

## EXPLANATORY NOTE.

The reports of the Secretary of War and the revising officer, which appear in volume one, were founded, so far as they relate to the route near the 35th parallel, upon the preliminary report of Lieutenant Whipple. The following chapters, being those which are principally referred to in those revisory reports, are, therefore, republished. They are chapters two, three, four, five, and eleven, with a portion of appendix B. The preliminary profiles are also reprinted.

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*Extracts from the [preliminary] report of Explorations for a Railway route, near the thirty-fifth parallel of north latitude, from the Mississippi river to the Pacific ocean, by Lieutenant A. W. Whipple, Corps of Topographical Engineers.*

## CHAPTER II.

### CONSIDERATIONS REGARDING THE TERMINI OF THE RAILROAD.—EXPLANATION OF THE MAPS.

Three of the principal centres of trade upon the Mississippi river are St. Louis, Memphis, and Vicksburg. To these cities converge railroads, constructed or proposed, from harbors upon the northern lakes, from the principal ports upon the Atlantic shore, and from those upon the Gulf of Mexico, uniting the interests of the northern, middle, and southern States. From the above mentioned places railroads have been projected, and several are in process of construction, westward to the extreme limits of the States of Louisiana, Arkansas, and Missouri, each with a purpose of forming a link in the great chain of communication which must ultimately lead to the Pacific ocean.

The question immediately arises, which of the various routes shall be at first prolonged; or, can there be found a location for a main trunk that may be advantageously united with several of these branches, affording nearly equal facilities to interests so widely diffused? Nature seems to point out such an intermediate location near the parallel of thirty-five degrees north latitude, referred to in the preceding instructions.

Following the south bank of the Canadian river for nearly one-third of the whole distance to the Pacific, we pass into the valley of Rio Grande del Norte, near the centre of New Mexico, where the soil is the most fertile, the population is the most numerous, and the mines are the most productive of any part of this interior portion of our possessions.

From Vicksburg to Shreveport the course of the railroad—already under construction—is nearly west. Should it be continued, as has been contemplated, to Preston, on Red river, the tendency will be considerably north of west. If prolonged, it would naturally ascend the fertile valley of the False Washita to a junction with the main branch from Fort Smith, which, in

Notwithstanding the richness of her mines of gold, of silver, of copper, and of iron, the deposits of coal that have been discovered in New Mexico have probably a more direct and practical bearing upon the project of a railway. The mountains east and west from Rio Grande—the Sandia and Manzana ranges, as well as the Sierra Madre—furnish a large supply of superb firs for timber. Near the base of the mountains, on gravel ridges and in dry ravines, are found cedar and mezquite, furnishing for the people sufficient fuel.

But the excellent coal, which is said to crop out in the Carnuel Pass and in the famous basin of Cibolleta, would, with railroad transportation, afford a large supply of this necessary commodity.

Hence, with the increase of population, the development of the precious metals, the manufacture of wine, and the produce of wool and other articles, will afford rich freights, east and west, in exchange for fabrics of every kind, and luxuries required from the older States.

Such seem a few of the considerations that will have an influence upon the prosperity of the Pacific railway.

## CHAPTER IV.

GENERAL DESCRIPTION OF ROUTE TRAVERSED FROM RIO DEL NORTE TO PORT OF SAN PEDRO.—REMARKS UPON THE VALLEY OF RIO COLORADO.

West of Rio del Norte, a ridge easily crossed brings us to Rio Puerco. A branch called Rio de San Jose, passing beds of coal, leads, by a gradual ascent, near to the summit of Sierra Madre. Two passes here were examined—both practicable, one leading by the Camino del Obispo, the other by Ojo del Oso. The latter, by report of my principal assistant surveyor, A. H. Campbell, esq., who examined it, scarcely needs excavation to prepare the way for iron tracks. The Obispo Pass would probably require a maximum grade from eighty to ninety feet per mile, and a tunnel of perhaps three-quarters of a mile, through soft limestone rock, at the summit. But nature has modelled the slope upon each side of the pass; and beyond, the route glides quietly into the extensive, well watered, and beautiful valley leading to Zufi. The route across the Sierra Madre passes extensive forests of excellent pine timber.

It is a singular fact that, throughout New Mexico, Pueblo Indians are universally conceded to be the most sober, honest, and industrious portion of the inhabitants of this Territory. My own observations would tend to confirm the fact. The Indians of Zufi cultivate a portion of an extensive valley, in the midst of which their pueblo is built. Without irrigation, depending only upon occasional rains, they produce abundant crops of grain and vegetables. Even though they had furnished forage for Fort Defiance, their supply of maize seemed inexhaustible. These Indians are more shrewd and more enterprising than the lower class of Mexican population. They comprehend the advantage of trade which the opening of a railway through their country would afford, and are eager for its accomplishment. The Caciques met in council and delegated three of their best men to show us the excellent route due west to Rio Colorado Chiquito, below the junction of Rio Puerco of the West. The service was accomplished to our complete satisfaction. The route was excellent, nearly devoid of hills, with frequent springs and streams of water, and grama grass abundant.

Here is where the route through Campbell's Pass, at Ojo del Oso, unites with the main line. It possesses the advantage of a low summit and easy grades along the channels of the two streams it follows. But the waters of Rio Puerco of the West, being generally lost below the surface, fail to produce the fertility that distinguishes the Zufi region.

The Colorado Chiquito is a stream smaller than the Gila, but similar in many respects. The banks are fringed with cotton wood; the valley is wide, the soil rich, and the gravelly ridges are covered with fragments of pottery, among ruins of ancient Indian pueblos. Drift wood here is very abundant, indicating occasional freshets, and plenty of timber near the sources of

the river. This stream we followed nearly west about sixty miles. Here the river turned northwest. Desiring to continue as we were, upon the parallel of  $35^{\circ}$ , a small reconnoitring party advanced to explore the low pass, where a spur of the Mogoyon mountains is broken by the volcanic peaks of San Francisco.

We had sent to Moqui, hoping to obtain Indian guides through this country also, but the messengers returned unsuccessful. They brought tidings that, by hundreds, the Moquis were dying by small-pox. Only three men could be found in health, and they were insufficient to throw the dead over the walls.

Without a guide, therefore, we moved onward about eighteen miles to a cañoned stream, with sides so precipitous and deep as to obstruct our march. Following north for a passage, fifteen miles brought us to its junction with the Colorado Chiquito. Again we explored westward, and with complete success. By an almost uniform grade, we ascended the wave-like swell of the Mogoyon spur, and, at the southern base of the San Francisco mountains, reached the headwaters of the San Francisco river. Here were vast forests of excellent timber, cedar, oak, and pine, covering the plains, and stretching southerly, over a region watered by San Francisco streams, to the furthest limits of vision. North of us rose the volcanic mountains, white with snow, and covered with new varieties of magnificent firs.

It was now between Christmas and New Year, and we were upon one of the most elevated parts of our whole route, seven thousand and two hundred feet above the level of the sea. The winter we knew to be unusually severe, as Mr. Leroux, for three previous winters, had seen these mountain peaks devoid of snow. Now, even at the base where we encamped, snow eight inches deep was lying upon the surface. But we were in a region where curled grama was everywhere abundant, and our mules fared well upon what they could glean from the rocky hill-sides. A thermometer immersed in Leroux's spring read  $48^{\circ}.4$  Fahrenheit. This is undoubtedly the mean temperature of the place.

Continuing our explorations west-southwest without difficulty, we found a route leading to a stream marked by Captain Sitgreaves, upon his manuscript map, "Bill Williams' fork," and represented as flowing into Rio Colorado forty-five miles below the Mojave villages. Following its course, we soon overlooked a vast region of charming country, which we called the "Black Forest." Notwithstanding the depth of winter, and the snowy mountains not far behind us, here nature had put forth spring flowers and green herbage.

To our regret, the drainage of this region was to the southeast, and Bill Williams' fork took the direction towards Rio San Francisco and the Gila. Disappointed, but not discouraged, we turned west, crossed streams, and, having made a circuit of one hundred miles, sent back messengers to bring up the train by a favorable route we had discovered. Our reconnaissance still continued in advance of the main body of the surveying party, communicating by signal smokes or messengers the proper course for it to pursue.

Partridge creek we now followed until it entered an extensive basin, so abundant in curled grama that we called it "Chino valley." This appeared like a branch of that to which we had previously traced Bill Williams' fork, and our hopes were again chilled by finding Partridge creek also turning east of south.

Thus far we had found no want of water, grass, and wood; no difficulty in the progress of our train of wagons, and scarcely an obstacle to the construction of a railway. But a continuous range of mountains seemed to deny our westward progress.

We ascended Chino valley northwest two days' march, finding no puerto for a passage through the mountain range, and no water among the ravines for our animals. The whole country to the northwest and north looked extremely unpromising; plains, barren and waterless, flanked upon the west by the still unbroken chain of mountains. In fact, it was the region over which Captain Sitgreaves passed two years before, finding no water for eighty miles, and

crossing, beyond, two ranges of mountains whose steep declivities were practicable only for pack mules.

We were now nearly five thousand feet above the level of the Rio Colorado, distant, in direct line, about one hundred and twenty-five miles. That would give a uniform grade, the whole distance, forty feet to the mile. It was, therefore, necessary to avoid ascents, and seek a route where a declivity might commence at the earliest moment.

Retracing our steps, we explored the same range south. Fifteen miles from Partridge creek we found flowing, through a dark grove of overhanging ash and hickory, a limpid stream, where ducks, turkeys, and deer were abundant. Five miles beyond Turkey creek we came upon Pueblo creek, so called on account of extensive ruins of houses and fortifications that lined its banks.

Thinking that this stream might change its southeast course and flow westward, we proceeded near to the base of Mount Hope. There ascending an elevated peak, the drainage of the country still appeared east of south, over the same great tract of fertile country we had previously seen from Bill Williams' fork.

Thirty miles south, at the base of Black mountain, seemed a low summit. But there were surer indications of a break in the mountain chain where cut by a branch of Pueblo creek. So, returning thither, we ascended its finely-timbered banks nearly due west. In six miles we gained the summit of a pass where two streams found their sources within five hundred feet of each other; one flowing eastwardly into Pueblo creek, the other westwardly along the course we sought. This cut through the sierra seemed formed by nature for a passage. Wide Indian trails and ruins of extensive fortifications, constructed centuries since upon the heights to defend it, showed that not only present tribes, but ancient races had deemed this "Aztec Pass" of great importance. Upon the northern side the mountain slope was regular, and followed in a spur parallel to Pueblo creek, enabling the engineer to commence his ascent so as to pass the summit with a favorable grade. A deep cut, or perhaps a tunnel of two or three hundred yards, might be required through the narrow hill which forms the divide. Leaving "Aztec Pass" behind us, we gently descended fifteen or twenty miles along the rivulet, which flowed sometimes above and sometimes below the surface. Our stream now turning northwest towards Yampai creek, in that direction appeared a valley uninterrupted even to the horizon. The reconnoitring party again turned westward over a rolling prairie, and, somewhat to our surprise, in ten or twelve miles we found our course cut by the creek we had left. It now flowed west of south, with cañoned banks fifty feet high. The general surface of the country was gently rolling. Following our stream—which now we call Cañon creek—we found that the country became more rough, the cañon deeper cutting through, and a few miles below emerging from the eruptive barrier that once opposed the flow of its waters. Although no extraordinary difficulty may be apprehended in constructing a railway through the channel formed by the stream, it was no natural road for our wagons. Turning westward, we crossed the Aquarius range of mountains, and found a favorable passage, which our train followed through "Cactus Pass" to "White Cliff" creek. This was a fine mountain stream that fretted upon its rocky shores, shaded by cotton wood and willows. It emptied into Big Sandy, the latter flowing south, and seldom showing water above the surface. Twelve miles below we again joined Cañon creek. The stream of transparent water, probably fifty feet wide and two feet deep, glides upon a pebbly bed, and nourishes upon its borders reeds and rushes of vivid green. Budding alamos line its banks, and mesquites cover the fertile valley. It is early in February, but the thermometer at midday stands 80° Fahrenheit, giving the climate of advanced spring. Following the creek for about thirty miles, to our regret it flowed nearly south, crossing three successive ranges of eruptive mountains, whose barriers were occasionally broken into cañons. There, having received an affluent from the east, it turned westward to the junction with the Rio Colorado.

This stream, indicated upon old Spanish and English charts, is designated Rio Santa Maria. Captain Sitgreaves, supposing when he saw its mouth that it was the same he had already named at its source in the mountains, calls it "Bill Williams' fork." It is an important stream, draining an extensive tract of country heretofore unknown. Alternate sections of its valley furnished scenery of strange contrasts. For five or six miles we follow marl bottoms, luxuriant with vegetation, with a stream rapid, clear, and two feet deep, shaded by dense groves of alamo, mezquite, and willow; then, gradually yielding to a sandy soil, the water passes beneath the surface, and for an equal distance we traverse a blank and dreary desert. There the quaint *cereus giganteus* and humbler cactaceæ, with occasional yuccas and curious shrubs, form a landscape extremely singular, but of which one soon wearies. Fortunately, these barren wastes seldom extend uninterruptedly above a few hours' march with the train.

Although our route equalled all we had reason to anticipate, it yet seems probable that the main eastern branch would lead through a more favorable country, by the Black Mountain to "Val de Chino." Thence a reconnaissance eastwardly might discover a passage through the Black Forest across the headwaters of Rio San Francisco, and unite with our trail upon Cañon Diablo, near the Colorado Chiquito.

What we saw of this country was full of interest to each department of science. There were extensive forests, abounding with game; wide grass valleys, affording pasturage to innumerable herds of deer; crystal brooks alive with trout, their fertile banks once cultivated and now lined with ash and walnut timber. From the heights were frequently seen, looking down upon us, the fleet cimaron, or mountain goat. That this solitude had not always been unbroken by man, was shown by the numerous ruins of stone houses that lined the borders of the streams, and the still high walls of extensive fortifications that covered the heights surrounding.

We traversed this region in winter, but the climate was that of spring, and vegetation was already rapidly advancing. Unpropitious as was the season, the botanist found much to delight him. New species of trees and tropical shrubs were collected; rare and beautiful plants were obtained; strange forms and unknown species of cactaceæ were gathered.

It was a beautiful view that burst upon us, as we ascended a hill and first beheld the Colorado sweeping from the northwest to unite with Bill Williams' fork, almost beneath our feet. One long and loud huzza burst spontaneously from the men, sending a thrill through every nerve. Their dreamy forebodings were cast upon its waters, and all felt relieved from a burden of anxieties.

The river appeared three or four hundred yards wide, with a dark and reddish hue, flowing with a swift current between bluff banks worn through the midst of wide alluvial bottoms. The valley was sprinkled with large alamos, and bounded by hills leading back to sharp ridges of mountains, by which below the junction it was contracted to a cañon. Upon the opposite side seemed a succession of mountains, which, receding from the river towards the northwest, terminated about ten miles above. There a wide plane seemed to extend indefinitely westward, and possibly might lead in about one hundred miles to San Gorgonio Pass, the fine puerto discovered by Lieutenant Williamson, to the valley of Los Angeles.

Ascending the left bank of the river about twenty miles over soil evidently rich, and in some places showing evidence of having been cultivated, we reached a point where spurs from the mountain impinged upon the river, forming an unexpected obstacle to the progress of our wagons. Labor for a few days, perhaps for a few hours, might probably have cut around their points a practicable way. But our time was precious; it was doubtful whether, with the utmost diligence, we could reach the settlements before our supply of subsistence should be exhausted. Therefore, abandoning our wagons, except a light vehicle to which was attached the viameter, and in which the lighter instruments were carried, we packed upon mules our collections, provisions, and necessaries, and cached such things as we could spare. Then crossing the spurs, we entered the fine valley of the Chemehuevis Indians. They are a band of the great Pai-ute

("Pah-Utah") nation, but live separate and distinct from the mountain robbers, whom we shall have occasion again to mention. This band contains probably two hundred warriors—short, but robust and well formed, with regular features, and a pleasing air of activity and intelligence. They received us kindly, and flooded our camp with a portion of the surplus produce of their fields for trade. The principal articles of traffic were beans, squashes, maize, and wheat—the latter usually ground to flour. Although the season was the latter part of February, when their winter's store had been consumed and the quantity for seed reserved, still the supply seemed limited only by the demand. Their villages were mostly upon the west bank of the river, and covered considerable space; yet of the fertile soil thus occupied not one acre in a hundred seemed cultivated.

We were now met by Mojaves, who, acting as guides around the next spur that formed a cañon, conducted the surveying party through a pass, invisible from the river, where not a hill intervened.

We now entered that great basin of the Colorado, several miles in width, and probably forty miles in length, which for ages—since the first visit of the Spaniards—has been the home of the Mojave tribe.

Successively, as we approached their several villages, five principal chiefs, each with his own particular band of warriors, met us in state, with all the forms and ceremonies with which they are wont to dignify great events. When informed of the object of our visit they were greatly pleased. They met in council, and determined to do all in their power to advance the interests of the Pacific railway survey.

They loaded us with provisions of flour and beans in return for cast-off clothing, and sent two guides, Ir-i-te-ba and Cai-rook, to conduct us to the intersection of the Salt Lake road with Mojave river.

The valley of the Rio Colorado forms a distinguishing feature in the topography of the western portion of the continent. It is the recipient of all the waters that drain the basin between the Sierra Madre and Sierra Nevada, or coast range, and extends, from its sources in the Rocky Mountains, to the Gulf of California. This region abounds in barren hills, naked plains, and wild cañons; yet it has frequent fertile spots, where water and timber are plenty, and where valleys of considerable extent have narrow belts of fertile soil. As instances, we may mention Rio Gila, Colorado Chiquito, Bill Williams' fork, and Rio Mojave. All contain, to a greater or less extent, soil favorable to agriculture. The southern bank of the Rio Gila, lately acquired by treaty from Mexico, contains large tracts of land capable of being irrigated and of producing excellent crops. Pimo Indians from time immemorial—certainly since they were first visited by Coronado, in 1540—have cultivated cotton of excellent quality. Specimens, which I showed to gentlemen in Texas, were pronounced nearly equal to the best Sea Island cotton of South Carolina. Tobacco, maize, wheat, beans, and melons, are also cultivated by Pimos and Maricopas upon the Gila. The soil upon all the rivers above mentioned would, doubtless, produce similar crops.

But the valley of Rio Colorado itself affords a large extent of fertile bottom-land, which may be perfectly irrigated and easily cultivated. The soil is pronounced to be far superior to that of the Del Norte, and being elevated at the Mojave only three hundred and fifty feet above the sea, the climate is milder and more tropical. As the Mojaves, Chemehuevia, Cuchans, and Cocopas, all cultivate without irrigation, it is probable that more rain falls here than in New Mexico. Judging from our own experience, and the robust health and fine personal appearance of all the Colorado Indians, no climate could be more salubrious. There are probably from one hundred and fifty to two hundred square miles of arable land in one tract occupied by Mojaves. The Chemehuevis, a band of Pai-utes, possess a tract of about thirty square miles. Below, near the junction of Bill Williams' fork, is a basin containing about thirty square miles. Thence, to within a short distance of the mouth of Rio Gila, I have no personal knowledge. The map of Captain Sitgreaves indicates an extensive valley there, not less

Eighty miles long, and averaging, at least, five miles in width, making four hundred square miles. It is occupied by three bands of Indians—"Yampais," "Cu-chans," and "Mojaves." From ten to fifteen miles above the junction of Rio Gila to the mouth of Rio Colorado is a wide strip of bottom-land, averaging, for ninety or a hundred miles, from ten to fifteen miles in width, giving at least one thousand square miles. Looking from the desert south, an extensive tract of country, from fifty to sixty miles in width, appears the bed of an ancient lake, now possessing a fertile soil, and capable of irrigation from the Colorado. Without this last, we have already estimated sixteen hundred and sixty square miles of arable land upon the Colorado. Beside maize, wheat, beans and melons, which, without irrigation, Indians now cultivate so abundantly, the soil and climate are remarkably adapted to the cultivation of cotton, sugar-cane, and rice. There can be no doubt that the valley of the Colorado is destined, at some future day, to be divided into plantations, supporting a numerous population.

The river itself is worthy of some consideration. From the Mojave villages to near its confluence with the gulf, the average width of the stream is from three hundred to five hundred yards. When at the junction of the Gila with the Colorado, in October and November, 1849, no change was apparent in the height of the stream; this is the driest season of the year, and no ford was known upon the river. From the mouth of Bill Williams' fork to Mojave villages, no place occurred where the depth of the channel was less than five or six feet. The current is rapid, but apparently not more so than that of the Ohio. The height, at the confluence of Bill Williams' fork, is two hundred and seventy feet above the level of the sea; distant, by course of the river, three hundred miles. This estimate would give an average inclination to the stream of nine-tenths of a foot per mile, slightly exceeding that of the navigable waters of the Arkansas. Steamboats navigate already as high as the mouth of Rio Gila, eighty miles from the Gulf, furnishing supplies to Fort Yuma. Captain Sitgreaves states that, at his camp No. 51, a large rock occupies the middle of the channel. This is supposed to be the principal bar to the navigation of this river to the Mojave villages. The rock could be removed by blasting; and then, should the railroad follow the route that has been indicated, this navigable river would bear to and from the Mojave depot commerce of no inconsiderable value.

About forty miles above the junction of Bill Williams' fork we left the Colorado at the mouth of a dry arroyo, heretofore supposed to be the bed of Rio Mojave. Gradually ascending the barren slope of the hill-side ten miles from the Colorado, we found several small springs of good water. Twenty miles beyond, we encamped upon a pretty rivulet, which watered a small valley that had been converted by the mountain Pai-utes into a luxuriant garden. Passing the crest of a hill, and leaving to our right the wide valley supposed to belong to Mojave river, by a gradual ascent over wide prairies of rich grama grass, we reached a rocky glen, where were springs abounding in excellent water. No timber was here, although low cedars afforded plenty of fuel.

From Rock spring, five miles led us to the summit, fifty miles beyond and 5,292 feet above Rio Colorado; the grades, however, by detours upon the ascending slopes, need not exceed seventy feet per mile.

We then passed into a dry ravine leading to Soda lake, which seems to absorb the waters of Rio Mojave. Turning from the valley of the ravine referred to, we ascended the hill-side, where, nineteen miles from Rock spring, were oozing, from an outcrop of marl, small rills of water. Should deep holes be dug, or tanks be constructed at this place, an abundant supply of water might doubtless be obtained.

The vegetation of this region consists of beautiful palm-like yuccas, cactaceæ, larrea, and patches of grass. From "Marl Springs" we ascended the mountain, to cut off a detour made by the surveying party, through a fine looking valley to our left. Crossing granitic hills, we soon saw upon our right a row of volcanic buttes and metamorphic mountains, beyond which appeared a deep and wide valley, probably that of the veritable Mojave.

In the far horizon north is seen a snow-white peak, said to be on Rio Virgin, or Santa Clara. Northwest, stands in high relief the lofty range of the Sierra Nevada, between which and Rio Colorado have been counted nine distinct ranges of mountains.

Passing on, we soon came to a ridge and commenced our descent; at first steep, then more gentle, along an arroyo, to a puerto at the foot of a large metamorphic mountain, where we had a view westward to the great valley before seen. In the midst seemed a lake, supposed to be mirage; to the left, however, curled a tall column of smoke, where, undoubtedly, were the camp-fires of the advance party, and water.

Having travelled about fourteen miles, we made a noon halt. The country traversed looked dreary—a mass of rock and gravel without useful vegetation.

At 5 p. m. we proceeded two miles down the arroyo and entered a field of drifted sand. By moonlight the effect was beautiful; it seemed a fairy scene, with the bright and placid firmament above, and the earth beneath covered with snow-white sand. The air was fresh, not cold, and all seemed to enjoy the march. Mexicans and Americans were singing, each his favorite song, as easily we trod the hard surface of drift. Even mules and the carretela had made but light impressions upon the compact surface. Two or three miles of this interesting but dreary prospect, which, sweeping from the southwest, seemed to extend indefinitely towards the north, brought us to a puerto in a low rocky ridge of hills, upon the northwest side of which, sand, piled nearly to the top, left bare the summits only.

Soon we struck the smooth bottom of a lake of efflorescent salts, probably sulphate of soda. Traversing this with a good road for about six miles, at 10 o'clock in the night we reached the camp of Lieutenant Ives, where water and grass were abundant; the latter was salt and the former brackish. Mules drank freely, but the water was unpalatable to men. By viameter, our distance from Marl springs is thirty-one miles, the greatest jornada upon our route. For nearly half the distance the soil is hard gravel; ten miles are sandy, the remainder being upon the hard clay forming the bed of the lake.

By results of the survey, Soda lake is found to be seven hundred and sixty-six feet above our crossing of the Colorado, the distance by trail being ninety-seven miles, and the average descent eight feet per mile.

Whether a channel exists by which the Mojave river finds its way to the Colorado is a problem not yet solved. We regretted exceedingly that time for a closer examination was not at our disposal. Our trusty Indian guide, however, assured us that the dry channel of that stream passed uninterruptedly north of our route to the Colorado, and that wagons could pass through it without encountering a hill.

Such a route as he describes, with water found by digging, is undoubtedly the most favorable for a railway that exists across the desert west from the Colorado river.

The true channel of the Mojave river, where it enters Soda lake, is but a bed of sand, which we ascend thirteen miles before finding running water. There it is a rapid rivulet, its clear waters making melody with the pebbly shore. A few miles higher up on the stream barrenness gave place to fertility; tularas, grass, alamos, and willows, covered rich meadows.

The river here is fifty yards in width and knee-deep. Mezquite trees, tornillas loaded with fruit, form occasional thickets.

For seventy-five or eighty miles above our course followed the gentle meanderings of Rio Mojave. The soil of the valley is rich, and there is plenty of water for irrigation, although occasionally it disappears for a short distance beneath the surface. There are cotton wood and mesquite for fuel. Timber is scarce and small, except near the sources of the stream in the San Bernardino mountains, where magnificent oaks, pines and spruce occur.

At the point of leaving the river we found it one hundred and fifty yards wide, and two and a half feet deep; its alluvial bottoms still fertile and densely covered with alamos and willows. Mounting the left bank, we found large springs gushing from the verdant slope. The air thermometer reading 15°.9 Cent., the temperature of the spring water was 19°.1 Cent. = 66°.4 Fahrenheit; which, probably, is the mean temperature of the climate in this region.

Ascending the wide-swelling prairie which leads to all the passes near the junction of the

Sierra Nevada with the coast range, our course was directed south  $38^{\circ}$  west towards an apparent gap in the mountains east of the snow-capped peaks of Sierra San Bernardino. Grass is thinly scattered over the plain, and beautiful yucca trees abound thirty feet in height. Sweet-berried cedars began to appear, affording excellent fuel. The Mojave river, not far upon our left, divides into three branches, heading in the mountains; the most eastern said to take its rise near Cajon Pass.

Proceeding through groves of yuccas beautiful as cocoanut and palms of southern climates, and dense thickets of cedars, by a gradual ascent, averaging probably sixty feet to the mile, we reached the summit of Cajon Pass, where the mercury measured 25.4 inches. Standing upon the crest, one could look far towards the north and northeast over immense prairies of gentle inclination. This pass appears the most truly difficult part of our route. It seemed, however, possible, by winding from the Pacific side around the slope of the mountain, thus increasing the distance, to locate the route upon a spur bounding the valley of Cajon creek, to the foot of the crest of drift over which passes the road. Here may commence a tunnel of about four or five miles in length, and eight hundred feet below the surface at the summit; thence becoming gradually less, until it issues upon the prairie slope near the Mojave river. The material is easily excavated, and would be useful in forming embankments required to cross a ravine leading to the spur referred to above. The termini, at least, will require arching; within, the rock may be firm enough to support the superincumbent weight.

In Cajon creek are boulders of marble, crystalline, white and pure as possible. This would form building material of incomparable beauty; there are also, probably, in the mountains, veins of it affording good quarries. Auriferous quartz has also been found in this vicinity. The botanist was delighted with the western slope of the Sierra Nevada, affording a class of vegetation new to our route. Four different species of cactaceæ were found upon the first mile of our descent—a new piñon, a new and magnificent oak, two new species of firs or pines, a currant, sycamore, and cowania. The hills are covered with a verdant red-barked shrub; the mountains with oaks and pines of many varieties. Here we find abundant material for the construction of a railway. With a few exceptions, this range of mountains must be our main dependence for supplies of pine timber until we may meet the forests of San Francisco mountains.

We descended about twelve hundred and fifty feet in eleven miles from the first point of striking the arroyo at the foot of the ridge. As we proceeded, the valley opened finely; mountain torrents swelled the creek, that boiled and fretted with granitic rocks. The descent became less steep, and the sides of the valley were regular slopes, where a railway might ascend so as to rise far above the bed of the creek, and diminish the grade to one hundred feet per mile in the cañon above.

This development diminishes the obstacles of Cajon Pass. The work will not be so extremely difficult nor expensive as at first seemed probable. Our greatest regret is, that it leads not directly to a port as safe and commodious as that of San Francisco.

Having descended the Caion creek about five miles, we left the way to San Bernardino, and keeping the road west, under the base of the mountain, entered a region of great beauty. We travelled twenty miles along a descent inappreciable to the eye, and arrived at Cocomongo rancho, where we encamped upon the beautiful stream that waters it.

We continued our course west southwest, by a road nearly as level and smooth as if graded for a railway, twenty-four miles to "El Monte." The valley traversed is continuous from the Cajon, fifteen to twenty-five miles in width, with soil abundantly rich, fertile, and at present well watered. Some of the streams crossed—Cocomongo, San José, and Rancho de Chino—are fed by permanent springs. Many others owe their origin to melting snows of the mountains. All were charmed by the beautiful scenery and heavenly climate. Fine spreading oaks and sycamores were sprinkled in pleasing variety with flowering shrubs through the valley.

From El Monte, passing a few hills, we enter the valley of Los Angeles. The stream upon which it is situated is about fifty yards wide and two feet deep. There were numerous acequias irrigating vineyards, orange and olive groves, peach orchards, gardens, and corn fields. Even as early as March 21st, full-grown oranges were seen ripening in the open air.

The town had the sombre cast of a Spanish pueblo, relieved, as it were, by innovations of American comforts. There was the bustle and activity of a business place. Many new houses were in process of construction. Everywhere was indicated a thriving population and a land of intrinsic wealth. Los Angeles is said to number five thousand inhabitants.

Our course from Los Angeles was twenty-four miles nearly south, over the low plains and a slight ridge, to the port of San Pedro. The town is situated on a bluff thirty feet above the ocean. Spring tides here rise nine or ten feet—neap tides from four to five. Small vessels, by crossing the bar with ten or twelve feet at high water, enter a basin at the mouth of San Gabriel river, where they are perfectly secure. A city has there been laid out, but its success is problematical.

At the playa (port,) shipping is said to be completely sheltered, except from southeast winds, which seldom occur, and only in winter. During the last season but one such storm occurred, and a ship in port rode it out at anchor. A breakwater, it is said, of about a mile in length, would afford complete protection even to a fleet; and wharves could be extended to deep water, so as to afford every advantage of a first rate harbor.

For a great portion of the route from the Mississippi we followed natural channels, where streams flow nearly east and west. The river Arkansas and the Canadian lead us to the base of the Rocky Mountains. Thence crossing table-lands to Rio Pecos, we ascend to the head of the Galisteo, which is followed to Rio del Norte. Descending Rio del Norte to Albuquerque, we cross to the Puerco and join Rio San José, which leads to Ojo del Oso, near Campbell's Pass, the summit of Sierra Madre. We now reach Rio Puerco of the west, which furnishes a valley to Rio Colorado Chiquito. The latter carries us to Chevelon's fork, where we turn westward, crossing the final spur of Mogoyon mountain and the headwaters of Rio San Francisco, to a branch of Bill Williams' fork, which leads to the Colorado. Thence we would propose to ascend to the mouth of Mojave river and follow the bed of that stream to the base of Sierra Nevada. The route should traverse, thence, the northern slope of the San Bernardino spur, which is said to furnish numerous rivulets, bearing clear waters into the sandy plains below. Approaches from the east to the various passes in this range—"Walker's," "Cañada de las Uvas," and "Tejon"—are known to be favorable. To examine these passes minutely, in order to determine that which shall be available for a railway to San Francisco, was a duty intrusted to another, whose labors, it is hoped, will be crowned with success.

As the shortest line to the Pacific ocean, we proceeded to San Pedro through the Cajon Pass, which is, indeed, difficult; but, should no better be found, ought not to be esteemed a barrier to the construction of a Pacific railway.

More specific information regarding the feasibility of this route for a railway, I beg leave to present in the form of reports from my principal assistants upon the survey.

That of the railroad surveyor is designed to speak more definitely upon the most favorable curves and grades available upon this line, and the labor required to construct the railway.

The geologist and mining engineer notices the rocks, and their adaptation to the purposes of construction; also the positions of beds of coal and mines of precious metals.

The botanist describes the forest trees, the quality and amount of timber, the produce of the soil, and its adaptation to agricultural purposes.

The zoologist refers to the game noticed upon the route; their habits and means of subsistence.

The details of our operations, with the results of the scientific investigations to be deduced from them, are necessarily deferred to the subsequent part of this report.