built around post. This station is on the extreme southern end of the range of hills that divides the Pahrump and Stewart valleys. This ridge is high and very rocky at the north end,



gradually getting lower to the south. It is about 10 miles long. Station is on a rocky spur that runs out in a westerly direction from the south end of ridge, projecting into the valley. It is about one-third of the way up to the first summit, about 50 feet higher than the old point, which was in the valley to the south. This point commands all points in the Pahrump Valley up to T 116.

T 109.

Station is in Pahrump Valley, about 5 miles south of the eastern end of the range of hills separating Pahrump and Stewart valleys. It is about one-fourth mile west of a low rolling hill, on the summit of which station Crown is located. Ground flat and sandy, covered with sagebrush and greasewood. Marked by drill hole in stone set in position, and a pole.

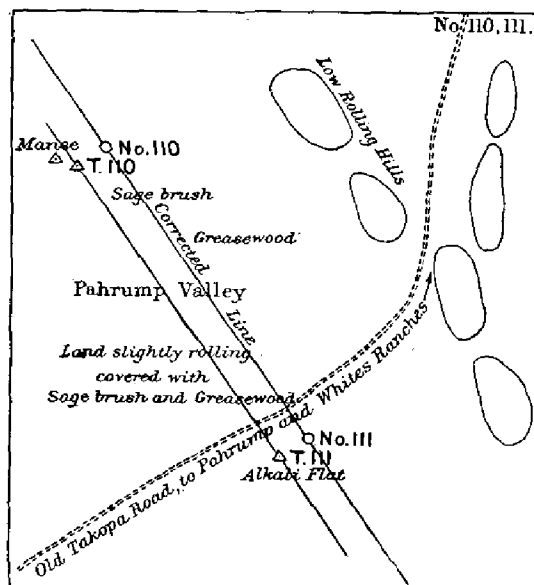


Point on corrected line, "No. 109," put in at right angles to line from old station to eastward, distant 108.35 meters, marked by a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 109." A stone with drill hole in it just southeast of post and a mound of earth thrown up around post and stone. Station is best reached from White's ranch (Manse post-office) by following out an old wood road to the west, to the the low hill on which station Crown is located, thence down to T 109.

T 110.

Station is in Pahrump Valley, just west of the low, rolling hills extending through the valley northwest and southeast. Land slightly rolling and sandy, covered with sagebrush and greasewood. Marked by drill hole in rock, and pole. Station Manse is 51.7 meters to the west, marked by stub with nail in it, and pole.

Point on corrected line, "No. 110," put in at right angles to line from old station to eastward, distant 110.37 meters, marked by a 4-inch by 4-inch by 4-foot post,



marked "C. N. 110." A stone with drill hole in it placed just southeast of post, and a mound of earth thrown up around post and stone. Most easily reached from the White ranch, by following wood road to the west.

T 111.

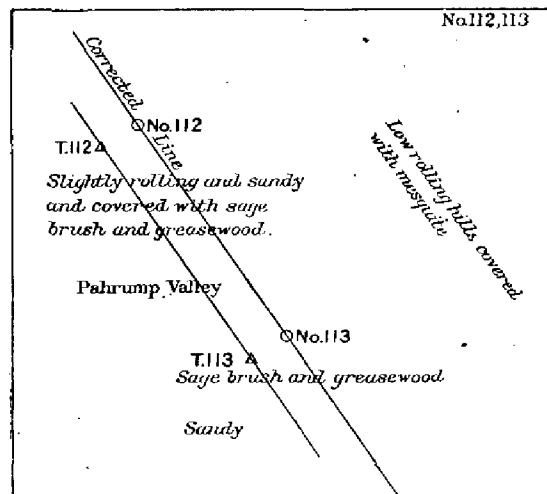
Station in Pahrump Valley, west of rolling hills in center of valley, on level alkali plain covered with sagebrush and greasewood and a few small stones. Station is about one-half of a mile south of the old Tekopa road, from White's ranch (Manse), to Tekopa mining camp, and about the same distance west from the low sand hills, reached from White's ranch by following the old Tekopa road through the sand hills to the Alkali Lake, thence southeast to station, marked by drill hole in rock and a pole.

Point on corrected line, "No. 111," put in at right angles to line from old station to eastward, distant 111.09 meters, marked by a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 111." Set in the ground, just southeast of post, was placed a stone with drill hole in it, and a mound of earth thrown up around post and stone.

T 112.

Station in Pahrump Valley, just west of the rolling sand hills and 3¼ miles southeast from T 111. Land slightly rolling and sandy, covered with sagebrush and greasewood, and with a few stones scattered about. Marked with stone with drill hole, and pole.

Point on corrected line, "No. 112," put in at right angles to line from old station to eastward, distant 113.58 meters, marked by a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 112," set in the ground. Just southeast of post was placed a stone with drill hole in it, and a mound of earth thrown up around post and stone.



T 113.

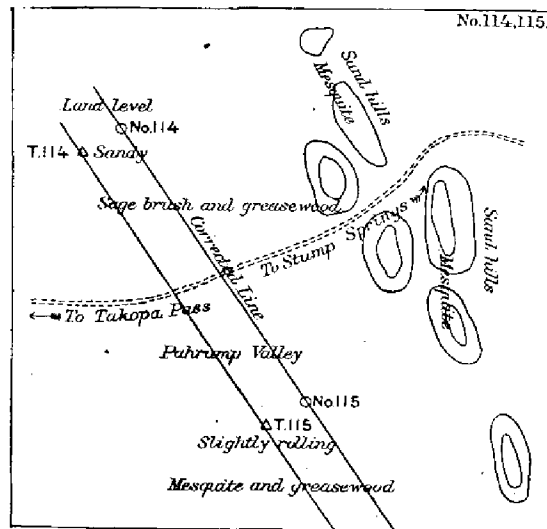
In Pahrump Valley, just west of rolling sand hills and 1 mile southeast from T 112, in hard, sandy plain, covered with sagebrush and greasewood. Marked by drill hole in stone set in position, and pole.

Point on corrected line, "No. 113," put in at right angles to line from old station to eastward, distant 111.22 meters, marked by a 4-inch by 4-inch by 4-foot redwood post, set in the ground and marked "C. N. 113." A stone with drill hole in it placed just southeast, and mound of earth around post and stone. Station about 2¾ miles north of road leading from Stump Spring across valley to Tekopa Pass.

T 114.

In Pahrump Valley, and just west of rolling hills about $2\frac{3}{4}$ miles from Stump Springs, and about three-fourths of a mile north of the road from Stump Springs to Tekopa Pass, where the line crosses. Land level and sandy, covered with sagebrush and greasewood, marked by drill hole in set stone, and pole.

Point on corrected line, "No. 114," put in at right angles to line from old station to eastward, distant 113.57 meters, marked by a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 114," set in the ground. A stone with drill hole in it placed just southeast, and a mound of earth then thrown up around post and stone.



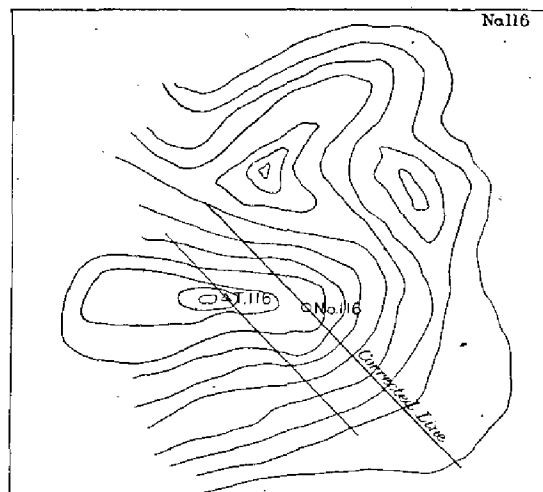
T 115.

This is the last station in Pahrump Valley before reaching the high, bare ridge upon which T 116 is situated. It is about three-fourths of a mile southeast of the Stump Spring and Tekopa Pass road where the line crosses, and some 2 miles from Stump Springs. Land level and sandy, with high sagebrush. Marked by drill hole and post.

Point on corrected line, "No. 115," put in at right angles to line from the old point to eastward, distant 112.40 meters, marked by a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 115," set in the ground. Stone with drill hole, set southeast, and a mound of earth around post and stone.

T 116.

Station is on the highest one of a chain of bare hills about 4 miles south of Stump Springs, extending about east and west and nearly dividing Pahrump Valley. The part of the valley south of this chain of hills is sometimes called Mesquite Valley. Station is about south from Stump Springs, on the highest of the hills. It is in a sag just to the east of the highest point. Hill bare, with a few scattering sagebrush, and ground covered with small loose stones. Marked by drill hole in large rock, and signal pole.

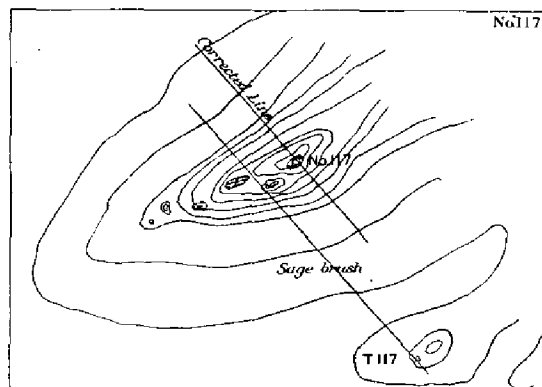


Point on corrected line, "No. 116," was lined in from No. 117, marked by drill hole in rock, over which was placed a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 116," surrounded by a cairn of rocks. This station is easily reached from Stump Springs, from which place it is visible. Ground at station is rocky. Station T 105, 34.8 miles to the northwest, and T 123, on the State Line Mountains, 26.3 miles southeast, are both visible from this station.

T 117.

Station is on a bare and very rocky black lava peak that juts out to the westward from the high black buttes that are in the center of Mesquite Valley. It is on the eastern slope and about 100 feet from summit, where is located station T 117 High. Both stations marked by drill holes in rocks, and poles.

Point on corrected line, "No. 117," was lined in by stations No. 118, No. 119, and No. 120, and is on the black, rocky point of the mass of Black Buttes that are in Mesquite Valley. The point is very rocky and rough, and full of holes and caves on



the south side. Station is on the third rocky knob from the northwest end, a great mass of black lava rock, and is on the highest part of knob, marked by drill hole in the solid rock. Over this a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 117," and a cairn built around post. This is a very conspicuous mark. About three-fourths of a mile south of station there is an isolated light-colored butte. T 117 High is about three-fourths of a mile southeast from station. Place best reached from Sandy post-office; leave Stump Springs road just before reaching the Black Butte; keep around it on south and west sides to T 117 High, and T 117, three-fourths mile northwest.

T 118.

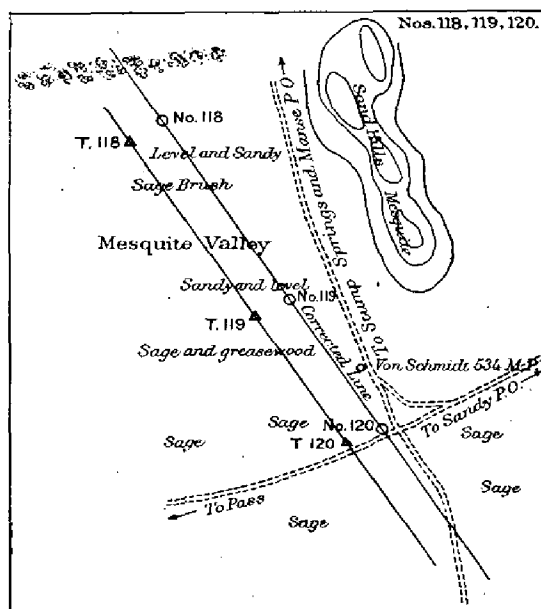
Station is in Mesquite Valley, the first station southeast of the Black Butte. It is in a level, sandy plain covered with sagebrush and greasewood. Is about three-fourths of a mile southwest from the Pahrump and Manvel road, and about 300 yards south of a belt of greasewood and mesquite that extends nearly across the valley east and west. Marked by a stone with drill hole in it set in position, and a pole.

Point on corrected line, "No. 118," put in at right angles to old station, to eastward, distant 120.17 meters marked by a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 118," set in the ground. A stone, with drill hole in it, placed just southeast of post, and two bottles, one northeast and one southwest of post. A mound of earth was then thrown up around post, stone, and bottles. Station most easily reached from Sandy post-office by following out the Pahrump road some 5 miles, thence

to the west to station. T 118 is almost due north of the largest of a group of sand hills partially covered with mesquite, on which station Snow is located, and is distant from it about $1\frac{1}{4}$ miles or 2 146 meters.

T 119.

Station is in Mesquite Valley, about one-third of a mile southwest of the Pahrump and Manvel road, and some 3 miles from Sandy post-office, on level, sandy plain covered with heavy growth of sagebrush and greasewood. To reach station from Sandy follow out the Pahrump road $2\frac{1}{2}$ miles, thence southwest through the sagebrush one-third of a mile to station. The mound can be seen from the road. Old station marked by rock with drill hole and a pole.



Point on corrected line, "No. 119," put in at right angles to line from old station, to eastward, distant 121 17 meters, marked by a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 119," with a mound of earth thrown up around post. The mesquite-covered sand hill on which station Snow is located, is west 14° north from this station, distant 3 558 meters.

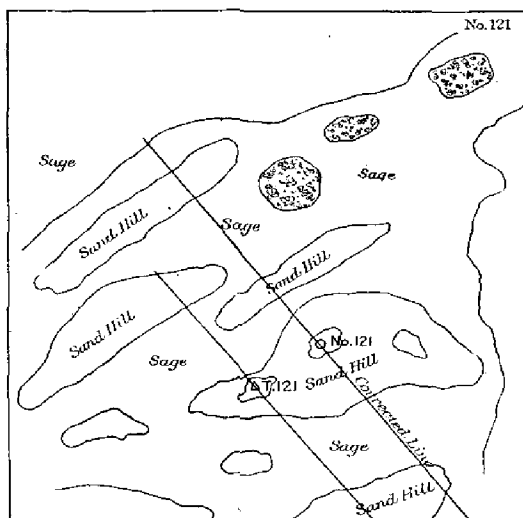
T 120.

Station is in Mesquite Valley, about $1\frac{1}{3}$ miles from Sandy post-office, and some 50 feet northwest of the road from Sandy post-office west across the valley to a pass just south of the Kingston Pass, and about 100 yards west of the crossing of the above road with the one from Pahrump to Manvel. In level, sandy plain covered with sagebrush and greasewood. Marked by drill hole in stone and a pole.

Point on corrected line, "No. 120," put in at right angles to line from old station, to eastward, distant 122'01 meters, thence 6'0 meters southeast in direction of line. Station is 7'0 meters southeast from center of road running west from Sandy post-office and 37'0 meters westward from road running from Pahrump to Manvel through State Line Pass, marked by a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 120," set in the ground. A rock with drill hole in it was placed just southeast and a mound of earth thrown up around rock and post.

T 121.

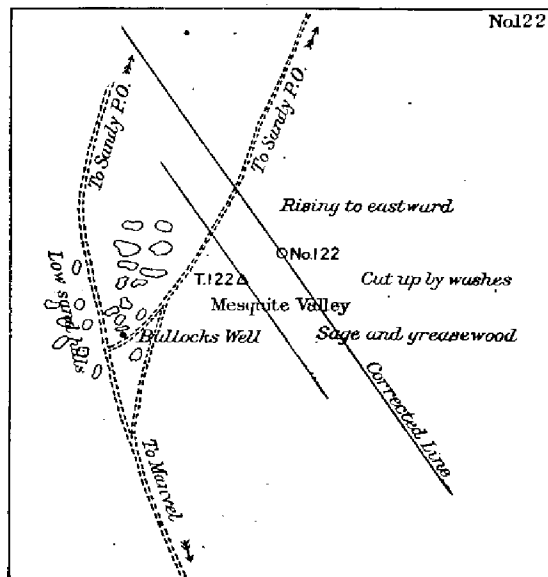
Station is on one of the group of sand hills, some bare and some covered with mesquite, that lie between the lower and upper roads from State Line Pass to Sandy post-office, and about half way from Bullock's well to Sandy, and about 1 mile east of the Oliver Rose Ranch. It is on one of the bare sand hills at the northeast end of the group. Marked by a stone with a drill hole in it and a pole.



Point on corrected line, "No. 121," was lined in from stations No. 119 and No. 120. It is on the highest part of the most northern of the clear sand hills, but to the north of it there are three separate sand hills, all higher and all covered with a mesquite growth. Only sagebrush covers the other hills of the group. Station is marked by a large stone with drill hole in it. Over this a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 121," and a large mound of sand thrown up around post and stone. Station is easily reached from the Oliver Rose Ranch, and is about 4 miles from Sandy post-office by the lower road.

T 122.

Station is in Mesquite Valley, about 1 mile above Bullock's well, on the upper road from State Line Pass to Sandy post-office. It is about one-half mile from this road on the slope leading up to the foot of the mountain bounding the eastern side of the valley. Marked by a stone with a drill hole and a small cairn of rocks.

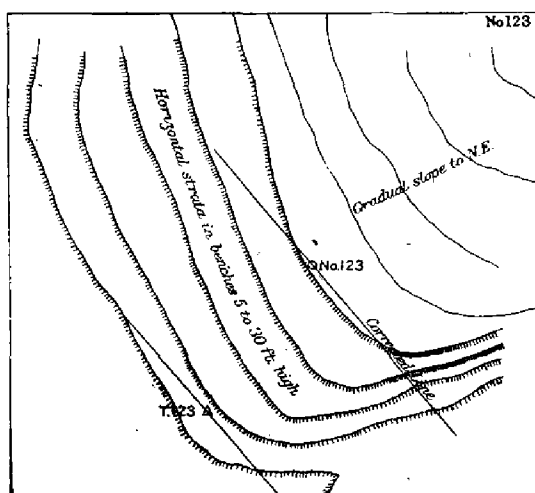


Point on corrected line, "No. 122," put in at right angles to line from old station, to eastward, distant 124'74 meters, marked by a drill hole in stone set level with surface of the ground. Over this a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 122." A cairn was built around post. Ground at station gently rising to eastward, cut up by washes and covered with sagebrush and greasewood.

T 123.

This station is on the west slope of the State Line Mountains, on east side of the pass high up near the first top. It is on the sharp saddle of a rock just above a ledge 10 feet high. Fifty feet southeast is a beetling rock, the under part having worn away, leaving a part projecting, under which the line passes. A cross cut on the rock and a pile of stones mark the point. A distinctive description on the slope is almost impossible.

Point on the corrected line, "No. 123," was lined in from the stations No. 126 and No. 127, marked by drill hole in the solid rock. Over this a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 123," and a cairn around post. Station is on the first



high point immediately northeast of the State Line Pass. It is on the top of the ridge on the western slope and about 150 feet from the summit. Very rough, rocky, and difficult to get up to this station from the pass.

T 124.

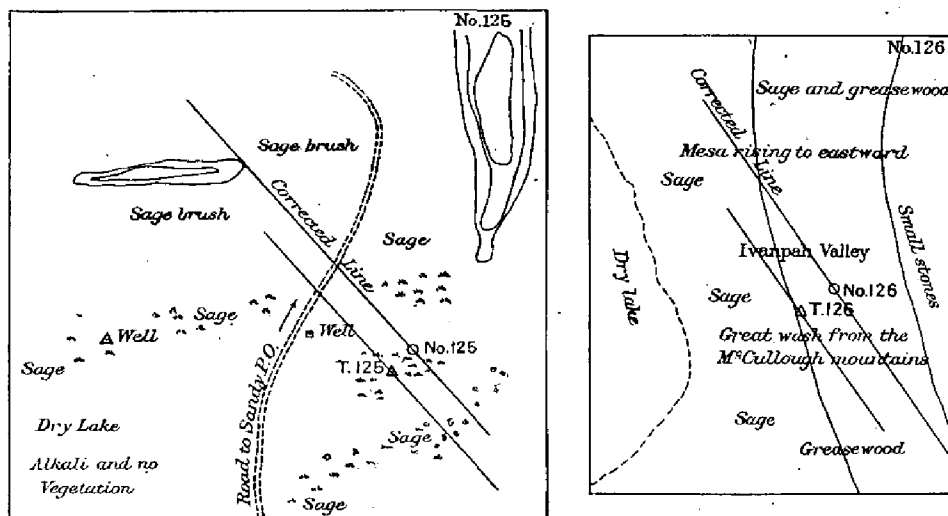
This station is situated on the fourth ledge from the top of the west side of a cliff that is just beyond the summit of the road leading to Ivanpah Valley through State Line Pass. Cliff is on the east side of the pass about one-half mile from where the road crosses. The vertical drop of the cliff is about 30 feet, succeeded by one of 50 feet. The stratification of this mountain was left nearly horizontal in the uplifting, and the weathering has formed a series of benches like the steps of a pyramid. Station is marked by $\frac{3}{4}$ -inch drill hole in the solid rock, a pole, and cairn.

Point on corrected line "No. 124" was not put in at this station, but it would be at right angles to the line from the old station, to the eastward, distant 126.77 meters. Not considered necessary.

T 125.

Station is near the east edge of a lot of sand hummocks, on top of one of them. It is near the east end of Dry Lake, in Ivanpah Valley. These sand hummocks are only about 3 feet high and covered with sagebrush. It is about one-fourth of a mile southwest of the black ridge which terminates the range of mountains and three-fourths of a mile east of an old well near the edge of Dry Lake where the road comes in from State Line Pass. Marked by a stone with drill hole in it and a pole.

Point on corrected line "No. 125" put in at right angles to line from old station, to eastward, distant 128.73 meters, marked by a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 125," set in the ground with mound of earth thrown up around post. Three meters southeast of post in direction of line was placed a stone, top flush with surface of ground and drill hole in rock. The point is clear of the sand hills out in the Dry Lake.



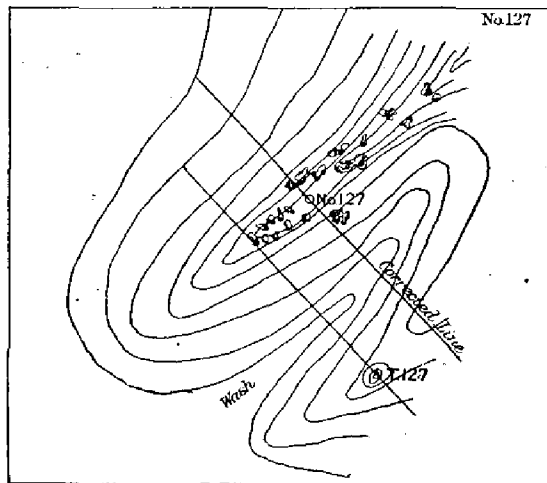
T 126.

Station is located in Ivanpah Valley, on the slope of the mesa, about 2 miles east of the Dry Lake and almost in line between the highest peak of the Mescal range on the west side of the valley and the highest peak of the range on the east side, on the great wash that comes down from the high peak on the east side. Land generally rising to the eastward, sandy, and covered with sagebrush, cut up by many washes with very rocky ridges between them. Marked by drill hole in large rock and a pole with pile of stone.

Point on corrected line, "No. 126," put in at right angles to line, from old station, to eastward, distant 130.09 meters, marked by drill hole in stone. Over this a 4-inch by 4-inch by 4-foot redwood post marked "C. N. 126," and around post a cairn.

T 127.

Station is on a rocky point, projecting from the foothills of the McCullough Mountains, extending along the east side of Ivanpah Valley. It is the first rocky point



extending into the valley from these mountains, north of the road from the Dry Well to Crossman's Spring and also to Crescent Spring. Station is on the second point south of the most southerly of the two grassy washes in foot of hills, and the third point north of an outstanding black butte, and is between two large washes on west slope of ridge, which is very rocky. Marked by drill hole and pole.

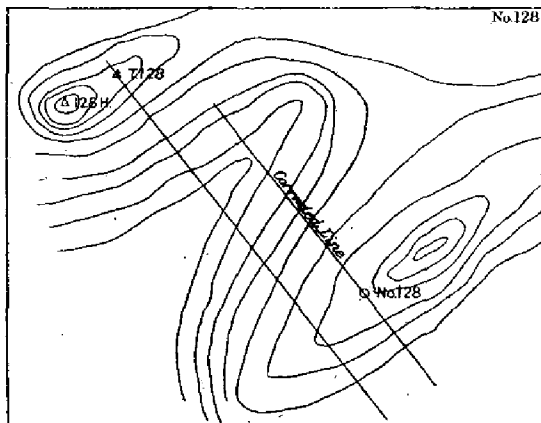
Point on corrected line, "No. 127," was lined in from stations No. 125 and No. 126. Is on the same ridge, but higher up. Marked by drill hole in solid rock. Over this a 4-inch by 4-inch by 4-foot

redwood post marked "C. N. 127," with a cairn around post. This point is about 6 miles north of the Dry Well on the Alkali Lake in Ivanpah Valley.

T 128.

Station is on one of the bare peaks of the cluster of hills on the east side of Ivanpah Valley that lie south of the road leading from Dry Well in Ivanpah Valley to Crescent Spring, and also to Crossman's Spring. It is about one-half mile south of the road and about east from the junction of that road with one coming from Vanderbilt. It is in a small saddle on a peak about 150 feet east of the summit on which Station T 128 High is located. Both stations marked by drill holes in rocks, and poles with stones around them.

Point on corrected line, "No. 128," was lined in from stations No. 127 and No. 129. Station is on the west slope of the bare hill that is just southeast and across the head of a big wash from T 128, old point. Marked by a cut in solid rock, over which was placed a stone with drill hole in it. Above this a 4-inch by 4-inch by 4-foot redwood post marked "C. N. 128," with

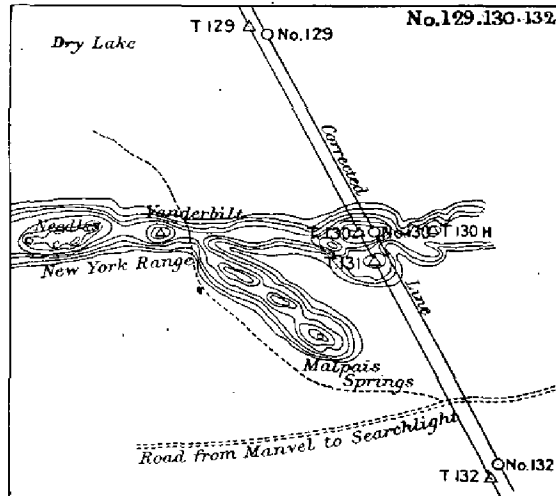
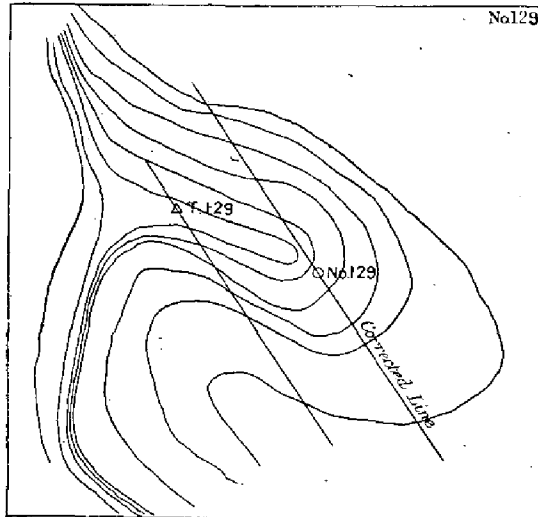


a cairn around post. To reach this station follow road from Dry Well to Crossman's Spring for about $7\frac{1}{2}$ miles from the well; thence to the right to foot of hill, about one-half mile distant.

T 129.

Station is on the east slope of the first high ridge north of the New York range, on the southeast side of Ivanpah Valley, and is the first high peak up from the valley. Station T 129 High is on this same peak, to the northward and on the highest point. Both stations marked by drill hole in rock, and pole with stones around it.

Point on corrected line, "No. 129," was lined in from No. 130. It is on the eastern slope, lower down, marked by drill hole in solid rock. Over this a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 129," and a cairn 5 feet in diameter at base and 4 feet high built around post. From Dry Well to foot of ridge is about 9 miles. To get there follow the Crossman's Spring road to the junction of the Vanderbilt road; then south on that road about three-fourths of a mile to the end of black, isolated lava peak; leave the road here and follow up the big wash on south side of peak. This wash heads up against the foot of ridge on which station is located. Can drive to foot of ridge in buckboard.

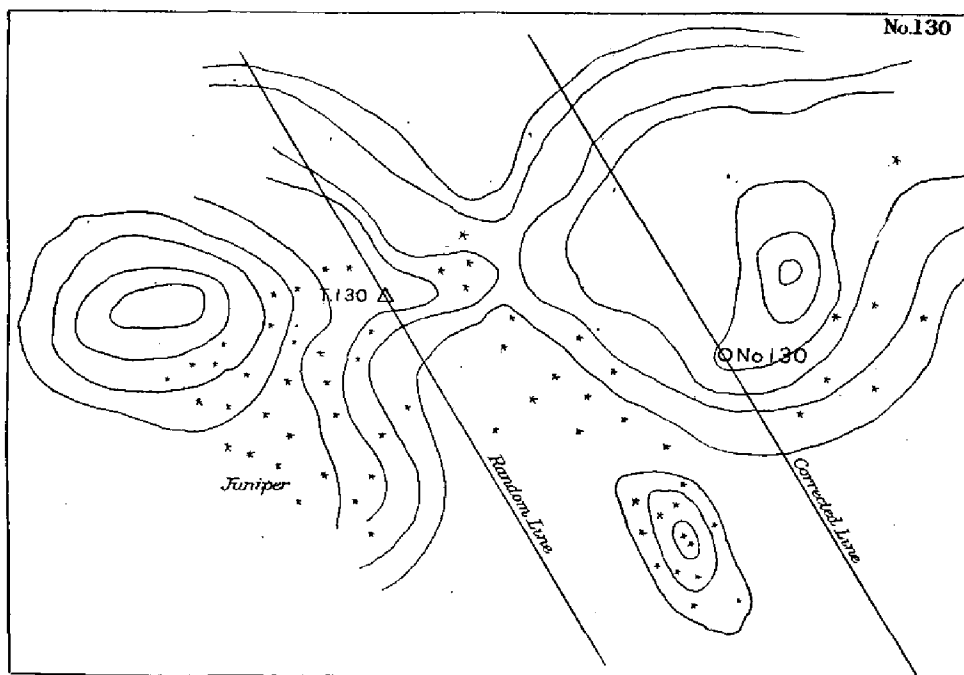


is on the summit of a conical peak about one-third mile east of the station, marked by drill hole and pole.

T 130.

Station is on the east slope of a high mountain in the New York range, about $2\frac{1}{2}$ miles east of the Vanderbilt Needles. Hill covered with nut pine growth. Marked by drill hole in rock, a pole, and pile of stone. Station T 130 High

Point on corrected line, "No 130," was lined in from No. 132. It is on the same ridge as old station, a little north and on opposite side of a wash that heads up against the ridge between the two stations. Marked by drill hole in rock set in position.



Over this a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 130," and around post a cairn. Station is most easily reached from Malpais Springs.

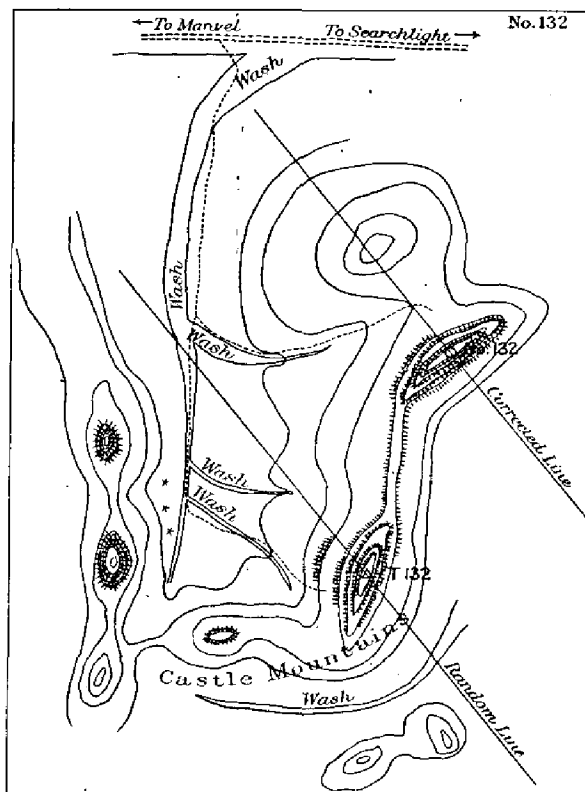
T 131.

Station is on the next ridge to the southeast, or rather a spur of the same ridge, as T 130 and only 237 meters from it. Marked by drill hole, pole, and pile of stones.

Point on corrected line, "No. 131," was not put in, as the station (new) No. 130 commands the line in both directions, northwest and southeast.

T 132.

Station is about 5 miles southeast of the New York range, on the most easterly of a number of high summits in the Castle Mountains. The summits are capped by vertical cliffs. To the west and south are very notable summits, higher than the station and rock capped. The summit on which station is has two ridges, and the station is on the southern and lowest one. Marked by a drill hole in solid rock in a little depression so as to give a place for the instrument. A pile of stone surrounds the pole.

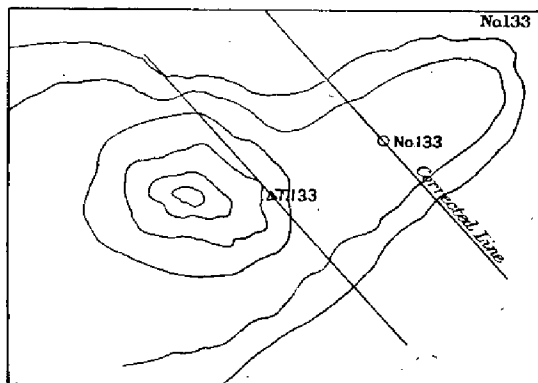


This mountain is south of the road from Manvel to the Search Light Mine and about $3\frac{1}{2}$ miles south of Malpais Springs, where good water may be obtained in abundance.

Point on corrected line, "No. 132," was lined in from No. 133. It is on the most northern and highest of the two summits, almost due north from the old station. Marked by drill hole in the rock. Over this a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 132," with a cairn around post.

T 133.

Station is on the Malpais Mountains, on the west side of Piute Valley and about one-half mile west of the two small black Malpais buttes that are at the southern end of



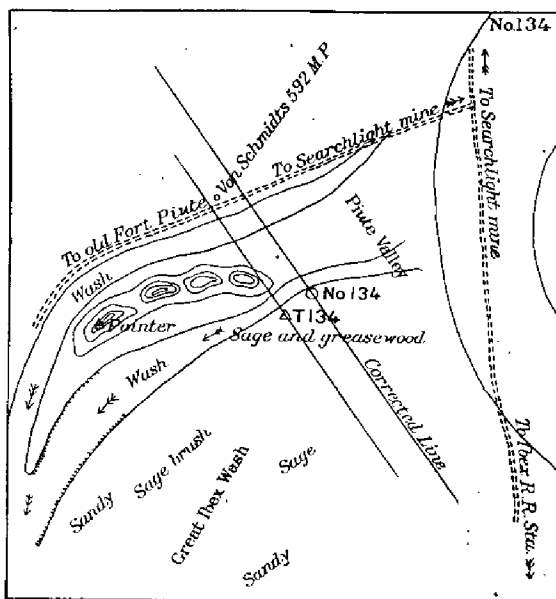
the Castle Mountains. It is a black and very rough and rocky ridge extending to the eastward from the higher mountains to the west. There is a large, deep cañon on the north side, also one on the south side, and the best way up is by the point of ridge between these cañons. Very steep and rocky, this ridge terminates in a round, rough, very rocky knob, with a hogback running down to the eastward. Station is on the top of knob, marked by drill hole in rock, pole, and rock cairn.

Point on corrected line, "No. 133," lined in by stations No. 134 and No. 135. It falls on the hogback to eastward of old station and some 50 feet below it, marked by drill hole in solid rock. Over this a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 133," and a large cairn. To reach station from Malpais Springs, follow the big wash down Piute Valley for about 8 miles to the rocky, isolated butte in mid valley (has a great cliff on east side); thence across valley to westward to the south end of the two black buttes, and from there climb up ridge to station.

T 134.

In Piute Valley, about 18 miles from Malpais Springs, and standing out in the great Ibex wash, are four isolated black buttes extending about north and south. The road from Searchlight mine to old Fort Piute, or Piute Springs, passes along the foot of these buttes on the north side, while the road from the Searchlight mine down Piute Valley to the railroad station of Ibex passes about $1\frac{1}{2}$ miles to the east of said buttes.

T 134 is in Piute Valley, some 300 meters east of the eastern end of the four little

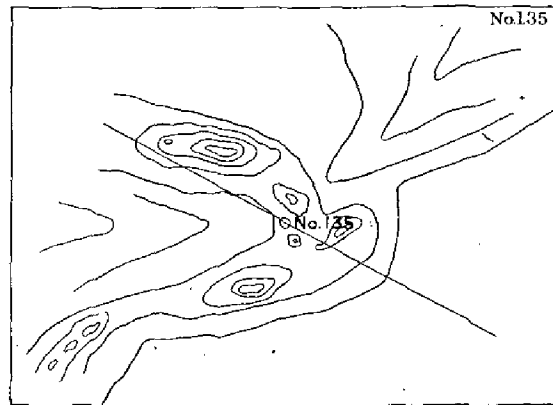


buttes, on south side of a wash, marked by drill hole in stone set in position, a pole, and mound of sand.

Point on corrected line, "No. 134," put in at right angles to line from old station, to eastward, distant 143.19 meters, marked by a large stone with drill hole in it; over this a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 134," and a mound of sand and stones 3 feet high and 6 feet in diameter thrown up around post.

T 135.

Station is on the southwest end of a range of black buttes that lie in the middle of Piute Valley, and about 5 miles east of the great Ibex wash. The road from Searchlight mine to Ibex goes by these buttes, leaving them about one-half mile to eastward. On the southwest side of the western butte there are three small, rocky knobs, the upper two being close together. On the upper one is the station, marked by a drill hole



in solid rock, pole, and pile of stone. One-half mile west of station is a small light-colored butte standing out by itself. An old road goes up the wash between this butte and the station.

Point on corrected line, "No. 135," was lined in from No. 137. It is on the southwest butte, about 50 meters east from the top, and in a saddle just below and to the east of a little rocky knob. These buttes are all black, with the exception of the little saddle, which is formed of white granite rock. Station marked by a drill hole in solid rock; over this a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 135," and a cairn built around post. These buttes are about northeast from Piute Springs and some 10 miles distant.

T 136.

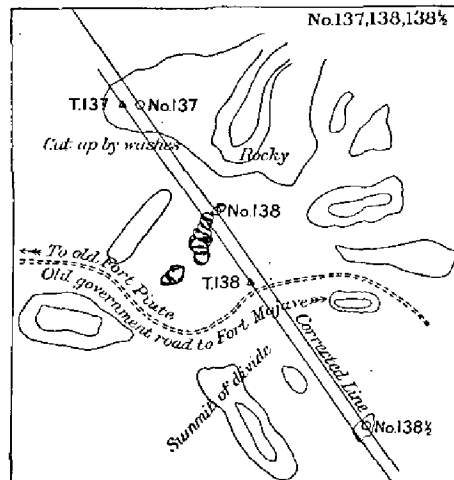
Station is on the first white, gravelly butte south of pass and west of the rough hills that extend from the pass to the north, on east side of Piute Valley. The butte is a white turtle backed one; entirely separated from the main range. On the top is located station T 136 High, marked by cross cut in the rock, pole and pile of stones.

Station T 136 is on the north slope of butte about 75 feet from T 136 High, marked by drill hole in solid rock, pole and pile of stones.

This point was omitted on the corrected line as it fell on a part of the line visible from no other station, and it was not practicable to measure from old station.

No. 137.

About 709 meters northwest of No. 138 on line, on a small rocky ridge on the south side of a large deep wash, is located station No. 137, which was lined in from No. 138. It is on the western edge of the summit of said ridge among some good sized boulders.



Station is marked by a drill hole in one of these boulders. Over this a 4-inch by 4-inch by 4-foot redwood post and a large cairn around same. Land rough and rocky, rising to the foothills to the east, covered with sage brush, greasewood, and cacti, and very much cut up by washes.

T 138.

Station is located on the summit of pass between Piute Valley and the Colorado River, and about 80 feet north of the old Government road at its highest point. It is a gravelly knoll and is marked by a drill hole in a large flat rock, pole, and pile of stones.

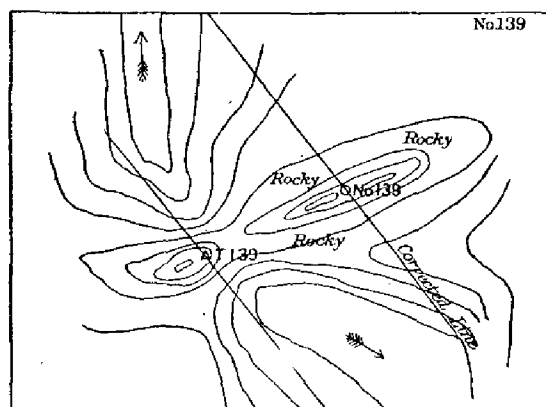
Point on corrected line, "No. 138," was lined in from No. 138 1/2. It is on the northeast end of the large mass of white boulders that extend down from the Newberry Mountains. These rocks are about 1 000 feet northwest of the old Government road where it crosses the summit, and are very prominent, as they stand up above the gravelly hill on which they are situated, some 25 feet. Station is at the northeast end, and is between two large boulders which form a gap 10 feet deep and 8 feet wide, the last one to the northeast. Station marked by a drill hole 1 1/2 inches deep in solid rock, and a 4-inch by 4-inch by 4-foot redwood post marked "C. N. 138. S." A cairn, 7 feet base and 7 feet high, built around post. The summit is 12.1 miles from Piute Springs by the old Government road.

No. 138½.

One thousand three hundred and twenty-three meters from No. 138 on the line there is a small rocky ridge that just cuts off the view from No. 138. No. 138½ is on the top of this ridge. The station was lined in from No. 139, marked by a drill hole in the rock, over this a 4-inch by 4-inch by 4-foot redwood post, marked "C. N. 138½" and with a large cairn around same. The random line ran to the west of this rocky peak or ridge and T 139 was visible from T 138, but the corrected line runs through the peak, therefore this extra station was put in. Land cut up by washes, with little rocky knolls and sand hills.

T 139.

Station is on the northeast slope of a rocky knoll about 700 meters east of station Vex, marked by a drill hole in the solid rock, a pole, and cairn around the pole.



Point on corrected line, "No. 139," falls on a rocky ridge just east of this peak and part of the same ridge. It is a saddle between two rocky little peaks, marked by drill hole in rock; over this a 4-inch by 4-inch by 4-foot redwood post with a large cairn around same. Land much cut up by washes, with little rocky ridges and peaks here and there.

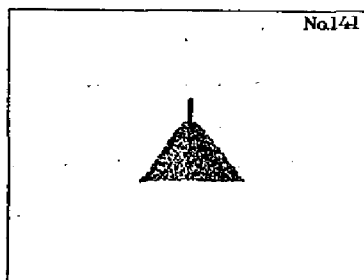
T 140 High and T 140.

Station T 140 High is on the summit of a sharp black cone, jutting up on the northeast end of a black mountain mass like the horn of a unicorn, just above a lot of white formation northwest of the spring in the cañon and 1½ miles from it. T 140 is on the northeast slope of the same cone. Both are marked by a drill hole in a rock with pole and pile of stones.

No. 140 was omitted from the corrected line.

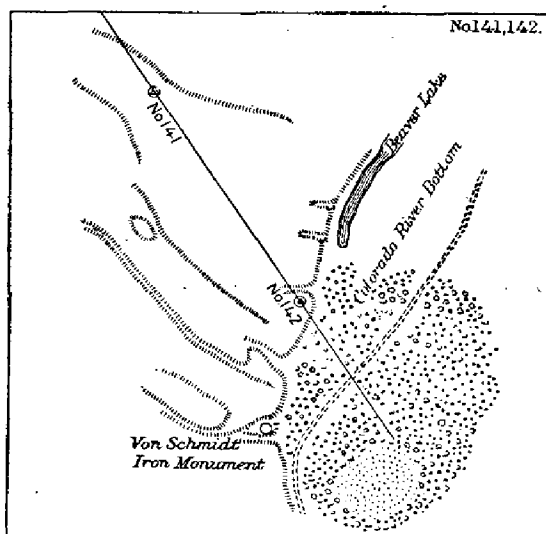
No. 141.

Station is on the mesa northwest of the last line point 2 334 meters, and nearly 184 meters south of the northwest line post of 1893, on the northwest side, of the mesa not far from a ravine. The mesa is of sand and gravel with very few stones, covered



sparsely with greasewood. Marked by a drill hole in a stone set flush with the ground. A pile of stones is around foot of pole.

Point on corrected line, "No. 141" was lined in from Station No. 142, the first one on the line, by the azimuth. Marked by a stone with drill hole set in the ground.



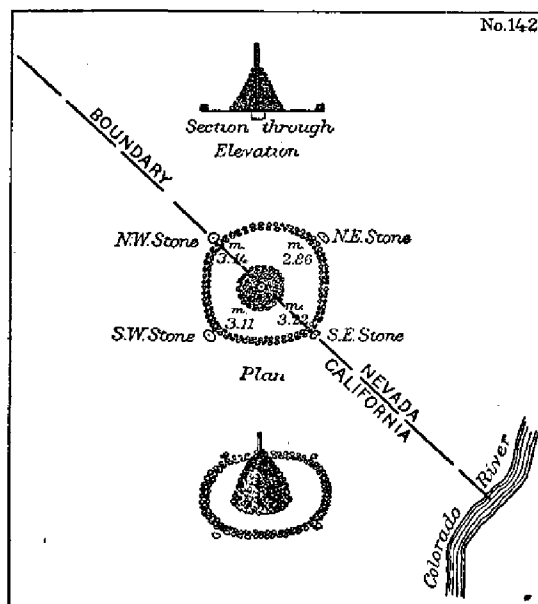
Over this a redwood post 4-inches by 4-inches by 6-feet, with "N. W. Line Post" and "C. & G. S." cut on it. Around post was built a large cairn.

Northwest line post of 1893 is a little west of north from new station, distant 12'75 meters. Marked by stone with drill hole in it. Cairn removed.

T 142.

On low mesa 159.4 meters southwest of the northeast line post set in 1893. It is just northeast of a wash and is marked by a drill hole in a stone, pole with pile of stone around it.

Point on the corrected line, "No. 142," or southeast line post, is 12.42 meters south of the other line post set in 1893 and was placed in February, 1899. It is marked by a mass of concrete 17 by 17 inches square and 18 inches long, sunk in the ground, with a drill hole in top to mark the center. On top of this was placed a redwood post, 6-inches by 6-inches by 6-feet, marked S. E. LINE POST. Around the post was built a cairn 10 feet in diameter at base and 6 feet high. An outer wall of stones nearly 20 feet in diameter and 1 foot high is outside the cairn. Four stones with drill holes were set in the ground just outside the outer wall, as shown in diagram, as reference marks. It stands on a sand ridge running east and west about 50 meters wide and about 100 meters west of the trees at the foot of the bluff.



Southeast line post of 1893 is 12.42 meters north of this station and is marked by a rock with drill hole in it. Cairn removed.

Station, East Post, 35° latitude, west side of river. C. H. Sinclair, 1893.

A redwood post 4-inches by 4-inches by 6-feet long was set over a drill hole in a stationary rock, and a pile of stones placed around it 7 feet in diameter and 5 feet high. On the west face was cut "Lat. 35°," on the north face was cut "1893," and on the east face was cut "C. G. S." This post is 100 meters west of the shore line of the lake, and 83 meters west of the foot line of the bluff. It stands on a sand ridge 42 feet high, and is 44.67 meters east of the meridian through Von Schmidt's 35° latitude post.

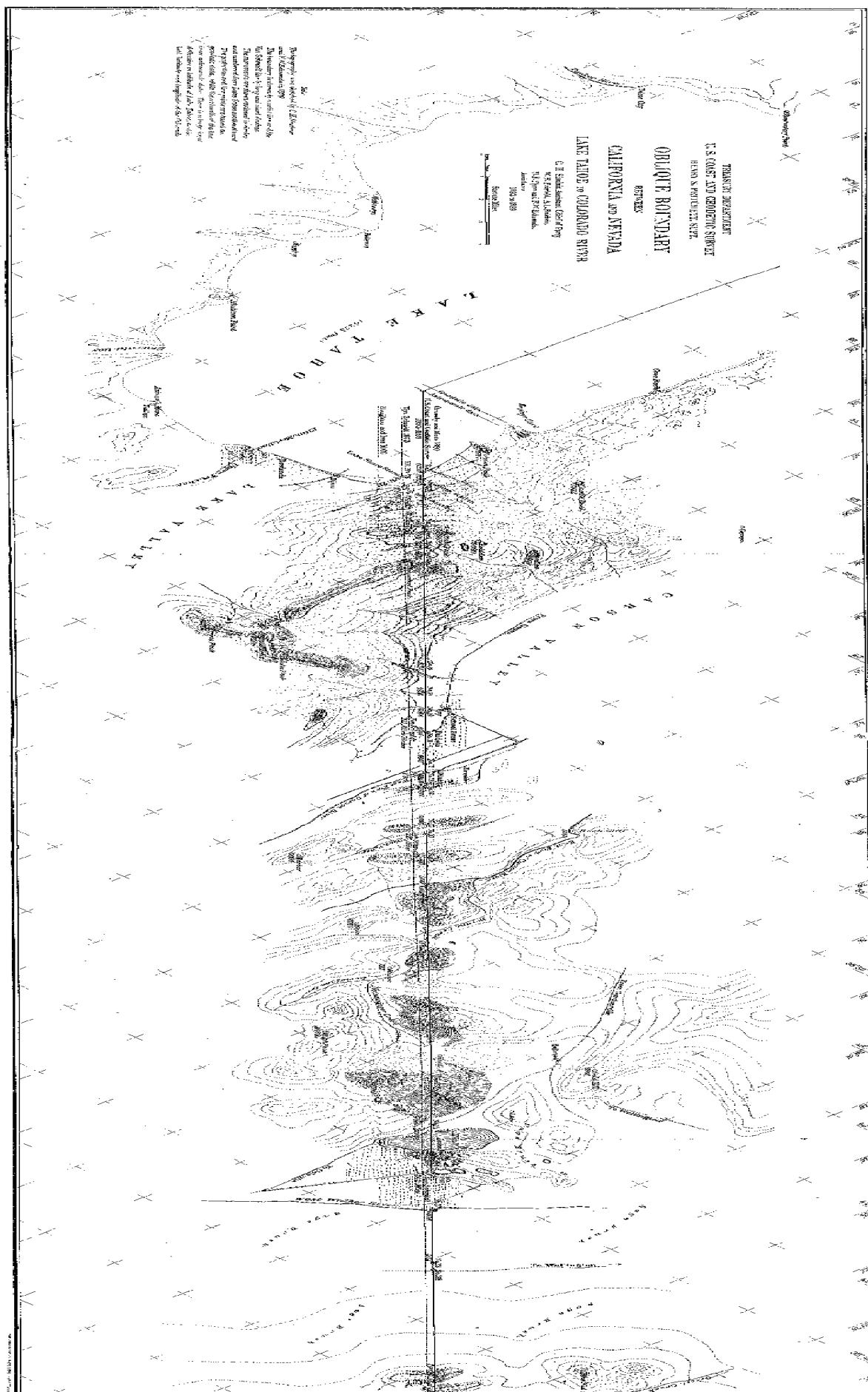
Station, West Post, 35° latitude, west side of river. C. H. Sinclair, 1893.

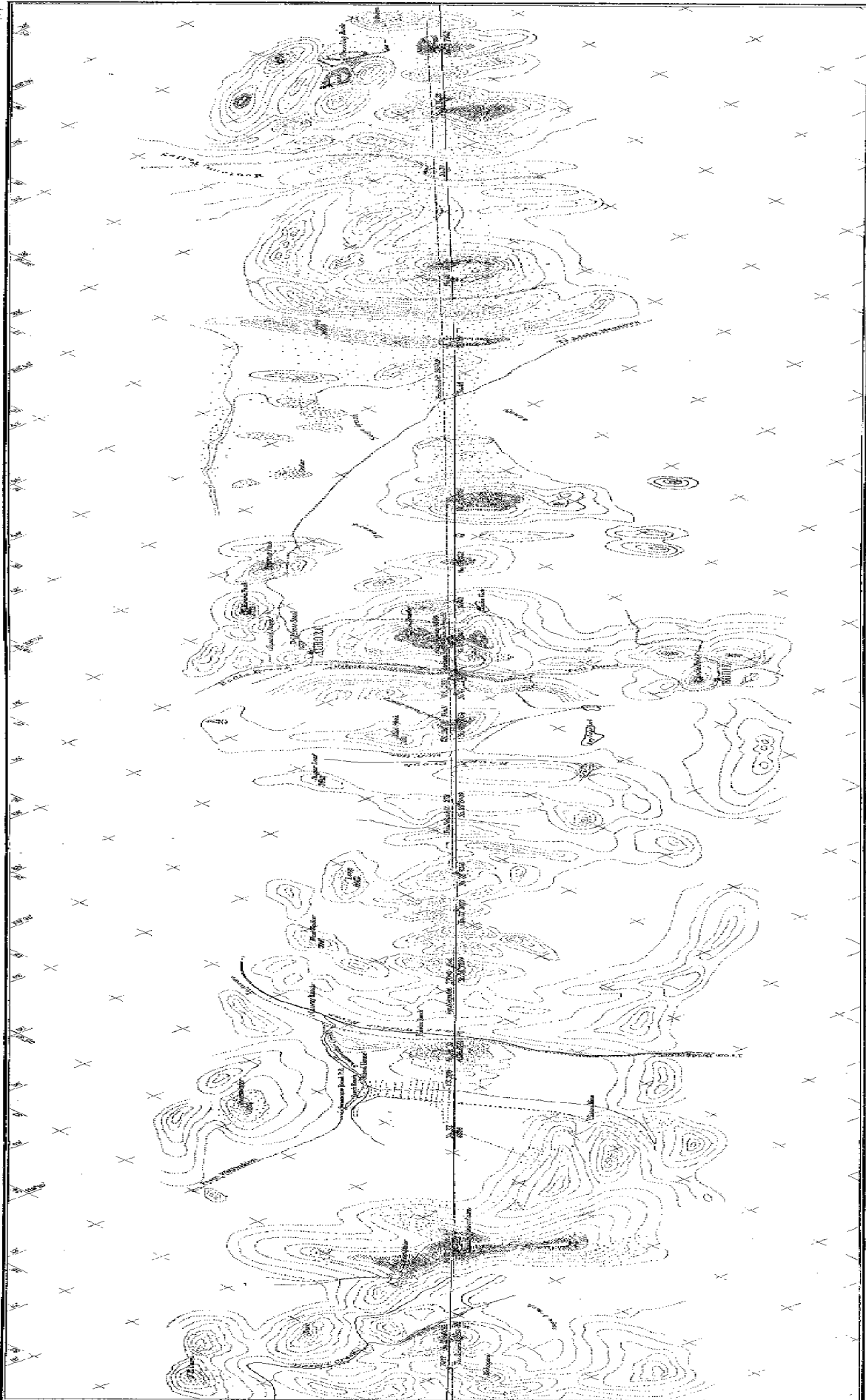
This post is similar to the one near the river, (East post), a drill hole in a stone, which was placed as a surface mark for this post. The post was set over this stone and a large stone and gravel mound, 7 feet in diameter and 5 feet high, built around it. On the east face was cut "Lat. 35°," on the north face was cut "1893," and on the west face was cut "C. G. S." This post is 440.068 meters west of east post. It stands a short distance south of a high sand plateau on a lower plateau, which is nearly one-half mile wide at this point.

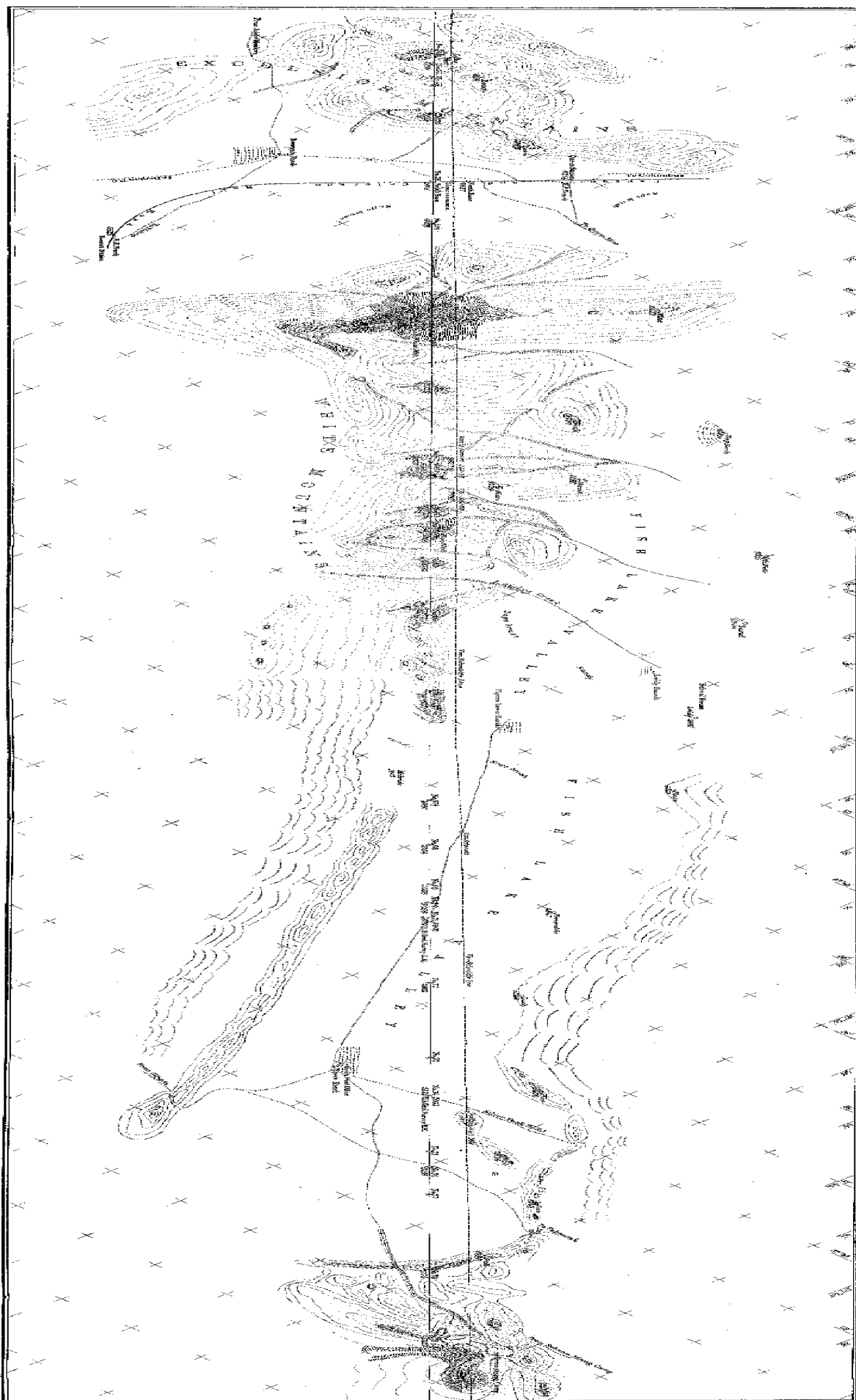
Station Von Schmidt's 35° latitude posts.

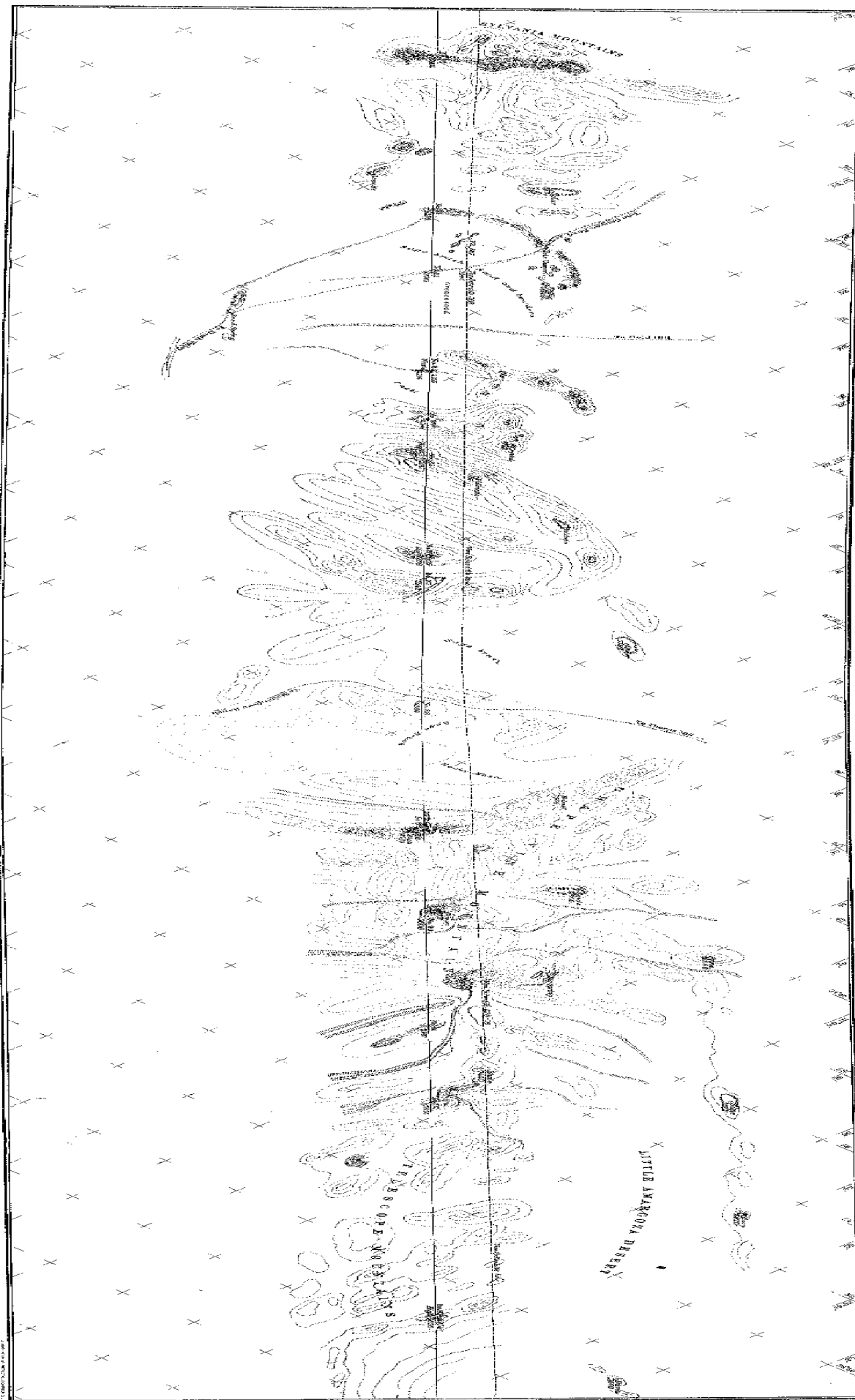
In 1873 two posts were placed by Mr. Alexey W. Von Schmidt, United States Astronomer, to mark the thirty-fifth degree of north latitude on the west side of the Colorado River, about 12 miles north of the town of Needles, Cal. The post nearest the river is on a sand and gravel bluff, about 50 feet above the water and about 40 feet from the shore line.

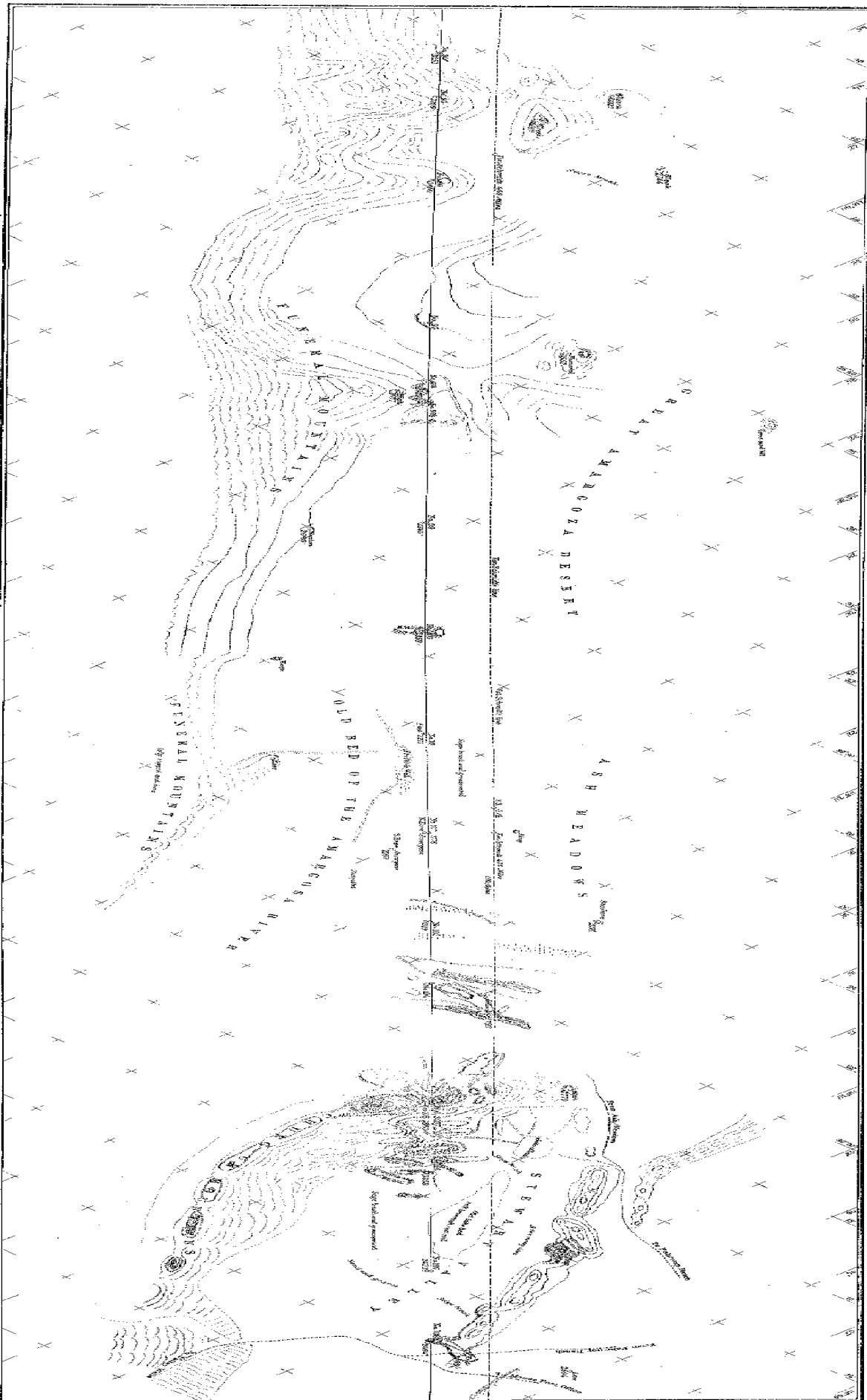
At this time (1893) the water is a lake, the remains of an old river channel. The other post is 463 meters west. The post nearest the river was used as a point in triangulation and also as the azimuth station. A large mound of stone and sand surrounded this post, which was well preserved, with the original carvings in good condition. This post was temporarily moved, a stone with a drill hole was placed 2 feet beneath the surface, and a larger stone with a drill hole was set as a surface mark. After the observations were completed for azimuth and horizontal angles, the post was carefully centered over its old position and a large cairn was built around it. This point is also the north end of a meridian line, the south end of which is 468.69 meters distant, and marked by a concrete block 12 by 18 by 10 inches, with a small hole in it.



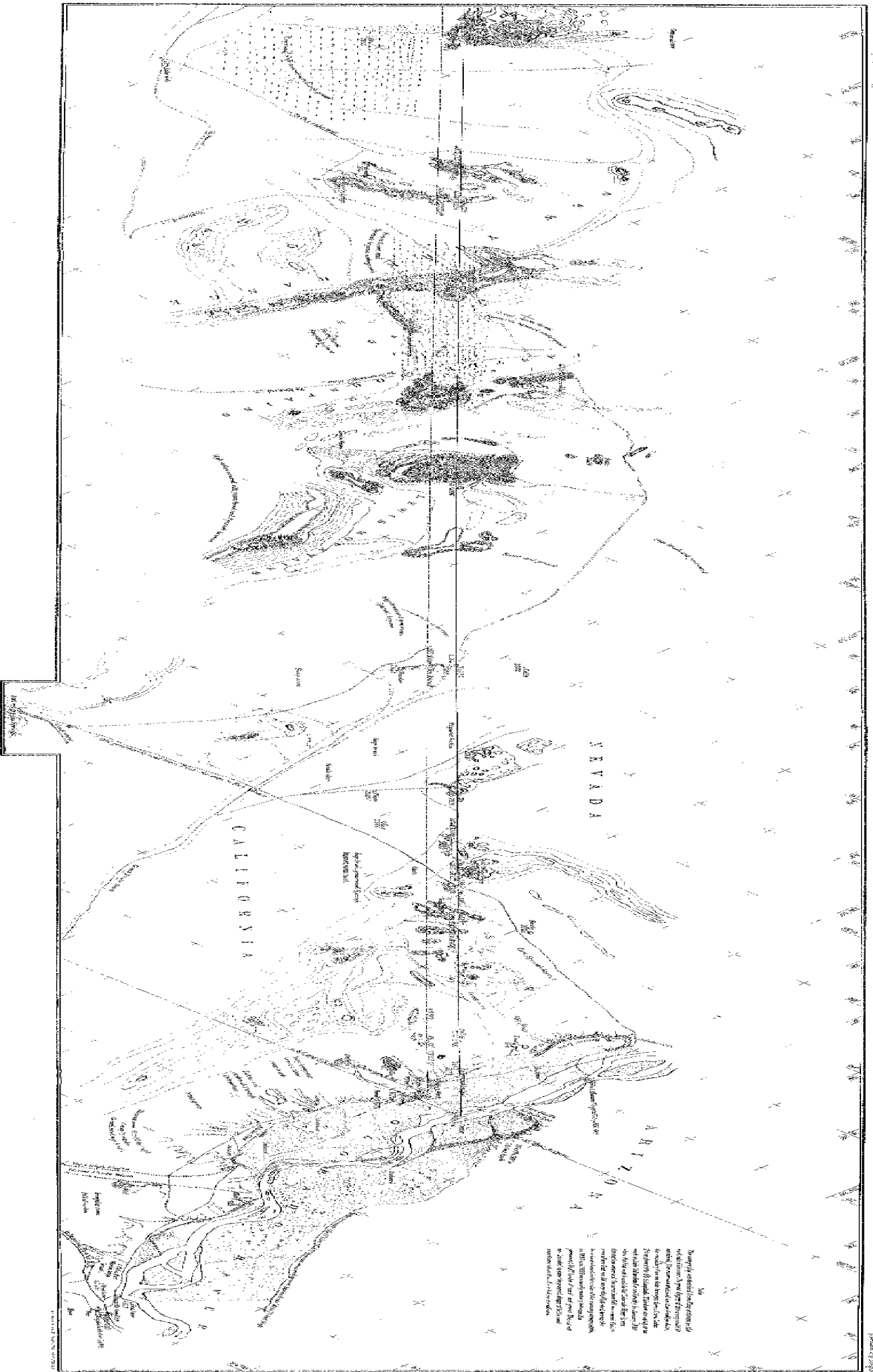


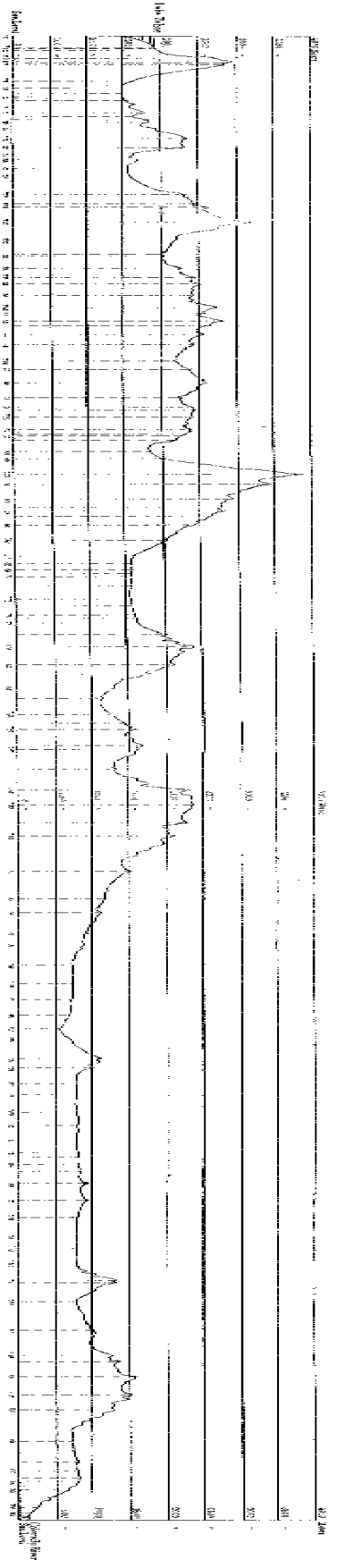






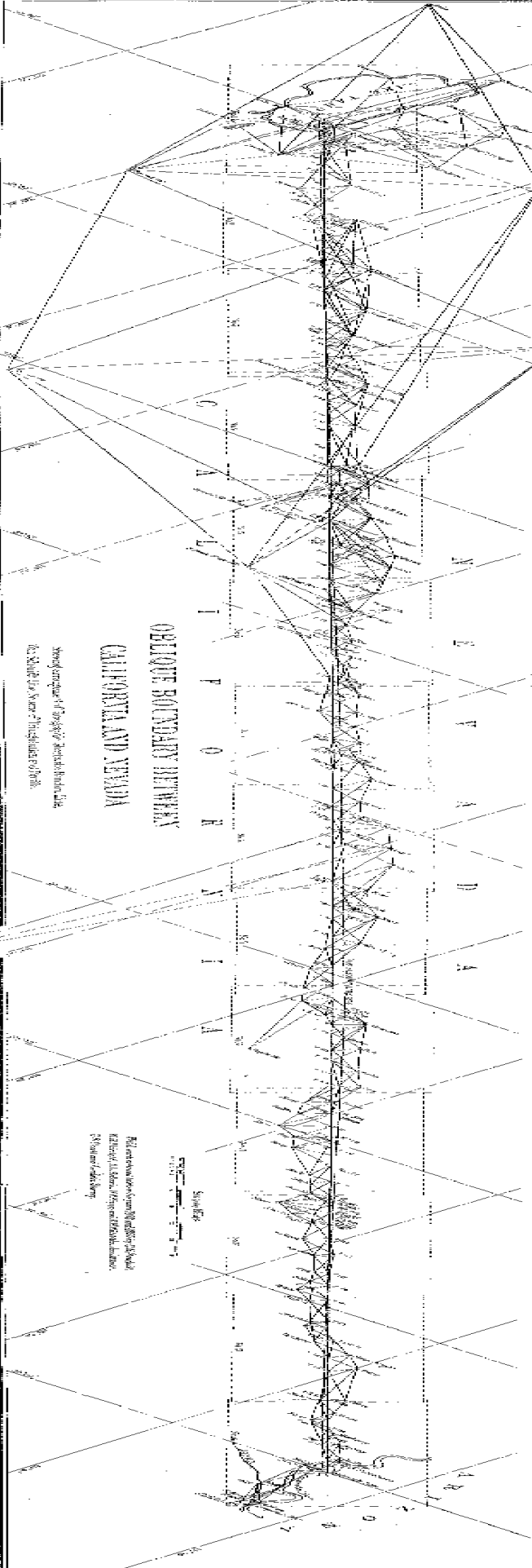






PROFILE OF THE RAZON LINE

(See also plates 2 and 3 in this volume)



OBLIQUE BOUNDARY BETWEEN CALIFORNIA AND NEVADA

Geological Survey of California

Geological Survey of California
 Division of Geology and Mineral Resources
 1415 Broadway, San Francisco, California 94103
 1967