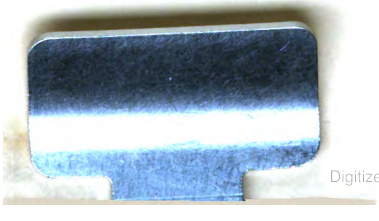
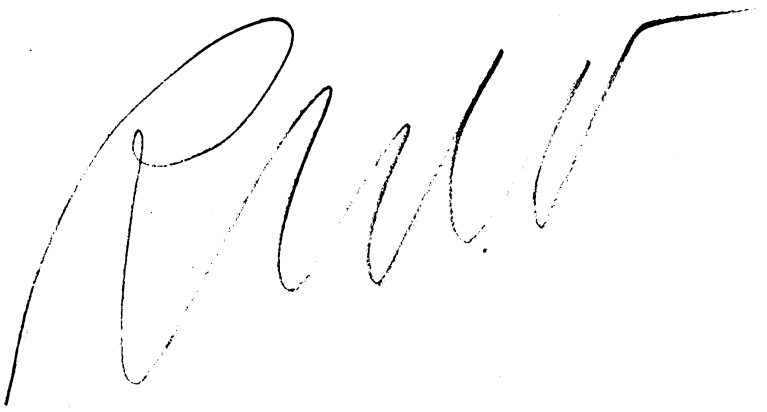
# *Annual Report of the State Mineralogist for the Year Ending ...*

California State Mining Bureau





# CALIFORNIA STATE MINING BUREAU.

HENRY G. HANKS, STATE MINERALOGIST.

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## SIXTH ANNUAL REPORT

OF THE

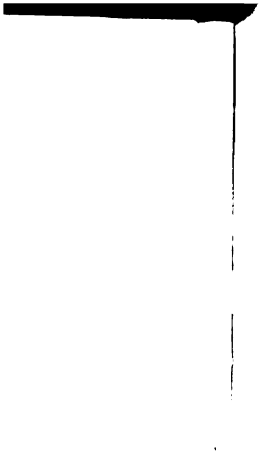
# STATE MINERALOGIST.

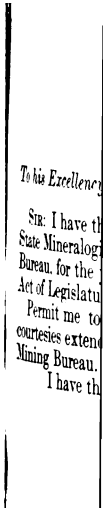
## PART I.

FOR THE YEAR ENDING JUNE 1, 1886.




SACRAMENTO:
STATE OFFICE.....J. J. AYERS, SUPT. STATE PRINTING.
1886.





Compliments of

Wm. Irelan Jr.

State Mineralogist

*To his Excellency* GEORGE STONEMAN, *Governor of California:*

SIR: I have the honor herewith to submit the sixth annual report of the State Mineralogist, and report of progress of the California State Mining Bureau, for the year ending June 1, 1886, prepared in accordance with the Act of Legislature, approved April 16, 1880.

Permit me to express my thanks to you and to other State officials for courtesies extended to me, and for the interest you have taken in the State Mining Bureau.

I have the honor, sir, to remain very respectfully,

HENRY G. HANKS,
State Mineralogist.

# REPORT.

## HISTORY OF THE STATE MINING BUREAU.

A very full history of the California State Mining Bureau, from its commencement in 1880 to the fifteenth of May, 1885, may be found in the five annual reports which precede this. The history includes a relation of the many difficulties met with in the establishment of the institution, which it will not be necessary to repeat here.

The Board of Trustees appointed by Governor Stoneman, in accordance with an Act of the Legislature (Assembly Bill No. 78, which passed the Assembly February 11, 1885, and the Senate March 5, 1885), organized April 18, 1885.

The following gentlemen constitute the Board: William Irelan, Jr., S. Heydenfeldt, Jr., J. Z. Davis, Walter E. Dean, and George Hearst. William Irelan, Jr., was elected Chairman, and S. Heydenfeldt, Jr., Secretary.

The Act providing for a Board of Trustees is published in full in the fifth annual report of this office.

Immediately on the return of the State Mineralogist from the New Orleans Exposition, preparation was made for removal to the fine fireproof building recently erected by the Society of California Pioneers. The building is situated on Fourth Street, near Market, on the property donated to that society by James Lick.

The removal, which was made during an unusually rainy season, was nevertheless finished without serious loss from breakage, and the entire time, up to the date of this report, has been employed in placing the museum in order.

The collection of seven thousand catalogued specimens, and many not yet entered, is arranged in cases, and classified into seven principal groups, as follows: MINERALS, ORES, ROCKS, FOSSILS, SHELLS, ETHNOLOGY, and SUNDRIES. The whole should now be rearranged into geographical divisions. This, by my calculation, would require the entire time of an industrious man for one year, as I have planned to do it. From this may be inferred the estimate I place on the magnitude and importance of the State Museum at the present time.

While the exhibition of the State minerals at New Orleans was worth far more than the cost necessitated by twice packing and thrice removing the specimens, it set back the work of the Mining Bureau for six months. The removal to the new building, and arrangement of the museum, occupied three months more. The specimens are now all in place, and I am pleased to state that no serious loss, or material injury from breakage, or otherwise, has been sustained.

## PRESENT CONDITION OF THE STATE MINING BUREAU.

The condition of the institution is most satisfactory. The State is now in possession of a very extensive museum, which has cost but a trifle compared with its actual value.

It would have been impossible to make so large and varied a collection, even if many times the money expended had been at the disposal of the State Mineralogist, were it not that prospectors were willing to send to the State Mining Bureau many fine and interesting specimens in return for information extended to them. The State is greatly indebted to Wells, Fargo & Co., and the several steamship companies, for free transportation.

The museum is one of which the people should be proud.

Mr. Joseph Wasson, to whom the State of California owes a just debt of gratitude, gave the future of the State Mining Bureau much thought, and nobly made the foundation broad and ample. But the institution has grown more rapidly than even he expected, and while it is at the present time in a healthy and prosperous condition, its future should be made the subject of careful legislation.

The institution has been carried through many difficulties, and has been placed in a safe and suitable building, and the financial management transferred to a Board of Trustees, who will care for it in the future. There is money enough to keep it alive until the meeting of the next Legislature. The museum is still growing, and will continue to do so. It is to be hoped that the next Legislature will make sufficient provision for its support.

From the experience I have made during a period of six years while holding the office of State Mineralogist, it is my opinion that the State Museum should be entirely separated from the office of State Mineralogist, and all the responsibility of that department removed from him. He should be provided with the necessary assistants and money (which need not be a large sum). The money for the support of his office, which is really the most important branch of the State Mining Bureau, should be entirely under his control, and he should be allowed to manage his department according to his own judgment, without interference from the Board of Trustees, he bearing the responsibility.

## DONATIONS.

Many valuable specimens have been presented to the museum during the past year, and I regret that, owing to reasons mentioned elsewhere, it has been impossible to present in this report a full list of the names of those who have thus enriched the State Museum by their generous donations. I take this occasion to acknowledge, generally, the receipt of many valuable gifts which have been placed in the museum cases when it has been possible to do so. Others will be arranged and catalogued in due time.

## CORRESPONDENCE.

This department has grown in proportion to the advance of the institution, and to that extent that it is now fully the work of one individual during business hours to care for it properly. I am sorry to say that the numerous letters received by the State Mining Bureau have not always been answered as promptly as they should have been—addressed as they were to an important institution in one of the most important States of the American Union. I can only offer as an excuse the utter impossibility of doing better, for reasons too often repeated in the reports of this office. The State Mining Bureau numbers among its correspondents scientific societies, State and foreign governments, and noted individuals, besides many citizens of the Pacific Coast, wishing information as to the natural resources of California. When it has been possible to do so, all procurable information has been given. The reputation of California as a mineral-producing State

is so widespread, and so much is expected of the Mining Bureau and the State Mineralogist, that it is a matter of regret that his work has been impeded for want of needed assistance in this department.

### CHEMICAL WORK.

Since Mr. Edward Booth, the very efficient chemist employed during the first year of the Mining Bureau, was discharged for want of funds, nearly all the chemical work has been done in the private laboratory of the State Mineralogist, maintained at his own expense. The work has been considerable, but not in proportion to the requirements of the office. Some of the results will appear elsewhere in this report.

### LIBRARY.

Very few volumes have been added to the library. Since the administration of the Board of Trustees a few valuable works have been purchased and a few acquired by donation.

### VISITORS.

The number of visitors to the museum has gradually increased. Since the removal to the new rooms the increase has been very noticeable.

### PUBLICATIONS.

The reports of this office, although below my standard, are much in demand, showing the interest taken by the world in our affairs. These reports should be made fuller and better with each issue; but this cannot be done until the State Mineralogist is furnished with more assistance and money with which to visit the localities in the State where valuable minerals are found. No matter how industrious he may be in collecting and arranging matter for his publications, unless he has clerical assistance to carefully revise the work, annoying and discreditable errors will be found when it is too late to correct them in the too hastily prepared reports. For these reasons the publications are not without certain crudities. If the most valuable parts of each volume were carefully revised, provided with maps and engravings, reprinted in one, and published officially, a volume would be so produced which might be given a wide circulation, to the advantage of the State.

### SACRAMENTO STATE COLLECTION OF MINERALS.

There is at the Capitol, in the State Library, in rooms wanted for books, a large and valuable collection of minerals, which was purchased many years ago by the State at an expenditure of a considerable sum of money. It is my opinion that this collection should be joined to the one now in the Pioneer Building in San Francisco, to which it would form a fine supplement. Repeated efforts have been made to effect this union, but always with opposition. Still it seems to be the proper thing to join them.

### STATE MAPS.

Considerable work has been done and much data collected with a view to the publication of a preliminary geological map of the State, and a large

map in sections, on a scale of one centimeter to the mile, on which it was intended to mark the exact locality of all valuable minerals found in the State. It is to be hoped that this work will be continued. An appropriation of several thousand dollars would not be too much for this alone.

## CATALOGUE.

A portion of the third volume of the museum catalogue has been printed, which brings the numbers up to seven thousand. When the entries number nine thousand this volume will be put into book form by the State Printer.

## ORIGIN OF THE NAME CALIFORNIA.

In preparing a history of the geological surveys and explorations of California, I frequently met with the statement that the name of our State was derived from a Spanish romance, published first in 1521. This was ignored or contradicted by other authors. I became very much interested in this subject, and wrote to the Librarian of the British Museum, asking him if there was such a work in his library. In due time a reply came from G. K. Fortescue, the Librarian, informing me that there was, and that in Chapter 157 the name California appears. Mr. Fortescue kindly offered to have the chapter copied for me, which I accepted, and received the chapter in Spanish, which follows this. I then applied to Mr. Camilo Martin, Consul for Spain, who made for me a literal translation, in which he aimed to reproduce in English the quaint idiom of the original.

In his first letter, Mr. Fortescue gave me certain references, which led to my finding in the Proceedings of the American Antiquarian Society, April 30, 1862, a paper on this same subject, by Edward Everett Hale, in which he quotes a few lines from the romance.

As the commander of the expedition sent out by Cortez did not discover Lower California until 1534, and as the romance was so popular that it passed rapidly through a number of editions, it is reasonable to infer that the name California had its origin in the fertile brain of the author. Mr. Hale seems to have been the first to discover and publish these facts.

LAS SERGAS del muy esforzado Caballero Esplandian, hijo del excelente Rey Amadis de GAULA.—Madrid, 1521.

### CAPITULO CLVII.

*Del espantoso y no pensado socorro con que la reina Calafia en favor de los turcos al puerto de Constantinopla llegó.*

Quiero agora que sepais una cosa la mas extraña que nunca por escriptura ni por memoria de gente en ningun caso hallar se pudo, por donde el dia siguiente fué la ciudad en punto de ser perdita, y cómo de alli donde le vino el peligro le vino la salud. Sabed que á la diestra mano de las Indias hubo una isla, llamada California, muy llegada á la parte del Paraiso Terrenal, la cual fué poblada de mujeres negras, sin que algun varon entre ellas hubiese, que casi como las amazonas era su estilo de vivir. Estras eran de valientes cuerpos y esforzados y ardientes corazones y de grandes fuerzas; la insula en si la mas fuerte de riscos y bravas peñas que en el mundo se hallaba; las sus armas eran todas de oro, y tambien las guarniciones de las bestias fieras, en que, después de las haber amansado, cabalgaban; que en toda la isla no habia otro metal alguno. Moraban en cuevas muy bien labradas; tenian navios muchos, en que salian á otras partes á hacer sus cabalgadas, y los hombres que prendian llevábanlos consigo, dándoles las muertes que adelante oiréis. Y algunas veces que teinan paces con sus contrarios, mezclábanse can toda seguranza unas con otros, y habian ayuntamientos carnales, de donde se seguia quedar muchas dellas preñadas, y si parian varon, luego era muerto. La causa dello, segun se sabia, era porque en sus pensamientos tenien firme de apocar los varones en tan pequeño número, que sin trabajo los pudiesen señorear, con todas sus tierras, y guardar aquellos que entendiesen que cumplia para que la generacion no pereciese.

En esta isla, California llamada, habia muchos grifos, por la grande aspereza de la tierra y por las infinitas salvajinas que en ella habitaban, los cuales en ninguna parte del mundo eran hallados; y en et tiempo que tenian hijos, iban estas mujeres con artificios para

los tomar, cubiertas todas de muy gruesos cueros, y traianlos à sus cuevas, y alli los criaban. Y siendo ya igualados, cebábanlos en aquellos hombres y en los niños que parian, tantas veces y con tales artes, que muy bien conocian à ellas, y no les hacian ningun mal. Cualquiera varon que en la isla entrase, luego por ellos era muerto y comido; y aunque hartos estuviesen, no dejaban por eso de los tomar y alzarlos arriba, volando por el aire, y cuando se enojaban de los traer, dejábanlos caer donde luego eran muertos. Pues al tiempo que aquellos grandes hombres de los paganos partieron con aquellas tan grandes flotas como la historia vos ha ya contado, reinaba en aquella isla California una reina muy grande de cuerpo, muy hermosa para entre ellas, en floreciente edad, deseosa en su pensamiento de acabar grandes cosas, valiente en esfuerzo y ardid de su bravo corazon, mas que otra ninguna de las que antes della aquel señorio mandaron. Y oyendo decir cómo toda la mayor parte del mundo se movia en aquel viaje contra los cristianos, no sabiendo ella que cosa era cristianos, ni teniendo noticia de otras tierras, sino aquellas que sus vecinas estaban, deseando ver el mundo y sus diversas generaciones, pensando que con la gran fortaleza suya y de las suyas, que de todo le que se ganase habria por fuerza ó por grado la mayor parte, habló con todas aquellas que en guerra diestras estaban, que seria bueno que, entrando en sus muy grandes flotas, siguiesen aquel viaje que aquellos grandes principes y altos hombres seguian; animándolas y esforzándolas, poniendoles delante las muy grandes honras y provechos que de tal camino seguirseles podrian, sobre todo con muy grande fama que por toda el mundo dellas seria sonada, que estando así en aquella isla, haciendo no otra cosa sino la que sus antecesores hicieron, no era sino estar como sepultadas en vida, como muertas viviendo, pasando sus dias sin fama, sin gloria, como los animales brutos hacien.

Tantas cosas les dijo aquella muy esforzada reina Calafia, que no solamente movió á sus gentes á consentir en el tal camino, mas ellas, con mayor deseo que sus famas por muchas partes divulgadas fuesen, le daban priesa que entrase en la mar luego, porque se hallesan en las afrentas, juntas con aquellos tan grandes hombres. La Reina, que la voluntad de las suyas vido, sin mas dilatar, mandó bastecer su grande flota de viandas y de armas todas de oro, y de todo lo demás necesario, y mandó reparar la mayor fusta de las suyas, hecha á manera de una red de gruesa madera, y hizo en ella meter hasta quinientos grifos, que, como ya se vos dijo, desde pequeños mandó criar y cebar en los hombres; y haciendo allí meter las bestias en que cabalgaban, que de diversas maneras eran, y todas las mas escogidas mujeres y mejor armadas que tenia en la flota, dejando tal recaudo en la isla con que segura quedase, y metióse ella las otras en la mar; y dióse tanta priesa, que llegó á las flotas de los paganos aquella noche que se os dijo del combate; con que todos ellos hubieron muy gran placer, y luego fué visitada de aquellos grandes señores, haciendole muy grande acatamiento. Ella quiso saber en qué estado estaba su hecho, rogándoles mucho que por extenso se lo contasen, y oida la relacion dello, dijo: "Vosotros habies combatido esta ciudad con vuestras grandes gentes, y no la pudístes tomar; pues yo con las mias, si á vosotros pluguiere, quiero el dia siguiente probar mis fuerzas á que bastarán, si quisieredes estar á mi consejo." Todos aquellos grandes señores le dijeron que como por ella fuese señalado, que asi lo mandarian cumplir.

"Pues enviad luego á todos los otros capitanes que por ninguna manera salgan mañana ellos ni los sujos de sus estancias, hasta que por mi les sea mandado, y veréis un combate el mas extraño que hasta hoy nunca vistes, ni de que jamás oistes hablar." Esto fué luego hecho saber al gran soldan de Liquia y al soldan de Halapa, que tenia cargo de todas las huestes que estaban en la tierra; los cuales así lo mandaron á todas sur gentes, maravillándose mucho á qué podria acudir el pensamiento y obra de aquella reina.

TRANSLATION.

The Exploits of the very valiant Knight Esplandian, son of the excellent King Amadis of Gaul.—[Madrid, 1521.]

## Chapter CLVII.

*The marvelous and not thought of succor with which the Queen Catafia came to the Port of Constantinople in favor of the Turks.*

I wish you now to know a thing the most strange which ever either in writing or in people's memory could be found, by which the city was the following day on the point of being lost, and how from there where the danger came, salvation came to it. Know then that to the right hand of the Indies, there was an island called California, very near the part of the terrestrial Paradise, and which was inhabited by black women, without there being among them even one man, that their style of living was almost like that of the Amazons. They were of robust bodies and valiant and ardent hearts and of great strength; the island itself was the strongest that could be found in the world through its steep and wild rocks; their arms were all of gold and also the harness of the wild beasts on which they rode after taming them, as there was no other metal in the whole island; they dwelled in well-finished caves; they had many ships in which they went to other parts to obtain booty, and the men whom they made prisoners they took along, killing them in the way you shall hear further on. And sometimes, when they were at peace with their adversaries, they used to mingle with them with entire confidence; if any of them gave birth to a son, he was put to death at once. The reason for it, as it was known, was because in their thoughts they were resolved to lessen the men to so small a number that they would be able to master them without much trouble, with all their lands, and preserve those who would understand that it was convenient to do so that the race might not perish.

In this island, called California, there were a great many griffins, the like, on account of the ruggedness of the land and the very many wild beasts therein contained, were not found in any other part of the world: and when they had little ones, these women would go covered with thick skins to catch them by tricks, and they would bring them to their caves and there rear them; and when they were accustomed to them, they would feed them with those men and with the male children they bore, so often and with such cunning that they very well learned to know them, and never did them any harm. Any man who landed on the island was at once killed and eaten by them; and though they might be glutted, they would not the less take them and lift them up, flying through the air, and when tired of carrying them, they would let them fall, where they would be killed at once. Well, at the time when those great men of the pagans departed with those large fleets, as history has already told you, there reigned in said Island California a Queen very tall of stature, very handsome for one of them, of blooming age, desiring in her thoughts to do great deeds, valiant in spirit, and in cunning of her fearless heart, more so than any of the others that before her reigned in that seigniory. And having heard how the greatest part of the world was moving in that expedition against the Christians, she, not knowing what beings were the Christians, nor having any knowledge of other countries except those which were next to hers, wishing to see the world and its different races, thinking that with her great valor and that of her adherents all that would be gained she would have, by force or by cunning, the largest share of, she spoke with all those that were skillful in war, telling them that it would be well that, going in their great fleets, they should follow the same road that those great princes and eminent men were taking, inciting and encouraging them by laying before them the very great honor and gain that might result to them from that undertaking; above all, the great fame that would resound in the whole world about them; that remaining in the island as they were, doing nothing but what their ancestors had done, would be only to be buried in life, like living dead, passing their days without fame and without glory, like wild animals.

So many things said to them by that very valiant Queen Calafia, that she not only moved her people to consent to the undertaking, but they, with their great desire that their fame should be published in many parts, hurried her to put to sea at once, so as to happen to be in the danger jointly with those great men. The Queen, who saw the determination of her people, ordered her great fleet to be supplied with provisions, and with arms all of gold and with all other necessaries; and she ordered the repairing of her largest vessel, made like a grate of thick timbers, and she had put into her up to five hundred griffins, which, as you have been told, she had raised from tender age and fed with the flesh of men, and having therein also put the animals on which they rode, and which were of different kinds; also, the best chosen and best armed women which were in the fleet, and, leaving such garrison in the island as to be secure, she put to sea with the others, and she hurried so much that she joined the fleets of the pagans the night of the combat, of which you have been told, which caused them all very great pleasure, and then she was visited by those great lords, who showed her great reverence. She wanted to know in what state was their enterprise, begging them to relate it to her minutely; and having heard the report from them, she said: "You have fought this city with your many people and could not take it; well, I with mine, if it is agreeable to you, will, on the following day, try the reach of my power, if you will accept my advice." All those great lords answered her, that whatever was by her indicated, they would order it executed. "Then notify at once all the other commanders that to-morrow, on no account, they nor theirs leave their quarters, until it is so ordered by me, and you shall see a fight the most strange never seen before this day, and of which you never have heard spoken." This was then made known to the great Sultan of Liquia and the Sultan of Halapa, who had charge of all the armies which were on land, and who thus ordered their people, wondering much what could be the thought and deed of that Queen.

## GENERAL CONDITION OF MINING IN CALIFORNIA.

California is just emerging from a condition of things that will be remembered for many years to come with regret and astonishment, and which will pass to history as one of those periodic manias which come over mankind like a calamity and shake the very foundations of society.

If the majority of the people of the Pacific Coast should be informed that instead of having been engaged in mining, they have simply been gambling, and have in the most foolish manner possible, given up their money to a comparatively few unscrupulous and dishonest sharpers, they would be slow to admit the fact, yet perhaps in the annals of history, there has never been such a wholesale transfer of money from a multitude of pockets to a few, without consideration, under the deceptive but fascinating name of mining.

Stock gambling is in no sense mining. It is a favorite excuse by those who have lost their savings in this way, to say sadly, "I invested all my

money in mines and lost it," which most of them did not, but bought worthless stocks instead. To recount the most successful deceptions that have been practiced to induce those who had money to invest it in stocks, would fill many pages and leave much more to be said. Still honest gold and silver mining presents the best field for the investment of capital of any business in California, for the following reasons:

Gold is becoming scarce, and consequently its purchasing power is greater than it has been for many years. The market for gold is in no way dependent on the population of the Pacific Coast; while a large population is essential to render manufacturing successful. We can produce gold with perfect confidence that the market of the world will gladly take all we are willing to spare, and in return will manufacture for us cheaper than we can hope or desire to do for ourselves.

Mines can now be worked in California at a much less cost than during the delirium of the first gold excitement, for the reason that transportation, provisions, labor, and fuel are cheaper; and every ounce of gold obtained is practically of double value. These facts are well known to intelligent miners in the State, and our mines are being better worked than ever before. New quartz veins are being taken up wherever they can be found; and there are indications of a new era in mining, which, it is to be hoped, will cause renewed prosperity in the State, even if we cannot utilize our vast deposits of placer gold.

## MINING ECONOMIES.

Within a few years railroad lines have been extended and settlements advanced. Ores that could only be worked if they would yield from twenty-five to fifty dollars per ton are now found to be rich, as they can be mined and milled at a very reduced expense. Dump piles, formerly considered worthless, are now valued at many thousands of dollars. Tailings, allowed to go to waste in former years, are now being prospected and assayed. The concentration of these tailings will furnish employment for many men in the near future.

When on a large scale gold quartz has been crushed in quartz mills, a sandy powder passes through the screens and over the amalgamating copper plates. Theoretically the gold contained in the quartz remains attached to the mercury; what flows away (which is nearly all that passes the screens) is known among miners as tailings. If the operation of milling was as perfect in practice as in theory, the tailings would be worthless, but this is not the case; not only does a considerable quantity of gold escape, but mercury also. The sulphurets, which are nearly always auriferous, are not decomposed in the operation, and carry their precious contents with them to the beds of the streams below the mills, or to the reservoirs, which the most prudent of superintendents or managers provide for the reception of the tailings. The ordinary quartz mill saves only *free* gold, and even a portion of that escapes, owing to defective milling, and the sometimes peculiar condition of the gold, which has been before referred to in these reports. Mercury is used in the batteries, and on the plates, but, notwithstanding the skill acquired by the amalgamators, and the experience of many years in California, a considerable portion escapes, taking gold with it that had already become amalgamated. To prevent this well known loss many ingenious inventors have spent years of their lives and much money in the construction of machines and in the planning of processes, many of which have been patented, until the art of concentration has reached a point approaching perfection. But there is still

room for improvement. There is a great future in California for the concentration of tailings and low grade ores which were wasted during the time of excitement, when it was found to be more profitable to extract gold and silver from the pockets of the credulous than from the mines. In this connection it is interesting to note that companies are now engaged, with large capital, in working the lead slags of Laurium in Greece, and other ancient mines in Spain, and with great profit.

The following newspaper extracts have a special bearing on this subject:

In cleaning up in quartz mills a lot of scraps of iron are always found, consisting of fragments from shoes, dies, shovels, picks, hammers, and drills; and these lumps are knocked about in the mortar until numerous particles of gold are driven into their interstices. A lot of such scraps collected in the Jefferson Mill, in Yuba County, supposed to weigh half a ton, after being broken up with sledges, were digested in warm sulphuric acid until the surface had been eaten away and the gold liberated, and the yield thus obtained was $3,000. The shoes and dies, being too large to be broken up or digested in acid, were boiled half an hour in water, and then when the iron was repeatedly struck with a hammer, the particles of gold dropped out.

The Pennsylvania Company have run a lot of tailings, formerly considered worthless, through one of Wheeler & Randall's grinding pans, and cleaned up eighty-four ounces of amalgam, worth $5 per oz.

In some comments yesterday on the new drift of mining industries, the more extreme instances of the working of low grade ores were not cited. In Calaveras County during the last two years more than eighty thousand tons of quartz rock have been worked by one mill, the yield of which rock was less than two dollars a ton. And yet this mine was worked at a profit—the yield per ton ranging from one dollar and eighty cents up to about one dollar and ninety-five cents. The assays show that the rock carried more gold. But this is all that could be saved by any process now known. Of course, when the yield per ton is so small, there must be many advantages of working. The quartz must be abundant, and there must be no long land transportation. It would appear from these and other facts that low grade gold quartz can be worked with as much advantage now in California as in Australia, or in any other part of the world. These facts are of special importance just now, while fresh attention has been turned to gold quartz mining in California. Gold bearing ledges will not hereafter be neglected because of low grade ores. Nothing comes amiss now in that way from two-dollar ore in good situations up to twenty-dollar quartz in more remote and less accessible districts.

The value of the gold in the tailings not only of the quartz mines, but the hydraulic mines, is something enormous. It is considered by the most practical miners in California that at least one half the gold in placer mining is lost—or, rather, not saved. The loss of mercury may be reckoned by hundreds, if not thousands, of tons. This can to a great extent be recovered by reworking and concentration. This subject is well worthy the attention of laborers and capitalists.

## IMPORTANCE OF GOLD AND GOLD MINING.

It cannot be denied that the love of gold is widespread, intense, and universal. It is vain to argue that gold is not an absolute necessity—to say that we cannot eat or wear it; that it is heavy and cumbersome—for we learn both in ancient and modern history that from the earliest ages mankind would sacrifice almost everything else for gold, and would even risk their lives to obtain it. The producers of all other staples, and the manufacturers of all articles of use and luxury, will gladly transport them from the ends of the earth and lay them at the feet of the miner in exchange for his yellow gold.

During a golden age, such as that through which we have just passed, real and personal property increase enormously. Without gold it would be impossible that there should be so many men possessing great wealth,

known as millionaires. The country that produces, holds, or utilizes the most gold, makes the greatest progress, and advances most rapidly in civilization and power. The discovery of gold in California stimulated commerce and manufactures and general progress more than any event in modern history, and its effect was felt over the whole civilized world. Without it the Pacific railroads would not so soon have been built, nor would the advancement of the Pacific Coast have been so rapid.

There has never perhaps been a period when labor has been so well paid and the world progressed as during the recent golden age, for in all former gold excitements the precious metal was extracted by slave or convict labor, and enriched kings instead of the people. While it is true that the thirst for gold brings in its train many evils, it must also be admitted that it is productive of much good. It begins to be realized by the world generally what a powerful lever or motor gold is to commerce, manufactures, and trade; that on the product of distant gold fields depends the rise and fall of prices, including salaries, in countries not producing gold, and whether trade and manufactures shall thrive or languish. In the United States the importance of our gold production is too often wholly disregarded, or but slightly considered.

Gold is true wealth. It cannot be destroyed by fire or by the action of ordinary chemical agents, and will always command its bullion value in whatever state or condition it may be. It is not only wealth in itself, but is the accepted measure of all other values. There is no other description of real property that can be so readily turned to account as gold. It seeks no market; on the contrary, all branches of trade and commerce seek it.

In digging for gold, the most desired of all products, natural or artificial, the miner becomes a consumer of all other products, and has at the same time the power to purchase them, conditions which render trade or barter most active. In the exchange of commodities—the business of the merchant—nothing is produced; the world is accommodated, but actual wealth is not increased. So with the manufacturer. He adds to the value of the crude material, but adds nothing to the actual wealth of the world. The agriculturist also produces what is consumed as food, and must be reproduced from the same source. But the real wealth of the world is derived from its crude products, generally dependent upon mining. The checking of gold mining, then, in our State, becomes a very serious matter, and affects not only California, but the United States and the world. Since it can be shown that our great and exceptional prosperity for many years was owing to the advantage we derived from our prolific gold fields, is it not more than possible that we have made a great mistake in crippling the most important producers, the gold miners?

The failure of any legitimate harvest is felt far beyond the area of its production. Thus the sudden cessation of the cotton crop in the Southern States, during the civil war, was the cause of great and widespread destitution among the mill operatives of Great Britain. In the same way the decrease of the gold crop of California not only places the people of our State at great disadvantage, but is felt in the general depression of business and the stringency of the money market in the country at large.

When the supply of gold diminishes suddenly, there follows a series of financial crises, so calamitous and far reaching that the most distant lands suffer in common with us. It can be shown that the present shrinkage in values, which is distressing the laboring classes at home and abroad, is the direct result of this decrease of gold, and is only a repetition of what has occurred many times in history under similar conditions.

If you ask ten men of average intelligence the cause of the present

general stringency of the times, the uneasiness of capital, the clashing between laborer and employer, the uprising of the many against the few, the stagnation of trade the world over, the apparent overproduction of manufactures and crude material, each would give a different answer, and probably none of them would be the full solution of the question. The primary and immediate cause is the scarcity of gold. Other minor influences are generally local, and nearly all of them hinge on the former.

The best thinkers and financiers of Europe assume that the production of gold is less than the requirements, and gold coinage is nearly suspended.

Assuming, therefore, the fall of prices to be caused by the diminished gold production, we must admit that if this were gradual, it would occasion no serious distress. It is the *sudden* diminution that causes the disturbance. Our people have the same elements of prosperity, but cannot divert the property they possess, or exchange to mutual advantage as when gold was plentiful. It is claimed that gold is hoarded in bank and Government treasuries. If this was so, the very necessity of the case would cause it to be brought out and used. The real truth is that it is scarce, and becoming more so, and unless new and prolific gold fields are discovered, the present depressed condition of trade will continue until prices adjust themselves to the increased value of gold.

Because the management of our gold and silver mines has too often been unwise and extravagant, and because in the days of our plenty we have disregarded small things, it should not be charged that the business itself is defective. On the contrary, its excellence is proved by its frequent success, even under admitted mismanagement.

Gold mining is a legitimate, honorable, and interesting occupation, and, when properly conducted, as safe as any that can be mentioned. The Government of Victoria, in Australia, already realizes how important to the Colonies and the mother country is the continued production of gold, and has enacted laws to assist the prospectors in discovering and working new gold fields; while California, with less wisdom and foresight, discourages mining. It should be the policy of our State, as of other countries, to turn her vast mineral resources to the best account. Instead of crippling the gold miner, he should be encouraged and afforded special facilities for his work. Instead of treating him as a public enemy, he should be regarded as a useful and important agent in maintaining the wealth of the country. Instead of stopping the work of those who injure without malice a small portion of the agricultural lands of the State, we should rather consider the vast importance of the gold yield, and seek some remedy or formulate some plan, whereby the miner may continue his work and the farmer at the same time be protected.

## BIMETALISM.

While it cannot be denied that gold is the king of metals, and that all values are measured directly or indirectly by it, silver and other inferior metals should not be scorned. From present indications California will become a large silver-producing State. Having had a period of gold production, a new era of silver begins to dawn upon us. It is known that at various times in the world's history, after an unusual output of gold, when that metal became scarce some inferior metal was substituted for it. Silver was at first taken for this purpose, but copper, and even iron, were also used for money. To this extent bimetalism is admissible and possible, but any attempt to establish and to long maintain a fixed relative value between any two or more metals, must result in failure.

The idea of sustaining a double standard is an absurdity. The word

*standard* implies something having a fixed or permanent value. While any one substance may be accepted as the measure of the comparative value of many or all others, if a double standard was possible, it would be equally possible to have a quadruple or multiple standard. There must be one standard, or none.

Any act of Legislature to create and maintain a double standard would be no less ridiculous than the deed of Xerxes, who lashed the Hellespont because it destroyed his bridge, or of Cyrus, who punished the river Gyndes.

So difficult has been the settlement of this question in times past—for it is as old as history—that the Chinese were compelled to substitute copper for gold as a measure of values. The standard, whatever its substance may be, is *fixed* only in name, for it fluctuates in obedience to the universal law of supply and demand; but as a standard it remains stationary, while everything measured by it fluctuates in proportion. This was shown in the case of United States currency during and immediately following the civil war, when paper was created a legal tender and assumed to be a standard. This was a fallacy, for while gold was said to fluctuate, it was in fact the currency that did so. In California, where we had no currency, the price of gold remained as nearly the same as it could, compared with other articles of commerce, and there was no change in the value of gold in other countries.

If it should be thought wise to make silver the standard, values would adjust themselves, and with an increased circulating medium, trade and commerce would prosper or seem to prosper as before. There would be no gold in circulation; if we wanted that metal we should have to buy it as we do any other commodity. Unless other nations also accepted the silver standard, our silver coin would be at a discount in all countries which retained the gold standard.

The acceptance by the United States of a silver standard would be a benefit to our State, for it would stimulate silver mining and lead to the opening of many mines now idle, whatever effect it might eventually have on trade and commerce.

We have the satisfaction of knowing that there are in our State practically inexhaustible reserves of the precious metals, which we can draw upon if we desire. That our people should not fully avail themselves of these advantages seems incredible.

### DIFFICULTIES ATTENDING MANUFACTURING IN CALIFORNIA.

Another reason for encouraging mining in California is the difficulty which manufacturers experience in disposing of their products, owing to competition with the East and Europe, and to the small population of the State and Pacific Coast. If the miners cease to be producers they must embark in some other business or leave the State. If the former, there is no avenue open but agriculture, manufactures, or commerce, all of which are already full, not to say overdone. If there is no gold produced for exchange with other centers, it will prove a check to enterprise on this coast. The sudden cessation of the former golden income to our merchants, manufacturers, mechanics, and farmers, cannot but be felt in every department of industry.

Upon agriculture alone the former prosperity of our State cannot at present be maintained. In course of time, when our population becomes larger, and prices have sunk to a level with those in older States; when we form habits of economy, frugality, and providence; when we discover new coal mines, or learn to utilize our petroleum, and all the various resources

of our State, the general prosperity will equal that of others; but now, without gold, we have no special advantage over our sister States, save in climate.

Population of California and the Pacific Coast, as compared with other centers:

| | |
|---|---|
| California, in 1880 | 864,694 |
| Oregon | 174,768 |
| Washington Territory | 75,116 |
| Nevada | 62,266 |
| Arizona | 40,440 |
| Total Pacific Coast | 1,217,284 |

New York and neighboring cities:

| | |
|---|---|
| New York | 1,206,299 |
| Brooklyn | 566,663 |
| Newark | 136,508 |
| Jersey City | 120,722 |
| Patterson | 51,031 |
| Hoboken | 30,999 |
| Elizabeth | 28,229 |
| Total | 2,140,451 |

It will be seen by the above figures that New York and the cities in its vicinity contain nearly twice as many people as the entire Pacific Coast.

How would New York prosper if it depended solely on its own inhabitants for a market? How can California support large manufactories with so small a market, and against the competition of eastern dealers, who have far greater advantages and facilities, and produce manufactured goods cheaper than we can?

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## BUILDING STONES AND BUILDING MATERIALS IN CALIFORNIA.

I have had occasion in all my reports to allude to the building materials already found and likely to be found, and the increasing use of them in the State. The subject is of such importance that I cannot refrain from again calling attention to it, to sum up recent discoveries made and to give general information, which I trust will be interesting and instructive to citizens of the State who have not the opportunity or the leisure to study the large number of reference works which treat on this subject.

### HISTORY OF BUILDING IN ANCIENT AND MODERN TIMES, WITH SOME ACCOUNT OF THE MATERIALS USED IN CONSTRUCTION.

The question as to what shall replace the perishable structures now so generally built in the State, and especially in the city of San Francisco, is one that should engage the serious and immediate attention of our people.

To those who have not well considered this subject, the solution would seem to be simply the selection of some accessible stone and its immediate use in buildings, but such hasty action might prove an error.

In the history of the world very serious mistakes have been made in the selection of building stones, to the injury of individuals and communities.

There are certain conditions which render stones suitable and durable in one locality, but short-lived and nearly worthless in others.

This was strikingly illustrated in the selection of stone for the construction of the Parliament Houses in London.

In their native beds these stones had withstood climatic influences for centuries, and two fine buildings, Southwell Minster and York Minster, both of the same material, and both many years old, were still in a good state of preservation. But when the same stone was laid in the magnificent walls of the palace, in the smoky, acid, foggy atmosphere of London, decay early commenced, and a system of patching, painting, scraping, and cleaning was found necessary, which has been continued at intervals, to the disappointment and chagrin of the good people of the world's greatest city. The obelisk which stood for thirty centuries, more or less, in the dry atmosphere of Egypt, crumbled in a few years in New York. If it had been set up in Arizona, or on the Colorado Desert of California, and protected from wind-driven sands, its deeply sculptured hieroglyphics would, without much doubt, have remained legible for a thousand years more. The desirable qualities which characterize a really good building stone are: *First*, durability. *Second*, beauty. *Third*, ease with which it can be cut into suitable forms for use. And, *Fourth*, proximity to the cities where the stone is required.

The advantages of stone over other building material may be summed up as follows: beauty, durability, and safety from fire and ordinary earthquakes, the latter an important consideration in California, and one we may not ignore.

In the one item of insurance alone, should fireproof buildings replace those of wood, millions of dollars would be retained in the country, while the cost of the Fire Department system would be reduced to a minimum.

The construction of good buildings gives employment to mechanics and workingmen, who are thereby enabled to support their families, and to live in comfort. Another consideration which is often overlooked is loss of capital employed in the construction of perishable buildings which become worthless in a few years. The rocks most generally used as building material are: *granite*, *syenite*, *porphyry*, *diorite* or *greenstone*, *lavas*, including basalt and trachyte; *freestones* or *sandstones*, and *limestones*, including tufa, travertine, and dolomite, *slates*, *serpentines*, etc.; all these are found in California and most of them are abundant.

The crust of the earth, as far as known to man, is composed principally of seven minerals, to the extent of nineteen twentieths, as follows:

1. Quartz.
2. Talc or steatite.
3. Serpentine.
4. Hornblende and augite (varieties of pyroxene).
5. Feldspar, several varieties.
6. Mica.
7. Carbonate of lime.

When two or more minerals are mechanically mixed they form *rocks*, as generally understood. Some minerals occur in such large masses that they also are classified as rocks. The crystalline rocks as granite, syenite, gneiss, etc., are complex, and contain nearly, if not all the elements which enter into the composition of volcanic, plutonic, sedimentary, and metamorphic rocks, including the metals, gold, silver, lead, tin, iron, etc.

They decompose to sand, kaolin, and alkalies, which form new combinations in soils and minerals. Sandstones, shales, slates, mica schists,

and argillaceous rocks, are built up of the ruins of older crystalline rocks, and, if we are not mistaken, return to their former condition and become crystalline rocks again.

In California building stones abound. It was a wise remark made by some writer unknown to me, but frequently quoted, that "Time seldom spares what it does not take time to create." This aptly applies to the art of building, an art greatly conducive to the comfort, prosperity, and happiness of mankind.

Wood was extensively employed in building ancient cities. These temporary houses were replaced first by brick, and then by those constructed of marble and other building stones. Wood was largely used in Rome. Up to the time of Augustus brick was the common building material, but the upper part of the better class of dwelling houses still continued to be of wood. From the reign of Augustus better materials were generally introduced, and after the great fire in Nero's time, a volcanic rock now called "peperino" came into quite common use. Nero did not allow the wooden upper structures to be renewed, and made the streets wider and straighter. Peperino is a volcanic ash, cemented by carbonate of lime or silica. It is very light, and for that reason suitable for a certain class of buildings. It was extensively used in the ancient cities of Herculaneum and Pompeii. This rock, or one of a similar character, is abundant in California.

Specimens from ancient Rome may be seen in the State Museum, numbered 6437, and others.

During the splendor of the Empire magnificent and costly buildings, both public and private, were erected in Rome; each Emperor vieing with his predecessor in their construction. After the time of Augustus, the then known world was ransacked for new and elegant marble. It was early discovered that certain volcanic tufas or ash, called Pozzuolana, when mixed with the proper proportion of lime, became a hard and durable cement.

The discovery of the cementing properties of this material seems to have been accidental. At Baiæ, on the coast of Italy—which was a celebrated watering place and resort of the wealthy Romans in ancient times—it was thought desirable to increase the coolness of the situation by building the summer villas on masonry, extending beyond the shore, and surrounded by the waters of the bay. In experiments for this purpose, made with different cements or mortar, a kind of earth now known to be of volcanic origin, was discovered at Puteoli, to which the name of Pulvis Puteolanus was given, afterwards corrupted to Pozzuolana, by which it is still known.

It is claimed by historians, that to the discovery of this cement, Rome owes, in great measure, the massive and stately character of her public works and buildings, and that without it, the magnificent bridges, aqueducts, and roads, would ere this have fallen into decay.

California is known to be rich in volcanic materials, and it is not unlikely that Pozzuolana may yet be found among them. Such a discovery by the State Mining Bureau would be worth more to California than the whole cost of the institution since its inception. The fact that our State is specially subject to earthquakes, must be admitted. It is also known that it is possible to construct buildings that will resist all but the most violent shocks. Since the weakest part of modern buildings is the cement or mortar with which they are put together, it is evident we must improve the quality of that, in order to insure their durability. It has been observed in many old Roman structures, that the mortar outlasts the stones themselves, and that where the latter have been worn away by the

influence of time, the cement, in some cases, actually projects from their surface.

A tufaceous limestone or travertine of a pale straw color was found in extensive quarries near Tivoli, a few miles from Rome, which proved to be a durable and beautiful building stone. This became the principal building material of the ancient and modern city. It was selected by the Emperor Augustus, and soon a style of building which combined travertine with Carrara marble became very popular. The first great public building of this material was the Colosseum, which was finished by Vespasian and Titus. After it fell into ruin, it became a convenient quarry from which stones were selected to put into more modern buildings, and it is intimated that even Michael Angelo was guilty of this vandalism.

In more modern Rome the following well known buildings and many others of lesser note, are built of travertine: *St. Peter's*, the *Museum and Church of Lateran*, the *Castle of St. Angelo*, and the *Quirinal*.

Travertine had the convenient property of being soft when first taken from the quarry, and could be cut with a common saw, but it hardened with time. Specimens of pozzuolano and travertine also find a place in the State Museum. In ancient Greece marbles were also extensively used; in Egypt granite, syenite, and porphyry; in Babylon, sun-dried brick and asphaltum.

Many of the ruins of ancient cities show that architecture had reached a point, even in very ancient times, as near to perfection as anything human can. It is admitted that the moderns have never equaled the ancients, and at the present time our best architects are content to imitate them.

Marble is generally understood to be *carbonate of lime*, either white or colored, uniform or variegated, and pleasing to the eye; the term is also applied to any colored stone soft enough to easily cut, and hard enough to bear a good polish. Under the latter meaning may be classed the following minerals and rocks: dolomite, serpentine, verde antique, steatite, ophite, and even diorite, and porphyry; *Inyo marble*, so called, is dolomite.

Webster gives the following definition of marble: "Any species of calcareous stone or mineral of compact texture, and of a beautiful appearance, susceptible of a good polish; any firm limestone, fitted when polished or otherwise for ornamental use. Also other rocks of nearly the same hardness, capable of the same uses, as serpentine; but improperly, polished slabs of harder rocks, as porphyry, granite, and the like."

The name is derived from a Greek word, to *sparkle* or *flash*.

True marble is *carbonate of lime*, composed of carbonic acid and the oxide of calcium, or lime, in the following proportions:

| | |
|---|---|
| Carbonic acid | 44 |
| Lime | 56 |
| | 100 |

Edward Clarke, who traveled in Europe in the year 1800 and after, came to the conclusion, from his large experience and observation, that Parian marble was the most enduring of stones used in ancient sculpture and architecture; but Geike, the English geologist, informs us that inscriptions on marble tombstones, in large towns where coal smoke and rain are abundant, become illegible in fifty years. Crystalline limestone has been formed artificially by heating chalk or lithographic stone, which seems to prove that marbles are metamorphic. The accounts given by travelers and historians concerning the art works of the ancients, are almost incredible. Clarke describes in pleasing detail the architectural ruins met with by him in the Crimea, in Greece, and on the plain of Troy; Volney has written in the

most charming language of the ruins of Palmyra; and Pliny informs us that the art of cutting marble into slabs dates back to the building of the palace of Mausolus at Halicarnassus. The walls of that celebrated building, one of the seven wonders of the world, were of brick, covered with Cyzican marble from Proconnesus.

This art was introduced into Rome, and the described mode of cutting, by the use of strips of iron and sand, does not materially differ from that practiced at the present day.

The same author states that marble began to be used in public buildings in Rome in the Ædileship of M. Sacurus. His theater, described by Pliny as "the greatest that has ever been made by the hands of man," was three stories high. The lower was of marble, supported by three hundred and sixty columns of the same material; the second of glass, and the highest of gilded wood. This building was planned to seat eighty thousand spectators. After this period there was a rivalry as to who should erect the most costly and grand public buildings; interior walls were not only covered with the most costly imported marbles, but the stone was richly sculptured, and even in part painted or gilded. In the time of Nero, a method of inserting spots, or ornamental patches of other marbles, was invented—a sort of Mosaic or inlaid work, very costly and unnatural, but nevertheless much admired.

Then followed a general mania for marbles and rare ornamental stones, which were introduced into private as well as public buildings, and which were sought in every part of the known world.

The first private citizen who covered the entire walls of his house in Rome was Mamurra, who was only satisfied with the costly and rare marble of Carystus and Luna, the modern Carrara. M. Lepidus made the lintels of his house of Numidian marble (Giallo Antico), in the year of Rome 676. A few years later columns of foreign marble were first erected in Rome by L. Crassus, the orator; his house on the Palatine Hill was remarkable for its magnificence. The columns were six in number, and twelve feet in height; they were of Hymettian marble (Carrara).

L. Lucullus, when Consul, introduced into Rome a black marble, which was found on the island of Melos, and named Lucullan marble after him. We are indebted to Pliny for this information.

The following is a list of the rarer and most noted of ancient marbles:

White: Parian, Pentellic, Luna.
Black: Lucullan, Nero Antico.
Red: Rosso Antico, Cottonello.
Green: Verde Antico.
Variegated: Lumachella, Phrygian, Oriental Alabaster or Onyx.

The Parian and Pentellic marbles were pure white, and were considered better than those of Carrara. They are nearly pure carbonate of lime. Parian was found on the Island of Paros, one of the Grecian Archipelago. It could be distinguished by a peculiar luster on the freshly broken surface. The quarries from which this fine marble was obtained are very ancient. Pentellic marble was from Mount Pentellicus, in Attica, ten miles only from Athens. The Parthenon, in that ancient city, was constructed of this stone. Being completed in 438 B. C., it has resisted the destroying hand of time for two thousand three hundred and twenty-four years. Phidias, born four hundred and ninety years B. C., and Praxitales, celebrated Grecian sculptors, both worked on this, the most magnificent of ancient or modern buildings. The Pentellic quarries have been lately reopened.

Luna or Carrara marble is also nearly pure carbonate of lime (98.1 per cent), the usual impurities are clay, pyrites, and quartz. The marble often contains imbedded crystals of quartz, perfectly transparent and doubly terminated, called "Cararra diamonds." There are a number of varieties of this marble, but the best has a delicate waxy luster which is much admired; there are many fine specimens in the State Museum. The quarries of Carrara are supposed to have been opened by the Romans one hundred years B. C.; they were worked in the time of Julius Cæsar, and more extensively in the time of Augustus, who was called by Livy "the builder and restorer of all the temples." The ancient Etruscan seaport of Luna, eight miles from Carrara, described by Pliny as a "noble harbor," is now more than a mile and a half inland, with meadows extending to the shore. Marble was largely used in the construction of this city; large blocks still remain which are supposed to have been the seawall, from a large metal ring found attached to one of them. During the dark ages, Luna having then fallen into decay, was robbed of its marble blocks and columns, which were sent to construct buildings elsewhere. The marble for the Pantheon at Rome was brought from Carrara; this building was erected by Agrippa twenty-six years B. C., and is still in a good state of preservation. The palace and arch in the Via Domizi, and the baths of Caracalla are of Carrara marble. Lucullan black marble was supposed to have been brought from Meroe in Abyssinia; it sometimes showed small spots and veining of white, but the best quality was pure black. A California marble, recently found near Colfax, and numbered 2799 in the State Museum Catalogue, answers very nearly to the description of the Lucullan marble. The "Nero Antico" was also a black marble, said to have been found in Laconia; it was fine-grained and compact, sometimes showing delicate veining of white.

Fragments of "Rosso Antico" marble are frequently found in the ruins of ancient Rome. The locality of the quarry is unknown, but a similar, if not the same, marble has recently been found at Skautari, a village in Greece. It is of a deep blood red color, sometimes inclining to purple, and even rose color; and sometimes clouded with white, black, or purple lines. A fine specimen from ancient Rome may be seen in the State Museum, numbered 6020. This marble was much admired and prized by the ancients. A marble of beautiful rose color has been found in California; it is numbered 5344 in the Catalogue of the State Museum, and is nearly identical with "Rosso Antico." Very little is yet known of its occurrence, but it is likely to be valuable and important. A description has been given elsewhere.

Cottonello marble was found near a town of the same name a short distance north of Rome. It was of many shades of red, but of inferior quality, although somewhat extensively used.

"Verde Antico," or as it is now called in English, "Verde Antique," is not a true marble, but is serpentine combined with carbonate of lime or magnesia. It was much prized by the ancients, and is still extensively used. The color is due to oxide of chrome, and as chromic iron and serpentine are both common and abundant in California, there is reason to hope that this beautiful ornamental stone may yet be found in the State. There are many fine specimens of "Verde Antico" from Italy in the State Museum.

"Giallo Antico" was considered one of the most valuable and beautiful of the ancient marbles. The grain was very fine, and the coloring beautiful and rich. It resembled the Sienna and Verona marbles, but exceeded them in beauty and texture. It was first found in Numidia, in Northern Africa, and for that reason sometimes called "Numidian marble." It

received a high polish. The base or keynote color was yellow of many shades, from the deepest to nearly white or pale straw color. Some varieties were brecciated, and others veined or mottled.

There are a number of examples of this marble still to be seen in Rome; columns at the Pantheon, the Arch of Constantine, and two columns at the Vatican. An ancient quarry has lately been discovered in Algiers, which is supposed to be that worked by the Romans, and afterwards abandoned and lost.

A beautiful yellow brecciated marble has been found at Tehachapi in Kern County, California, which resembles some of the described varieties of "Giallo Antico." It is certainly very beautiful. It is numbered 710 in the State Museum Catalogue. Another mention of this beautiful marble is made elsewhere.

Sienna marble, found near Volterra, is from cream color to dark yellow, sometimes veined with white, and even black. It is much employed at the present time, and is a durable and beautiful ornamental stone.

Nummulitic, or Verona marble, is in color from cream to nearly white. It was much used in ancient and mediæval buildings; the Roman amphitheater of Diocletian was built of it. It was extensively used in Venice; the porch and interior columns of the cathedral of Verona are fine examples.

Lumachello, or "fire marble," owes its wonderful brilliancy and play of colors to imbedded shells; it is now found at Bleiberg in Carinthia.

The Phrygian marble was very rare and costly; the ground color was creamy white, with veins of dark red, sometimes pink, or yellow. From its fancied resemblance to the plumage of the peacock, it was sometimes called "Pavonazetta." The Emperor Hadrian was very fond of it, and it was used in the construction of his tomb. The temples of Juno and Jupiter had one hundred and twenty columns, and a pillar of it was found in the ruins of Pompeii.

Oriental alabaster or onyx marble was held in high esteem by the ancients a thousand years or more ago. The quarries were lost, and for a long time remained unknown, until rediscovered in Egypt in 1849, by M. Delmonte, a French traveler. The marble of the same nature found in California and known as "Suisun marble," and "California onyx," is more beautiful in some of its varieties than the ancient, and it has gained a world wide reputation for beauty. In the fourth annual report of this office, on folio 72, this beautiful ornamental stone has been described, and the principal locality given. Attention has only lately been called to the marbles of our State, and while few fine varieties are known, many more will doubtless be found. There is reason to believe that there will soon be an awakening in our State and principal cities to the importance of this subject, and in time our mountains, now so celebrated for the vast quantities of gold they have given to the world, will be searched over for building materials, and the fortunate person who discovers a quarry of good building stone or marble, will be more sure of a fortune than the gold seeker who now prospects the heights for the precious metals. In anticipation of this, new localities have been recorded in these reports, and discoveries already made. It will be seen that during the few years of the duration of the State Mining Bureau, that something has been accomplished in this direction.

### TECHNICAL DESCRIPTION OF THE RED MARBLE (ROSEO ANTICO), FOUND IN AMADOR COUNTY, MENTIONED ABOVE.

Color, blood red, with mottlings of a slightly different shade, and an occasional vein of pure white. Specific gravity, 2.828; hardness, 3. By

qualitative analysis it was found to contain *lime*, *carbonic acid*, *oxide of iron*, and *silica*.

It dissolves with violent effervescence in hot hydrochloric acid, leaving a small red insoluble residue. The filtrate was golden yellow; ammonia threw down a heavy precipitate, leaving a transparent and colorless liquid, in which oxalate of ammonia caused a heavy precipitate of lime. This filtered off, phosphate of soda gave no precipitate, but the filtrate became slightly opalescent.

A few fragments of the marble, heated to redness in a platinum crucible, lost 14 per cent by weight. The residue was nearly white. It slaked and became hot on addition of water, but still contained carbonic acid, and effervesced slightly with hydrochloric acid. When dissolved and the residue dried on a water bath, a considerable portion was found to be magnetic. The non-magnetic portion looked, when seen under the microscope, like selenite, or more like brucite.

A sample treated in powder with cold diluted hydrochloric acid, left a large red residue, 9.4 per cent, and the solution was colorless. The red residue was partly soluble in boiling hydrochloric acid. Fused with alkaline carbonates it became decomposed, and was then soluble in hydrochloric acid, leaving a residue of silica, equal to 3.74 of the marble. The solution containing sesqui-chloride of iron was golden yellow; ammonia precipitated all the iron, leaving the solution colorless.

The yellow brecciated Tehachapi marble, from Kern County; the California giallo antico, mentioned above, was also examined chemically. It effervesced with acids and was nearly all soluble, the insoluble portion being only 1.6 per cent. From the solution carbonate of soda threw down a precipitate weighing 92 per cent.

Mr. Israel Luce, of Sacramento, called April 20, 1886, at the State Mining Bureau, and gave the following information regarding the locality of this marble.

The deposit is a large one, and is situated half a mile from the town of Tehachapi, on the road to Caliente. At that distance, on a flat on which there are springs of water, stands a small house. Less than a quarter of a mile from the house, up the hill, by an old wagon road, the excavations may be seen, and some large blocks lie quarried out. Mr. Luce says that some of the marble is of a pure yellow color and very beautiful.

### TEHACHAPI MARBLE (not Giallo Antico).

Mr. W. G. Campbell called April 23, 1886, at the State Mining Bureau and informed me that the so called *Tehachapi marble* is found nine miles west of the town of Tehachapi, in Bright's Valley. It is found in large quantities, and there is a large block at the railroad station at Tehachapi. The marble is fine grained and beautifully mottled, resembling specimen No. 5860 of the museum catalogue.

The beautiful recently discovered Humboldt marble is found on the lumber claim of Flanegan & Brosman, seven miles from Eureka. This is all the information this office has concerning it.

### DOLOMITE.

Dolomite is a double carbonate of lime and magnesia, sometimes in chemical equivalents, sometimes in mechanical mixture. It is called by many names, as dolomite, magnesian limestone, bitter spar, magnesian spar,

pearl spar, brown spar, compound spar, rhomb spar, muricalcite, picrite, tharandite, miemite, conite, gurhofian, and, lastly, Inyo marble.

It is considered true dolomite when in chemical proportions, otherwise magnesian limestone. Its hardness is from 3–5 to 4; specific gravity, 2–9; weight of cubic foot, about 180 pounds; luster, from vitreous to earthy; color, white, various shades of rose red, gray, brown, green, or nearly black. The composition is so varied that no single analysis would convey a correct idea; when expressed by the formula, Ca O, $CO_2$+MgO $CO_2$, it contains—

| | |
|---|---|
| Carbonate of lime | 54.35 |
| Carbonate of magnesia | 45.65 |
| | 100.00 |

In Klaproth's Chemical Mineralogy, published in English in 1801, may be found detailed analyses of two specimens, one from Sweden, and the other from the Tyrol, since which time very many analyses have been made and published. Before 1791 dolomite was confounded with the limestones, until the celebrated French chemist and mineralogist, Dolomieu, called attention to it. He first noticed it among the remains of ancient sculpture in Rome. In a paper to the Journal of Physics, he described it under the name of "A calcareous stone which effervesces but little with the acids." Saussure, a Swiss naturalist, found it in place in the Alps, and named it after the original discoverer "dolomie." The present name, "dolomite," was given to it in 1794 by Kirwan, an Irish chemist and mineralogist.

Dolomite was originally a sedimentary rock; this is proved by the fossils it often contains. There are several theories as to its formation, but the chemistry of its genesis is admitted to be very imperfectly understood. One theory is that it was formed in the beds of large lagoons, which became inland seas by being cut off from the ocean by some geological change in the earth's surface. As the confined water slowly evaporated, it dropped its lime, its salt, and lastly its magnesia, forming beds of dolomite. This theory is supported by the fact that beds of clay, gypsum, and rock salt are frequently found associated with dolomite. Another theory is that it was originally a precipitate let fall from the primitive sea by supersaturation, as thinolite is now being and has been formed in the alkaline lakes of the Great Basin of California, Nevada, and Utah. Still another theory assumes that the deposit was originally limestone, formed at the bottom of an ancient ocean, and that metamorphism has taken place by the addition of carbonate of magnesia from concentrated sea water, or by the abstraction of a portion of the lime by the action of water holding carbonic acid from a mineral or rock already containing a notable quantity of carbonate of magnesia. Dolomite has been formed artificially in several instances. Once in a glass flask containing a mineral water, which held bi-carbonate of lime and magnesia in considerable quantity, crystals of dolomite formed from two to three millimeters long.

Morlot produced dolomite crystals by heating carbonate of lime with solution of sulphate of magnesia in a closed tube.

Durocher subjected fragments of porous limestone in a bed of chloride of magnesium for three hours in a gun barrel kept at a red heat. Dolomite crystals formed which were stained yellow by iron. Other successful experiments of a similar nature have been recorded.

Dolomite has been used in sculpture, in architecture, and for making lime and cement. In the United States lime made of it is held in esteem,

but in England it is considered of bad quality, and is not much used. Magnesian limestones burn more easily, slake more slowly, and do not set so quickly as other limestones. As a building stone dolomite ranks among the best, but there are many different qualities, some of which are inferior to others. It is one of the chief building stones of the north of England, where a silicious dolomite is used in paving and building which gives perfect satisfaction. A yellow dolomite was used for the front of the Museum of Practical Geology in London, and the Parliament houses are built of it; but it has been shown that this stone was a failure. The commission of geologists and scientific men appointed to select a suitable stone for these buildings decided that crystalline dolomite was the best and most durable in proportion as the composition approached a mixture in chemical equivalents.

Dolomite was much used by ancient sculptors. The Apollo Belvidere, the greatest existing work of ancient art, is of dolomite. It was so called because placed in the belvidere of the Vatican. It represents the deity at the moment of his conquest of the python. The statue was found in the ruins of ancient Antium in 1503, and placed in the Vatican by Pope Julius II. Many other statues and works of art are of dolomite.

The so called Inyo marble has been selected for the building material to be used in the construction of the Sharon Gate at Golden Gate Park, and of which I am quite sure the people of San Francisco and California will be proud. It is my opinion that no use of the generous bequest could be more appropriate, or more likely to give general satisfaction, and I am fortunate in knowing by actual observation something concerning this now much-talked-of "Inyo marble."

As early as 1862 I traveled from the south side of Mono Lake to the head of Owen's Valley, then without a house or a settler north of Camp Independence. From Adobe Meadows our party of four saw for the first time the grand summit of White Mountain, capped with what seemed to be snow, slightly yellow in tint, which we attributed to the golden light of the setting sun, or dusty particles blown upon it from the desert adjacent; but snow it certainly appeared to be. When, however, we reached the base of the mountain, I discovered that the apparently snowy summit was in reality composed of a white rock; and in the rugged cañons we picked up fragments which, when freshly broken, were as pure and white as the finest Carrara marble. Subsequent chemical examination proved it to be dolomite of the finest quality. This was the now celebrated Inyo marble, which is found in numerous localities in the Inyo Range, from White Mountain south one hundred miles or more. While we make special mention here of Inyo marble, we must not for that reason omit to state that other beautiful marbles and building stones are found in those mountains, which I have seen and examined with great interest.

The most beautiful porphyries, equal to those of Egypt, are of frequent occurrence, while granite, syenite, pegmatite, and various crystalline and metamorphic rocks are met with in the sublime cañons, or lie tilted against the flanks of the higher mountains.

### TECHNICAL DESCRIPTION OF INYO MARBLE.

Color, pure white, saccharoidal, cryptocrystalline, hardness between 3 and 4, scratches calc-spar with ease, specific gravity 2,856, which being the case a cubic foot will weigh 178.5 pounds avoirdupois. While in mass the mineral is resistant to crushing force, a small fragment can be crumbled between the fingers to a crystalline powder, which under the micro-

scope may be seen to be obscure crystals with concave faces; some four sided pyramidal terminations are more distinct. At a red heat continued for two hours, the mineral loses 30.3 per cent by weight; the calcined mineral when wet with water becomes very hot and falls to a powder. In cold concentrated hydrochloric acid the mineral even when pulverized effervesces but feebly, but on application of heat the action is intensified, and a perfect solution is obtained which is golden yellow when concentrated, and pale straw color when dilute. The hydrochloric acid solution becomes darker colored on addition of nitric acid, and solution of sulphocyanide of potassium imparts a deep blood red color to it. From the first solution ammonia throws down a small precipitate; the filtrate from this precipitate is colorless. Oxalate of ammonia throws down a copious precipitate; this being filtered off, phosphate of soda gives a second and also copious white precipitate. The mineral does not absorb water to any considerable extent; a fragment weighing 39.71 grains, soaked in water for twenty-four hours, increased in weight only 79 milligrams.

Before the blowpipe on charcoal the mineral falls to a powder like aragonite. This is owing to the fact revealed by the microscope that it consists of crystals distinct in themselves held together by a feeble force. In a closed glass tube the mineral gives traces only of water. These reactions show the presence of the following substances: Carbonic acid, lime, magnesia, iron, alumina. The two latter in small quantities, and traces of water. A full qualitive and quantitive analysis will be made in the future.

Measurements of the crystals, average of ten, in decimals of an inch:

| | |
|---|---|
| Smallest | 0 — 00082 + |
| Largest | 0 — 02853 + |
| Average | 0 — 01472 + |

Mr. Israel Luce, a marble cutter of Sacramento, has given the following information as to the quarry from which the Inyo marble is to be taken to build the Sharon gate to the park: It lies a few miles from Keeler and near the lake. The exact locality is the southwest quarter of section fourteen, township sixteen south, and range thirty-seven east. It is owned by the Inyo Marble Company, incorporated last September in the State of Nevada.

A variety of dolomite has been found cropping on the Contra Costa hills, not far from the State University. When found it was said to be pozzuolana. An analysis made by Professor Rising, of the State University, gave the following result:

| | |
|---|---|
| Lime | 24.52 |
| Magnesia | 17.48 |
| Carbonic acid | 38.48 |
| Alumina and iron | 3.13 |
| Silica | 14.55 |
| Water | 2.09 |
| | 100.25 |

The rock has not been sufficiently developed to prove its quantity.

THE FOLLOWING ARE LOCALITIES

Of the principal rocks, building stones, and building materials collected by the State Mining Bureau:

1. AGALMATOLITE (?), somewhat resembling the Chinese figure stone. This beautiful ornamental stone is found two miles west of Greenwood, El Dorado County, in a vein from six inches to a foot in thickness.
2. BASALT, plains between Oroville and Pence, Butte County.
3. BASALT. Used for street pavement. Mt. Pisgah quarries, one mile south of Petaluma, Sonoma County.
4. FINE GRAINED DIORITE OR BASALT, Folsom, Sacramento County. Strongly resembling serpentine externally.
5. BUILDING STONE, Mr. Wheat's house, Double Springs, Calaveras County.
6. DIORITE, wall rock of the Clipper Gap Iron Mine, Placer County.
7. DIORITE, near the bridge, section fifteen, township eighteen north, range thirteen east, Mount Diablo meridian, Placer County.
8. DIORITE, township thirteen north, range eight east, Mount Diablo meridian, Placer County.
9. DIORITE, iron mines near Clipper Gap, section twenty-four, township thirteen north, range eight east, Placer County.
10. DIORITE, wall of furnace building, Clipper Gap Iron Mines, Placer County.
11. DIORITE, fine grained, Mineral Hill District, Mono County. It contains considerable finely divided magnetite.
12. DIORITE, fine grained, in which magnetite is replaced by pyrites, Mineral Hill, Mono County.
13. DIORITE, croppings near Cave City, Calaveras County.
14. DOLERITE, east wall, Comanche Mine, Mono County.
15. DOLOMITE, Modoc Mine, Inyo County.
16. DOLOMITE, Guadalupe Quicksilver Mine, Santa Clara County.
17. DOLOMITE (resembling fossil coral), Morro, San Luis Obispo County.
18. DOLOMITE, Deep Spring Valley, Inyo County.
19. DOLOMITE, white, Amargosa Wash, San Bernardino County.
20. DOLOMITE, Inyo County.
21. DOLOMITE, white, Tujunga Cañon, seven miles from San Fernando, San Gabriel Mountains, Los Angeles County; valuable for building and manufacturing purposes.
22. DOLOMITE (impure), found near the State University, Berkeley, Contra Costa County; mistaken for pozzuolana.
23. FOSSILIFEROUS ROCK, near Soledad, San Diego County.
24. GARNET ROCK, Calpella, Mendocino County. A large cropping.
25. GLAUCOPHANE ROCK, wall rock of the Collier Mine, six miles northeast from Murphy's, Calaveras County.
26. GNEISS, brought to San Francisco on river schooners and used for street pavements.
27. GNEISS, said to be found in San Francisco in place.
28. COARSE GRANITE, near Sacramento.
29. GRANITE, Newcastle, Placer County.
30. GRANITE, Folsom, Sacramento County.
31. GRANITE, Rocklin, Placer County.
32. GRANITE, Yosemite Valley, Mariposa County.
33. GRANITE, Mariposa Mine, Mariposa County.

34. GRANITE, Crystal Lake, Summit Valley, Nevada County.
35. GRANITE (micaceous), near Penryn, Placer County.
36. GRAVEL, San Pablo, Contra Costa County.
37. GRAVEL, distinct from the sandstone; used in macadamizing streets, Los Angeles.
38. HORNBLENDE ROCK, Santa Barbara Mountains.
39. HORNBLENDE ROCK, Healdsburg, Sonoma County.
40. HORNBLENDE ROCK, Folsom, Sacramento County.
41. HORNBLENDE ROCK, Gold Run, Placer County.
42. LAVA, Mendocino County.
43. LAVA, Napa County.
44. LAVA, compact, near St. Helena, Napa County.
45. LAVA, basaltic, near Calistoga, Napa County.
46. LAVA, red, Butte Mountain, near Jackson, Amador County.
47. LAVA, near Santa Rosa, Sonoma County.
48. LAVA, trachytic (?), which caps isolated hills between Milton and San Andreas, Calaveras County.
49. LAVA, brecciated, found in immense cliffs, Little Shasta River, Shasta County.
50. LAVA, basaltic, showing a scale, which is due to oxidation of iron to limonite, near Doon's Mill, Butte County.
51. LAVA, white (so called), indurated volcanic ash, near Murphy's, Calaveras County.
52. LAVA, which exists in immense quantities on the borders of Mono Lake, Mono County. Owens River cuts through this formation in a deep cañon. It is easily decomposed, and supposed to yield the soda salts so abundant in that region. It crops out also at Adobe Meadows, in Mono County.
53. LAVA, white (so called), probably indurated volcanic ash, Southern Pacific Railroad, Los Angeles County.
54. LAVA, and pumice, Alviso, Santa Clara County. The Guadalupe River winds through a chain of volcanic vents. They rise but a few feet above the valley.
55. LAVA, cellular, with zeolite, Soledad Cañon, Los Angeles County.
56. LAVA, cellular, Captain Jack's Cave, Modoc Lava Beds, Modoc County.
57. LIMESTONE, calcite, Santa Cruz.
58. LIMESTONE, San Bernardino County.
59. LIMESTONE, tufaceous (thinolite?), Lassen County, section thirty, township thirty north, range fourteen west.
60. LIMESTONE (marble), Clipper Gap Lime Quarry, section thirty, township thirteen north, range nine east, Mount Diablo meridian, Placer County.
61. LIMESTONE (marble), Cave Valley, near Auburn, Placer County.
62. LIMESTONE (hydraulic?), found at the residence of Captain J. M. McDonald, San Francisco.
63. LIMESTONE (fossiliferous), Almaden Consolidated Quicksilver Mining Company, southwest quarter section thirty-four, township twenty-six south, range ten east, San Luis Obispo County; elevation fifteen hundred feet.
64. LIMESTONE, Bridgeport, Mono County.
65. LIMESTONE, Tres Pinos, San Benito County, fifteen miles east of the town.
66. LIMESTONE, Modoc Mine, Inyo County.

67. LIMESTONE, arenaceous, found in the bed of the river, near Yreka, Siskiyou County.

68. LIMESTONE OR MARBLE, blue, with veins of white, Pence, Butte County. It is soluble in hydrochloric acid with effervescence, leaving a small hepatic residue—when struck with a hammer it emits a feted odor—anthraconite—burns to a pure white lime, which slakes perfectly. This stone is well adapted for building purposes, as a useful and ornamental stone. Valuable, also, for manufacturing purposes.

69. LIMESTONE, Posa Creek, foothills of the Sierra Nevada, Kern County.

70. LIMESTONE, near Auburn, Placer County.

71. LIMESTONE, silicious, with what seems to be graphite or molybdenite in small scales, Kern County.

72. LIMESTONE (marble), Bitterwater Ranch, San Benito County.

73. LITHOGRAPHIC STONE, Kern County.

74. MAGNESITE (carbonate of magnesia), Tulare County.

75. MAGNESITE, Damascus, Placer County. Large quantities of this mineral at the locality.

76. MARBLE, white, fifteen miles from Monterey.

77. MARBLE, near Angel's Camp, Calaveras County.

78. MARBLE, Bear Creek, three miles from Colfax, Nevada County.

79. MARBLE, Abby's Ferry, Tuolumne County.

80. MARBLE, Giallo Antico, Tehachapi, Kern County.

81. MARBLE, white, Tuolumne County.

82. MARBLE, white, section fifteen, township thirteen north, range eight east, Mount Diablo meridian, Placer County. This marble has been used in San Francisco for the generation of carbonic acid in the manufacture of mineral waters. It is used also as a flux in iron smelting.

83. MARBLE, white, Tehachapi, Kern County.

84. MARBLE, black, near Central Pacific Railroad, two miles above Colfax, at the lower end of the high trestle, Placer County.

85. MARBLE, half a mile from the railroad depot, Auburn, Placer County.

86. MARBLE, from the Cave, at Cave City, Calaveras County.

87. MARBLE, bed of the Tuolumne River, Tuolumne County.

88. MARBLE, white, nine miles north of Ione, Amador County.

89. MARBLE, red, a beautiful ornamental stone, bearing a good polish, Amador County.

90. MARBLE, fine white, slightly bluish green, suitable for building stone and lime, Inyo County, near C. & C. R. R.

91. METAMORPHIC SLATE, which accompanies the quartz vein, Soulsby Mine, Tuolumne County.

92. METAMORPHIC SLATE, with quartz attached, Soulsby Mine, Tuolumne County.

93. MICA SCHIST, Gold Lake, Plumas County.

94. MICA SCHIST, Ivawatt District, San Bernardino County.

95. MICA SCHIST, Berkeley Hills, Alameda County.

96. PORPHYRY, foot wall Standard Mine, Bodie District, Mono County.

97. PORPHYRY, Bodie Mine, Bodie Mining District, Mono County.

98. PORPHYRITIC DIORITE, Clipper Gap, Placer County.

99. PORPHYRY, red, eight or nine miles from Mesquite Station, San Diego County.

100. PORPHYRY BEDROCK, Malakoff Mine, North Bloomfield, Nevado County.

101. PORPHYRY, Polar Star Mine, Dutch Flat, Placer County.

102. PORPHYRY (probably diorite), Placer County. Said to be found in large quantities. A very beautiful building and ornamental stone, equal to the finest porphyries of Egypt and Europe.
103. PORPHYRY, seventy-five feet thick, Bodie Mine, Mono County.
104. PUMICE STONE, near Mammoth City, Mono County.
105. PUMICE STONE, near Dos Palmos, San Diego County.
106. ROCK RESEMBLING HALLEFLINTA, Fruit Vale, Alameda County.
107. ROCK RESEMBLING HALLEFLINTA, Spanish Ranch, Plumas County.
108. SAND ROCK, with chalcedony, ten miles west of Havilah, Kern County.
109. SANDSTONE, near San José, Santa Clara County.
110. SANDSTONE, eighteen feet thick, Tuolumne County.
111. SANDSTONE, Saucelito, Marin County.
112. SANDSTONE, Glenn Mills, San Mateo County.
113. SANDSTONE, eight miles west of Napa City, Napa County.
114. SANDSTONE, suitable for building stone, Eureka, Humboldt County.
115. SANDSTONE (stained red), Santa Margarita Ranch, San Diego County, near San Luis Rey.
116. SANDSTONE, Glenn Mills, San Mateo County.
117. SANDSTONE, west side of Great Eastern Quicksilver Mine, Sonoma County, supposed to be the footwall.
118. SANDSTONE (coarse grained), Coal Mine, San Benito County, township nineteen south, range eleven east.
119. SANDSTONE (fine grained), Coal Mine, San Benito County, township nineteen south, range eleven east.
120. SANDSTONE, Seal Rock, off Point St. George, northwest boundary of California.
121. SANDSTONE, fossiliferous, near Shasta.
122. SANDSTONE, variegated, near Buchanan Copper Mine, Fresno County.
123. SANDSTONE, feldspathic, sedimentary rock, composed of feldspar, quartz mica, and hornblende, Telegraph Hill, San Francisco.
124. SANDSTONE, Pescadero, San Mateo County.
125. SCORIA, Point San Pedro, San Mateo County, eighteen miles south of San Francisco.
126. SCHIST with garnets, mouth of Russian River, Sonoma County.
127. SCHIST, with impressions of fossil plants, found in the lignite near Vacaville, Solano County.
128. SEDIMENTARY DEPOSIT, Chalk Bluffs, near surface, containing impressions of fossil leaves.
129. SEDIMENTARY MATTER, North Bloomfield Mine, Nevada County.
130. SEDIMENTARY DEPOSIT, found in digging a well, at a depth of seventy-five feet, near Roseville Station, Placer County.
131. SEDIMENTARY ROCK, San Francisco.
132. SEDIMENTARY ROCK, Cliff House, San Francisco.
133. SEDIMENTARY ROCK, Oil Creek, San Luis Obispo County, found in slabs from two to eight inches thick, and from one to three feet wide.
134. SEDIMENTARY DEPOSIT, resembling diatomaceous earth, twelve miles east of Santa Rosa, Sonoma County.
135. SERPENTINE, Bear Valley, Mariposa County.

136. SERPENTINE, Key's Tunnel, California Mine, Yolo County.
137. SERPENTINE, three hundred yards northeast of Pine Tree Mine, Bear Valley, Mariposa County.
138. SERPENTINE, transformation from gabbro, Peninsula of San Francisco.
139. SERPENTINE, Fort Point, San Francisco.
140. SERPENTINE, Yuba County.
141. SERPENTINE, Market and Guerrero Streets, San Francisco.
142. SERPENTINE, center of Lone Mountain Cemetery, San Francisco.
143. SERPENTINE (five varieties), Lone Mountain Cemetery, San Francisco.
144. SERPENTINE, Market Street Cut, San Francisco.
145. SERPENTINE SCHISTOSE, met with before reaching the so called footwall, New Almaden Quicksilver Mine, Santa Clara County.
146. SERPENTINE, Kelseyville, Lake County.
147. SERPENTINE, Bald Prairie, Placer County.
148. SERPENTINE, Monterey, Monterey County.
149. SHALE (with Lignite), near San Bernardino, San Bernardino County.
150. SHELL ROCK, Sandstone Bluff, township one north, and on the Humboldt meridian, Humboldt County.
151. SILICIOUS BRECCIA, Little Butte, section thirteen, township thirteen south, range thirty-five east, Mount Diablo meridian.
152. SLATE AND GRANITE, Bodie District, Mono County.
153. SLATE AND PYRITES, Mariposa Tunnel, two thousand six hundred and twenty foot point, Mariposa County.
154. SLATE, which crops out over a large extent of country between San Andreas and Cave City, Calaveras County; strike nearly west northwest, dip nearly vertical.
155. SLATE, near Red Hill, Butte County.
156. SLATE, near Emigrant Gap, Placer County.
157. SLATE, roofing, El Dorado County.
158. STRATIFIED FORMATION, old lime kiln, near Clipper Gap, Placer County.
159. SYENITE, Point San Pedro, San Mateo County, eighteen miles south of San Francisco.
160. TALCOSE ROCK, wall rock of the Idaho Mine, Grass Valley, Nevada County.
161. TALCOSE SLATE, Tuolumne County.
162. TALCOSE SLATE, El Dorado County.
163. TRACHYTE, near St. Helena, Napa County.
164. TRIPOLITE, Santa Barbara.
165. TUFA, Kern County.
166. TUFA, Sulphur Springs, Mono County.
167. TUFA, very interesting formation, Gold Gravel Hydraulic Mine, La Porte, Plumas County.
168. VOLCANIC BRECCIA, used as a building stone in Susanville. It is said to resist the action of fire, as shown during a recent conflagration in that town. Section five, township twenty-nine north, range thirteen east, eight and one half miles from Susanville, Lassen County.
169. VOLCANIC CONGLOMERATE, Mono Lake, Mono County.
170. VOLCANIC ROCK, Kelsey Valley, Lake County, taken from a well ten feet deep. It is several feet in thickness. Sinking the well was discontinued, owing to the emanation of large quantities of carbonic acid gas.

171. VOLCANIC ASH (allied to pumice stone), Calaveras County, eighteen miles from Lodi.

172. VOLCANIC TUFA (so called white lava). A similar rock is used in Europe in building ovens for bread baking. Found near Etna Springs, Napa County.

173. VOLCANIC ASH, Chalk Bluffs, Nevada County.

174. VOLCANIC ASH, Ione Valley, Amador County.

175. VOLCANIC ASH, Tufa or Lava, Mono County, near Carson and Colorado Railroad.

The following have been added since the publication of the second volume of the museum catalogue:

176. ANTHRACONITE, cave at Murphy's, Calaveras County.

177. BITUMINOUS SHALE, from which oil and gas can be manufactured, Calistoga, Napa County.

178. BRECCIATED QUARTZ, vein matter, Calistoga or Venus Mine, Mt. St. Helena, Napa County.

179. BROWN COAL (Lignite), from vein near Lancha Plana, Calaveras County.

180. BUILDING STONE, Valley Springs, Calaveras County.

181. CAPROCK, used for paving sluices, worn from thickness of eighteen inches by eight months' use, Spring Valley Mine, Cherokee, Butte County.

182. CONCRETION, resembling a geode, Bottle Hill, El Dorado County.

183. DUNNITE, from Carga Muchacho gold mining district, San Diego County. This rock is more minutely described elsewhere.

184. FELDSPAR (orthoclase), Hunsecker Grade, stage road from San Diego to Julian, San Diego County.

185. FREESTONE, from Stony Brook, near Niles, Alameda County, on the property of J. D. Farwell. It seems to possess many of the qualities which characterize a good building stone. In the quarry where the croppings have long been exposed to the elements, it shows evidences of great durability, as it does laid in the piers and abutments of the railroad bridge which crosses the Alameda Creek near by. This block has been sculptured by Morton A. Edwards, of San Francisco, and was presented by J. D. Farwell.

186. LAVA, used in building at Mokelumne Hill, Calaveras County. Three varieties. It is a durable and convenient material, and could be more generally utilized.

187. PEGMATITE, Hunsecker Grade, stage road from San Diego to Julian, San Diego County.

188. ROCK SPECIMEN, from the summit of Mt. St. Helena, altitude 4,343 feet. It rises in columns like basalt, in large outcrops; the whole summit of the mountain is of this formation. The soil produced by its disintegration is of a pale green color. Napa County.

189. ROCK SPECIMEN, from the side of Mt. St. Helena, Napa County.

190. ROCK RESEMBLING HALLEFLINTA, found on the sides of Mt. St. Helena, Napa County.

191. ROCK SPECIMEN, with veins of cinnabar, Manhattan Mine, Napa County.

192. ROCK SPECIMEN, near Deffebach's Ranch, one mile from the bay, Sausalito, Marin County.

193. ROCK SPECIMEN, from first tunnel on N. P. C. R. R., Blithdale Station, Marin County.

194. ROCK SPECIMEN, with microscopical section, Union Mine, near San Andreas, Calaveras County, believed to be slaty serpentine.

195. ROCK CONTAINING FOSSIL TURRITELLA. Section thirty-three, township twenty-two south, range sixteen east, Mt. Diablo meridian. Fossils are very abundant at this locality.

196. SAND, from the beach, near the whaling station, Monterey, Monterey County.

197. SAND, from opposite the bath house, Santa Barbara.

198. SAND, from the ocean beach, two miles south of Pescadero, San Mateo County.

199. SERPENTINE, Point Tiburon, Marin County.

200. SERPENTINE FOLIATED, altered to Picrolite, found in considerable quantity in Mendocino County, township nineteen north, range ten west, Mt. Diablo meridian.

201. SILICIOUS MINERAL, OR ROCK, probably a deposition from hot mineral water. This specimen is opaque, and shows the effect of solfataric action about the orifices, round the mouths of which little ridges of silica have been deposited. Manhattan Quicksilver Mine, Napa County.

202. STEATITE, Coulterville, Mariposa County. Of excellent quality, and said to be in large quantities.

203. WALL ROCK, Manhattan Mine, Napa County.

204. WALL ROCK WITH FOSSILS, Manzanita Gold Mine, Sulphur Creek, Colusa County.

An excellent building stone is found in a white rock, of sedimentary origin, thought to be volcanic ash. It is found in the foothills over a large extent of country. It has been used in building in Mokelumne Hill, Calaveras County, for many years, where it has been found to be very durable. The walls of some buildings which were destroyed by fire are uninjured, or only slightly so. There are some fine buildings being constructed of this stone in St. Helena, in Napa County. Their general appearance is very fine. This material should be introduced into San Francisco and other large towns.

Basaltic rocks are quite common in numerous localities in the State. In Butte County, between Oroville and Magalia, there are large outcrops of cellular lava and fine columnar bluffs. The stone is of excellent quality, and quite suitable for pavements and building. The basaltic columns of Mount St. Helena have been described elsewhere.

EXAMINATION OF DUNNITE FROM SAN DIEGO COUNTY—NO. 183 OF THE ABOVE LIST.

Color pale green, with dark spots. It consists of three distinct minerals—*olivine*, *magnetite*, and a *micaceous mineral*, unknown.

In its natural state it slightly deflects the needle. When pulverized, a portion can be removed by the magnet, and on heating to redness, a second smaller portion becomes magnetic, and can be separated in the same way. A sample of rock was pulverized, sized by sifting, and placed in a long glass tube full of water. On placing the tube in a vertical position, the magnetite fell first. The other two minerals did not separate, but fell together, showing that they had nearly the same specific gravity.

Another portion was divided into three parts by the magnet as follows:

| | |
|---|---|
| (A) magnetic | 12.2 |
| (B) magnetic by heating | 2.1 |
| (C) non-magnetic | 85.7 |
| | 100.0 |

The non-magnetic portion (C) was examined under the microscope and found to consist of two minerals, one dark colored, but which changed to bronze color by heating. The other was pale green in nearly transparent angular particles, with vitreous luster. Being of the same sized particles, of nearly the same specific gravity, they were counted under the microscope and found to be in equal numbers very nearly, therefore the mechanical analysis would stand thus:

| | |
|---|---|
| Magnetic (A) | 12.20 |
| Magnetic by heating (B) | 2.10 |
| Micaceous (D) | 42.85 |
| Pale green (E) | 42.85 |
| | 100.00 |

The portion (C) from which magnetite had been removed by the magnet was boiled repeatedly in nitro-hydrochloric acid, by which treatment the micaceous mineral was decomposed. The residue being well washed, the pale green mineral (olivine) was left in a state of apparent purity. The specific gravity was found to be 3.321.

This is a beautiful and interesting rock, and one that it would seem might be put to some practical use. Sections cut for the microscope are also very interesting.

The following is the result of an examination of the straw-colored sandstone from Santa Barbara, used in the construction of the old Mission, and latterly in a number of fine modern buildings in the beautiful town of Santa Barbara: Specific gravity, 2.7; one part of the stone by weight absorbed only .012 parts of water. The stone is rather easily reduced to powder; more so when wet. In this respect it resembles the sandstone of a similar color found at San José. Under the microscope the powder is seen to consist of rounded grains of milky quartz. The silica was determined and found to be 75 per cent. The specific gravity being as above, a cubic foot would weigh 168.75 pounds. While this is a beautiful and easily worked building stone, its use in the old Mission has shown that it is not very durable.

## TABLE OF ALTITUDES.

The first 1,109 are copied from Bulletin of the United States Geological Survey No. 5; the remainder are gathered from various sources, and may be considered as approximative. They are probably as correct as those generally first published in a new and large State like California.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 1 | Abbey Hill | U. S. C. & G. S. | 1,232 |
| 2 | Abbott | U. S. C. & G. S. | 375 |
| 3 | Acampo | | 59 |
| 4 | Adalante | Cal. P. R. R. | 76 |
| 5 | Adams, Mt. | Wheeler | 8,431 |
| 6 | Adobe | Wheeler | 282 |
| 7 | Adobe Meadows | Wheeler | 6,594 |
| 8 | Agua Caliente | Emory | 3,013 |
| 9 | Agua Caliente | Wheeler | 725 |
| 10 | Agua Caliente | Wheeler | 3,617 |
| 11 | Alamo Mocho | P. R. R. Reports | —70 |
| 12 | Alcatraz Island | U. S. C. & G. S. | 143 |
| 13 | Algodones | P. R. R. Reports | 46 |
| 14 | Alpine | C. P. R. R. | 2,822 |

TABLE OF ALTITUDES—Continued.

| No. | STATION. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 15 | Alta | C. P. R. R. | 3,607 |
| 16 | Altamont | C. P. R. R. | 740 |
| 17 | Alturas | Wheeler | 4,365 |
| 18 | Alturas Hill | Wheeler | 4,459 |
| 19 | Amys' Ranch | Wheeler | 1,494 |
| 20 | Anaheim | C. P. R. R. | 130 |
| 21 | Anderson | Toner | 33 |
| 22 | Anderson, Mt. | Whitney | 9,000 |
| 23 | Angel Island, N. W. | U. S. C. & G. S. | 159 |
| 24 | Angel Island Peak | U. S. C. & G. S. | 782 |
| 25 | Aneta | Toner | 161 |
| 26 | Antelope | C. P. R. R. | 154 |
| 27 | Antelope Ranch | Wheeler | 359 |
| 28 | Antelope Spring | Wheeler | 4,272 |
| 29 | Arab Spring | Wheeler | 5,697 |
| 30 | Arcade | C. P. R. R. | 55 |
| 31 | Arlington Bridge | Wheeler | 3.375 |
| 32 | Ash Springs | Wheeler | 1,810 |
| 33 | Auburn | C. P. R. R. | 1,360 |
| 34 | Auburn | Smithsonian Institute | 1,176 |
| 35 | Aurora | Wheeler | 7,449 |
| 36 | Advisadera, Point | U. S. C. & G. S. | 171 |
| 37 | Azusa | Wheeler | 594 |
| 38 | Babbitt, Camp | Williamson | 384 |
| 39 | Bache, Mt. | U. S. C. & G. S. | 3,793 |
| 40 | Bache, Mt. | Peterman | 3,790 |
| 41 | Bacons' Ranch | Wheeler | 4,076 |
| 42 | Bagley's Ranch | Wheeler | 5,387 |
| 43 | Bah-li-vah Spring | Wheeler | 6,284 |
| 44 | Bakersfield | Wheeler | 432 |
| 45 | Baker's Ranch | Toner | 3,285 |
| 46 | Bald Mountain | Wheeler | 5,829 |
| 47 | Bald Mountain | Wheeler | 8,295 |
| 48 | Bald Rock | Wheeler | 7,825 |
| 49 | Balley, Mt. | Whitney | 6,357 |
| 50 | Ballona | L. A. & I. R. R. | 103 |
| 51 | Bantas | C. P. R. R. | 30 |
| 52 | Bardins | Monterey R. R. | 48 |
| 53 | Bare Mountain | Wheeler | 6,039 |
| 54 | Bares' Ranch, Surprise Valley | Wheeler | 4,680 |
| 55 | Barker's Ranch | Wheeler | 594 |
| 56 | Barnard's Hotel | Wheeler | 3,851 |
| 57 | Batavia | C. P. R. R. | 64 |
| 58 | Battle Creek Meadows | Wheeler | 4,700 |
| 59 | Battle Hill | | 2,389 |
| 60 | Baxter's Station | Wheeler | 4,115 |
| 61 | Bear Valley Post Office | Wheeler | 2,087 |
| 62 | Bear Valley, Town Hotel | Wheeler | 6,592 |
| 63 | Beckworth's Pass | Wheeler | 5,193 |
| 64 | Beckworth's Pass | R. R. surveys | 4,682 |
| 65 | Beckworth's Pass | Whitney | 5,327 |
| 66 | Beckworth's Store | Wheeler | 4,887 |
| 67 | Bell Mill | Wheeler | 3,681 |
| 68 | Bello | Cal. P. R. R. | 203 |
| 69 | Benicia Arsenal | U. S. C. & G. S. | 6 |
| 70 | Benicia Barracks | Med. Dept., U. S. A. | 64 |
| 71 | Bennett's Wells, Death Valley | Wheeler | —68 |
| 72 | Berenda | Toner | 256 |
| 73 | Bidwell | Wheeler | 4,612 |
| 74 | Bidwell Camp | Wheeler | 4,647 |
| 75 | Bidwell Camp | Med. Dept., U. S. A. | 4,680 |
| 76 | Bidwell, Mt. | Wheeler | 8,551 |
| 77 | Bidwell's Bar, South Fork Feather River | Wheeler | 342 |
| 78 | Bielowski | Whitney | 3,269 |
| 79 | Biggs's | C. P. R. R. | 124 |
| 80 | Big Logan | Toner | 70 |
| 81 | Big Meadow Ranch | Wheeler | 6,464 |
| 82 | Big Meadows | Wheeler | 4,234 |
| 83 | Big Oak Flat | Wheeler | 2,823 |

TABLE OF ALTITUDES—Continued.

| No. | STATION. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 84 | Big Springs | Wheeler | 4,553 |
| 85 | Big Tree Grove, Calaveras County | Wheeler | 4,794 |
| 86 | Big Tree Station | Wheeler | 3,925 |
| 87 | Birds' Springs | Wheeler | 3,949 |
| 88 | Black Bluff | U. S. C. & G. S. | 208 |
| 89 | Black Mountain | U. S. C. & G. S. | 2,811 |
| 90 | Blackmore's Ranch | Wheeler | 2,230 |
| 91 | Black Ridge | U. S. C. & G. S. | 756 |
| 92 | Black Springs | Wheeler | 6,485 |
| 93 | Blodgett's Ranch | Wheeler | 216 |
| 94 | Blood's Station | Wheeler | 6,979 |
| 95 | Blue Cañon | C. P. R. R. | 4,693 |
| 96 | Bluff Point | U. S. C. & G. S. | 177 |
| 97 | Board Ranch | Wheeler | 4,639 |
| 98 | Boca | Wheeler | 5,230 |
| 99 | Boca | C. P. R. R. | 5,531 |
| 100 | Bodega Head | U. S. C. & G. S. | 241 |
| 101 | Bold's Ranch | Wheeler | 141 |
| 102 | Bonita, Point | U. S. C. & G. S. | 283 |
| 103 | Boneyard Ranch | Wheeler | 2,450 |
| 104 | Bootjack Ranch | Wheeler | 2,107 |
| 105 | Borden | Toner | 172 |
| 106 | Boston Peak | Wheeler | 6,519 |
| 107 | Bower Cave | Wheeler | 2,360 |
| 108 | Box Elder | | 1,430 |
| 109 | Boyd's Ranch | Wheeler | 622 |
| 110 | Bozeman's Ranch | Wheeler | 3,157 |
| 111 | Brandy City | | 3,592 |
| 112 | Breccia Pass | Goddard | 10,150 |
| 113 | Breckinridge, Mt. | Wheeler | 5,693 |
| 114 | Breckenridge, Mt. | Wheeler | 7,418 |
| 115 | Brewer, Mt. | Whitney | 13,886 |
| 116 | Brewery | Wheeler | 2,838 |
| 117 | Bridgeport | Wheeler | 1,357 |
| 118 | Pridgeport Post Office | Wheeler | 6,423 |
| 119 | Brighton | S. & P. R. R. | 42 |
| 120 | Brighton, cross S. V. R. R. | C. P. R. R. | 54 |
| 121 | Broncho | Wheeler | 5,310 |
| 122 | Brown's Flat | Wheeler | 1,964 |
| 123 | Brown's Peak | Wheeler | 5,392 |
| 124 | Brown's Ranch | Wheeler | 1,759 |
| 125 | Buckeye | Wheeler | 4,938 |
| 126 | Buckhorn Ranch (or Warren Station) | Wheeler | 693 |
| 127 | Buck's Ranch | Wheeler | 5,112 |
| 128 | Buena Vista | Wheeler | 323 |
| 129 | Buena Vista | Nev. Co. N. G. R. R. | 2,618 |
| 130 | Buena Vista Oil Works | | 790 |
| 131 | Buffalo Station | Wheeler | 4,378 |
| 132 | Burrows, Mt. | Wheeler | 4,267 |
| 133 | Burst Rock | Wheeler | 9,157 |
| 134 | Bush Hill | U. S. C. & G. S. | 482 |
| 135 | Butte Creek Bridge | Wheeler | 4,692 |
| 136 | Butte Creek House | Wheeler | 5,758 |
| 137 | Butt, Mt. | Wheeler | 7,830 |
| 138 | Byrnes' Ferry | Wheeler | 380 |
| 139 | Cady, Camp | Wheeler | 1,894 |
| 140 | Cahto | Smithsonian Inst. | 2,000 |
| 141 | Cahuenga Pass | Wheeler | 750 |
| 142 | Cajon Pass | Pacific R. R. Reports | 4,676 |
| 143 | Cajon Pass Divide | Wheeler | 4,195 |
| 144 | Cajon Ranch | Pacific R. R. Reports | 412 |
| 145 | Calaveras Grove | Wheeler | 4,730 |
| 146 | Caliente | C. P. R. R. | 1,290 |
| 147 | Caliente | Wheeler | 1,314 |
| 148 | Caliente Springs | Wheeler | 3,688 |
| 149 | California City Point | U. S. C. & G. S. | 75 |
| 150 | Calistoga | C. P. R. R. | 331 |
| 151 | Campo, Signal Station | U. S. Signal Office | 2,527 |
| 152 | Camptonville | Toner | 2,388 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 153 | Camp Weldon (Mountain) | Wheeler | 2,716 |
| 154 | Canebrake Ranch | Wheeler | 3,904 |
| 155 | Cannelas Ranch | Wheeler | 799 |
| 156 | Cannon | C. P. R. R. | 90 |
| 157 | Cañon de Turruco Pass | | 4,256 |
| 158 | Cañon Spring | Wheeler | 1,238 |
| 159 | Cañon Station | Wheeler | 2,650 |
| 160 | Capitan Grande | Pacific R. R. Reports | 730 |
| 161 | Caples Ranch | Wheeler | 7,780 |
| 162 | Caples Spring | Wheeler | 5,512 |
| 163 | Carbondale | C. P. R. R. | 222 |
| 164 | Caribou Bridge, North Fork | Wheeler | 2,843 |
| 165 | Carizzo | | 431 |
| 166 | Carlos, Mt. | Whitney | 4,977 |
| 167 | Carmel, Mt. | U. S. C. & G. S. | 4,415 |
| 168 | Carnelian Hot Springs | Wheeler | 6,237 |
| 169 | Carson Cañon Toll House | Wheeler | 6,596 |
| 170 | Carson Pass | Goddard | 7,972 |
| 171 | Carson Pass | Whitney | 8,759 |
| 172 | Carson Pass | Wheeler | 8,634 |
| 173 | Cartago | | 3,589 |
| 174 | Carthage, on Owens Lake | Wheeler | 3,589 |
| 175 | Cary, Mt. | Wheeler | 9,970 |
| 176 | Cascade | C. P. R. R. | 6,538 |
| 177 | Castle, Mt. | Wheeler | 9,013 |
| 178 | Castle Peak | Whitney | 12,500 |
| 179 | Castle Rock | Wheeler | 9,872 |
| 180 | Castroville, on line of S. P. R. R. | Monterey R. R. | 19 |
| 181 | Catherines | S. P. R. R. | 512 |
| 182 | Cathedral Rock (lower) | Wheeler | 6,430 |
| 183 | Cathedral Rock (higher) | Wheeler | 6,529 |
| 184 | Cathey's Ranch | Wheeler | 1,260 |
| 185 | Cavallos, Point de los | U. S. C. & G. S. | 126 |
| 186 | Coyote Ridge | U. S. C. & G. S. | 1,034 |
| 187 | Cedar, Mt. | Wheeler | 8,308 |
| 188 | Cedar Point | Toner | 5,614 |
| 189 | Cedarville | Wheeler | 4,675 |
| 190 | Centerville | Wheeler | 503 |
| 191 | Cerro Gordo Landing, Col. River | Wheeler | 3,656 |
| 192 | Cerro Gordo Pass | Wheeler | 8,874 |
| 193 | Chapman's Ranch | Wheeler | 4,992 |
| 194 | Chapperal House | Wheeler | 5,076 |
| 195 | Chemehuevis Pass | K. P. R. R. Surveys | 675 |
| 196 | Chico | C. P. R. R. | 193 |
| 197 | Chico | Smithsonian Inst. | 150 |
| 198 | Chico | Wheeler | 177 |
| 199 | Chinese Camp | Wheeler | 1,299 |
| 200 | Chiquita Peak | Wheeler | 8,136 |
| 201 | Chuckawalla | Wheeler | 2,095 |
| 202 | Cicero | C. P. R. R. | 90 |
| 203 | Cienega | L. A. & I. R. R. | 121 |
| 204 | Cisco | C. P. R. R. | 5,934 |
| 205 | Cisco (site) South Fork Yuba River | Wheeler | 5,654 |
| 206 | Clark Peak | Wheeler | 11,295 |
| 207 | Clark's | Wheeler | 3,925 |
| 208 | Clark's Ranch | Wheeler | 4,677 |
| 209 | Clayton | Smithsonian Inst. | 76 |
| 210 | Clear Lake | Wheeler | 5,808 |
| 211 | Clipper Gap | C. P. R. R. | 1,759 |
| 212 | Cloud Rest | Wheeler | 9,772 |
| 213 | Clover Valley | Wheeler | 3,464 |
| 214 | Cohen's Ranch | Wheeler | 281 |
| 215 | Cohuilla Village | Pacific R. R. Reports | 85 |
| 216 | Colby's Ranch | Wheeler | 4,990 |
| 217 | Cold Spring | Wheeler | 3,126 |
| 218 | Cold Spring | Wheeler | 5,375 |
| 219 | Cold Spring Ranch | Wheeler | 565 |
| 220 | Cole's Ranch | Wheeler | 1,221 |
| 221 | Coleville (blacksmith shop) | Wheeler | 5,190 |

TABLE OF ABTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 222 | Colfax | Nev. Co. N. G. R. R. | 2,422 |
| 223 | Colfax | Wheeler | 3,022 |
| 224 | Colfax Junction, with Nevada Co. R. R. | C. P. R. R. | 2,422 |
| 225 | Colona | | 835 |
| 226 | Colton | Wheeler | 808 |
| 227 | Colton | C. P. R. R. | 965 |
| 328 | Columbia | Toner | 2,314 |
| 229 | Columbia P. O. | Wheeler | 2,157 |
| 230 | Columbia Rock (above valley) | Wheeler | 5,005 |
| 231 | Conejos | Wheeler | 2,565 |
| 232 | Conejas Ranch | Wheeler | 579 |
| 233 | Conness Peak | Wheeler | 12,518 |
| 234 | Contra Costa | U. S. C. & G. S. | 96 |
| 235 | Cook's Point (Mountain) | Wheeler | 6,336 |
| 236 | Cook's Wells | Pacific R. R. Reports | —62 |
| 237 | Coomb's Station | Wheeler | 2,886 |
| 238 | Cooper's Ranch | Wheeler | 8,406 |
| 239 | Copperopolis P. O. | Wheeler | 1,015 |
| 240 | Corbett's Ranch | Wheeler | 1,075 |
| 241 | Corcoran, Mt. | Wheeler | 14,093 |
| 242 | Cordelia | C. P. R. R. | 11 |
| 243 | Cordelia | Pacific R. R. Reports | 69 |
| 244 | Cory's Peak | Wheeler | 11,326 |
| 245 | Costa | C. P. R. R. | 85 |
| 246 | Cottonwood | Toner | 423 |
| 247 | Cottonwood Island | Wheeler | 787 |
| 248 | Cottonwood Station | Wheeler | 2,488 |
| 249 | Coulterville | Wheeler | 1,665 |
| 250 | Cow Creek Ranch, Sonora Road | Wheeler | 5,905 |
| 251 | Cow Head Lake | Wheeler | 6,041 |
| 252 | Cow Head Lake Spring | Wheeler | 5,329 |
| 253 | Cow Spring | Wheeler | 3,876 |
| 254 | Cox's Ferry | Wheeler | 250 |
| 255 | Crabtrees | Wheeler | 934 |
| 256 | Crane Flat | Wheeler | 6,054 |
| 257 | Crane Valley | Wheeler | 3,185 |
| 258 | Crater Station | | 1,000 |
| 259 | Crescent City | Smithsonian Inst. | 12 |
| 260 | Crescent City | Wheeler | 3,306 |
| 261 | Cress's Ranch | Wheeler | 5,157 |
| 262 | Creston | C. P. R. R. | 313 |
| 263 | Crimea House | Wheeler | 1,221 |
| 264 | Crook, Fort | Medical Dept. U. S. A. | 3,390 |
| 265 | Crow's Ranch, Clover Valley | Wheeler | 5,464 |
| 266 | Crystal Lake | R. R. Reports | 5,907 |
| 267 | Culbertson's | Wheeler | 980 |
| 268 | Culbertson's Vineyard | Wheeler | 981 |
| 269 | Cucamonga | C. P. R. R. | 952 |
| 270 | Cucamonga | Wheeler | 1,328 |
| 271 | Cucamonga Peak | Wheeler | 8,529 |
| 272 | Cucamonga Ranch | Wheeler | 1,168 |
| 273 | Cuddy's Ranch | Wheeler | 5,278 |
| 274 | Cunningham's Ranch | Wheeler | 387 |
| 275 | Curtis | C. P. R. R. | 39 |
| 276 | Daggett's Pass | Goddard | 6,824 |
| 277 | Dahlonega | Wheeler | 2,162 |
| 278 | Dalton's Ranch | Wheeler | 568 |
| 279 | Dana, Mt. | Whitney | 13,227 |
| 280 | Darwin Cañon | Wheeler | 3,143 |
| 281 | Davis | C. P. R. R. | 54 |
| 282 | Dawes Ranch | Wheeler | 451 |
| 283 | Deadfall Bridge | Wheeler | 3,426 |
| 284 | Deadwood Peak | Wheeler | 4,451 |
| 285 | Decoto | C. P. R. R. | 68 |
| 286 | Deep Spring | Wheeler | 4,957 |
| 287 | Deer Creek | Wheeler | 4,518 |
| 288 | Delaney's Ranch | Wheeler | 4,840 |
| 289 | Delano | C. P. R. R. | 313 |
| 290 | Desert Springs | Wheeler | 1,989 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 291 | Dewser's Station | Wheeler | 2,922 |
| 292 | Devil's Peak | Wheeler | 6,910 |
| 293 | Diablo Point | U. S. C. & G. S. | 202 |
| 294 | Diablo, Monte, Hotel | U. S. C. & G. S. | 2,327 |
| 295 | Diablo, Monte | U. S. C. & G. S. | 3,849 |
| 296 | Dixon | C. P. R. R. | 65 |
| 297 | Donner Lake | R. R. Reports | 5,964 |
| 298 | Donner Lake | Wheeler | 5,885 |
| 299 | Donner Pass | C. P. R. R. Surveys | 7,901 |
| 300 | Donner Pass | Whitney | 7,056 |
| 301 | Doon's Sawmill | Wheeler | 3,420 |
| 302 | Dos Palmas | Wheeler | 103 |
| 303 | Downey | C. P. R. R. | 114 |
| 304 | Downieville | Smithsonian Inst. | 2,200 |
| 305 | Downieville Buttes | Whitney | 8,400 |
| 306 | Downieville Buttes | Wheeler | 8,541 |
| 307 | Drew's Ranch | Wheeler | 1,090 |
| 308 | Dribblesby's Ferry | Pacific R. R. Reports | 954 |
| 309 | Drune Barracks | Medical Dept. U. S. A. | 32 |
| 310 | Dudley's | Wheeler | 2,959 |
| 311 | Duxbury | U. S. C. & G. S. | 797 |
| 312 | Dugan's | S. & P. R. R | 1,106 |
| 313 | Dunderberg Peak | Wheeler | 12,289 |
| 314 | Dutch Flat | C. P. R. R. | 3,395 |
| 315 | Dutch Henry's Ranch | Wheeler | 1,195 |
| 316 | Dutch Hill Mining Camp | Wheeler | 4,692 |
| 317 | Dyer Mountain, near Big Meadows | Wheeler | 7,369 |
| 318 | Eagle Lake | Wheeler | 5,115 |
| 319 | Eagle Mountain | Wheeler | 9,933 |
| 320 | Eagleville | Wheeler | 4,632 |
| 321 | Ebbitt's Pass | P. R. R. Reports | 8,793 |
| 322 | Echo Peak | Wheeler | 11,231 |
| 323 | Edgar's Spring | Wheeler | 4,061 |
| 324 | Eisen Vineyard | Wheeler | 358 |
| 325 | El Dorado Mill | Wheeler | 863 |
| 326 | Elephant, Mt. | Wheeler | 10,418 |
| 327 | Eleven Mile Station, Mariposa Road | Wheeler | 5,567 |
| 328 | Eliot's Ranch, on Little Truckee River | Wheeler | 6,233 |
| 329 | Elizabeth Lake | Wheeler | 3,317 |
| 330 | Elk Grove | C. P. R. R. | 53 |
| 331 | Elk Horn | Pacific R. R. Reports | 89 |
| 332 | Elkhorn Ranch | Wheeler | 1,049 |
| 333 | Elk Valley | | 3,751 |
| 334 | Ellis | C. P. R. R. | 76 |
| 335 | Ellis Mountain | Wheeler | 8,675 |
| 336 | Elmira | C. P. R. R. | 75 |
| 337 | El Monte | Wheeler | 329 |
| 338 | El Paso Mines | Wheeler | 4,113 |
| 339 | Emigrants' Gap | C. P. R. R. | 5,221 |
| 340 | Emigrants' Gap | Pacific R. R. Reports | 5,221 |
| 341 | Eureka | | 5,223 |
| 342 | Eureka Valley | Wheeler | 5,957 |
| 343 | Excelsior Hotel | Wheeler | 4,570 |
| 344 | Fandango Peak | Wheeler | 7,849 |
| 345 | Far West, Camp | Medical Dept. U. S. A. | 175 |
| 346 | Fears' Station | Wheeler | 3,393 |
| 347 | Ferguson's Mill | Wheeler | 1,389 |
| 348 | Fifteen Mile Creek | Wheeler | 1,267 |
| 349 | Fisherman's Peak | Wheeler | 14,448 |
| 350 | Fishpond Station | Toner | 1,900 |
| 351 | Florence | C. P. R. R. | 153 |
| 352 | Florin | Toner | 42 |
| 353 | Folsom | S. & P. R. R. | 182 |
| 354 | Forest Ranch | Wheeler | 2,217 |
| 355 | Forgay's Ranch | Wheeler | 3,381 |
| 356 | Fornis' Ranch | Wheeler | 4,225 |
| 357 | Forsee's Ranch | Wheeler | 3,587 |
| 358 | Fort Point | U. S. C. & G. S. | 186 |
| 359 | "Forty-nine," Cañon Pass | Wheeler | 6,306 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 360 | Foster's Bar | Toner | 1,371 |
| 361 | Foster's Station | Wheeler | 3,265 |
| 362 | Fowler's Peak | Wheeler | 1,760 |
| 363 | Francis' Spring | Wheeler | 4,220 |
| 364 | Frank's Lagoon | U. S. C. & G. S. | 497 |
| 365 | Fredonyer's Peak | Wheeler | 7,995 |
| 366 | Freels' Mountain | Wheeler | 10,848 |
| 367 | Fremont | C. P. R. R. | 58 |
| 368 | Frenchman's Cove | Wheeler | 5,565 |
| 369 | Fresno | C. P. R. R. | 294 |
| 370 | Fresno | Wheeler | 314 |
| 371 | Fresno Flat | Wheeler | 2,192 |
| 372 | Fryes' | Wheeler | 2,181 |
| 373 | Fulsom & Hall's Ranch | Wheeler | 4,282 |
| 374 | Furnace Creek | Wheeler | 405 |
| 375 | Furnace Springs | Wheeler | 337 |
| 376 | Galt Junction | C. P. R. R. | 49 |
| 377 | Gavilan | U. S. C. & G. S. | 2,816 |
| 378 | Gavilan | Whitney | 3,381 |
| 379 | Georgetown | Toner | 2,433 |
| 380 | Georgetown Pass | Whitney | 7,119 |
| 381 | Georgetown Pass | C. P. R. R. Surveys | 7,154 |
| 382 | Gilroy | Toner | 193 |
| 383 | Glenville | Wheeler | 3,094 |
| 384 | Gold Run | C. P. R. R. | 3,220 |
| 385 | Gold Spring Ranch | Wheeler | 2,014 |
| 386 | Goodrich's Ranch | Wheeler | 4,883 |
| 387 | Goose Lake | Wheeler | 4,697 |
| 388 | Gordon's Ranch | Wheeler | 737 |
| 389 | Gorman's Ranch | Wheeler | 3,838 |
| 390 | Goshen | C. P. R. R. | 278 |
| 391 | Goshen Junction (with S. P. R. R.) | C. P. R. R. | 280 |
| 392 | Guano Island | U. S. C. & G. S. | 28 |
| 393 | Granite Spring | Wheeler | 1,435 |
| 394 | Granite Springs | Wheeler | 4,115 |
| 395 | Granite Station | Wheeler | 1,744 |
| 396 | Granite Wells | Wheeler | 2,080 |
| 397 | Grapevine Peak | Wheeler | 8,528 |
| 398 | Grapevine Ranch | Wheeler | 2,247 |
| 399 | Grapevine Spring | Wheeler | 2,432 |
| 400 | Grass Lake | Wheeler | 8,564 |
| 401 | Grass Valley | | 2,090 |
| 402 | Grass Valley | Nev. Co. N. G. R. R. | 2,454 |
| 403 | Gravel Range | Wheeler | 2,987 |
| 404 | Gray's Ranch | Wheeler | 307 |
| 405 | Gray's Ranch | Wheeler | 1,100 |
| 406 | Green Bluff | U. S. C. & G. S. | 486 |
| 407 | Green Mountain | Wheeler | 1,351 |
| 408 | Green Mountain | Wheeler | 1,352 |
| 409 | Green's Ranch | Wheeler | 4,479 |
| 410 | Greenville | Wheeler | 3,544 |
| 411 | Gridley | Toner | 97 |
| 412 | Griffith's Ranch | Wheeler | 473 |
| 413 | Grizzly Giant, Mariposa Grove | Wheeler | 5,838 |
| 414 | Grizzly Hill | Wheeler (Theod) | 5,709 |
| 415 | Grizzly Peak | Wheeler | 11,723 |
| 416 | Grizzly Peak | Wheeler | 10,369 |
| 417 | Groveland | Wheeler | 2,828 |
| 418 | Gyser's | Wheeler | 5,864 |
| 419 | Haighs' | Wheeler | 1,807 |
| 420 | Hale's | Wheeler | 2,739 |
| 421 | Halfway House | Wheeler | 3,359 |
| 422 | Halloran Spring | Wheeler | 3,272 |
| 423 | Hamilton Mountain | Whitney | 4,440 |
| 424 | Hamilton (near) | Pacific R. R. Reports | 260 |
| 425 | Hardin's | Wheeler | 3,396 |
| 426 | Harkness Mountain, near Big Meadows | Wheeler (Theod) | 8,875 |
| 427 | Harris' Ranch, Madeline Plains | Wheeler | 5,339 |
| 428 | Harris' Station, Amander Road | Wheeler | 5,439 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 429 | Hart's Ranch | Wheeler | 242 |
| 430 | Haskell's Peak | Wheeler | 8,126 |
| 431 | Hat Mountain | Wheeler | 7,676 |
| 432 | Haughtown Crossing | S. & P. R. R. | 85 |
| 433 | Havilah Town | Wheeler | 3,150 |
| 434 | Hays' Station | Wheeler | 5,957 |
| 435 | Hazel Green | Wheeler | 5,550 |
| 436 | Hazelton Peak | Wheeler | 2,960 |
| 437 | Hazel Valley | Wheeler | 3,404 |
| 438 | Helena, Mount | Whitney | 4,343 |
| 439 | Henness Pass | C. P. R. R. Surveys | 7,031 |
| 440 | Henness Pass | Whitney | 6,996 |
| 441 | Hennessy's Bridge | Wheeler | 1,821 |
| 442 | Henry, Mount | Whitney | 2,398 |
| 443 | Hermit Valley | Wheeler | 7,039 |
| 444 | Hickman's Ranch | Wheeler | 1,907 |
| 445 | High Bluff | U. S. C. & G. S. | 533 |
| 446 | High Hill | U. S. C. & G. S. | 490 |
| 447 | Highland Peak | Wheeler | 10,956 |
| 448 | Hill's Ranch | Pacific R. R. Reports | 4,131 |
| 449 | Hite's Cove | Wheeler | 1,601 |
| 450 | Hodgdon's | Wheeler | 4,506 |
| 451 | Hoffmann Peak | Wheeler | 10,872 |
| 452 | Hogle | C. P. R. R. | 76 |
| 453 | Hollister | Toner | 284 |
| 454 | Homestead | S. & P. R. R. | 32 |
| 455 | Honey Lake | Wheeler | 3,949 |
| 456 | Hooker | | 543 |
| 457 | Hope Valley | Williamson | 7,072 |
| 458 | Hornitos Hotel | Wheeler | 847 |
| 459 | Horn Spring | Wheeler | 5,477 |
| 460 | Horseley's Station | Wheeler | 3,860 |
| 461 | Hosselkus' Ranch | Wheeler | 3,635 |
| 462 | Hotchkiss Ranch | Wheeler | 2,931 |
| 463 | Hot Springs | Wheeler | 6,080 |
| 464 | Hot Springs | Wheeler | 7,384 |
| 465 | Hot Springs | Wheeler | 7,692 |
| 466 | Hough's Mountain | Wheeler (Theod) | 7,391 |
| 467 | Hovely's Camp | Wheeler | 3,860 |
| 468 | Hubertville | Toner | 980 |
| 469 | Hughes' Ranch | Wheeler | 3,122 |
| 470 | Humboldt, Fort | Med. Dept., U. S. A. | 50 |
| 471 | Humbug Park | Wheeler | 4,847 |
| 472 | Humpahyamup Pass | P. R. R. Reports | 5,351 |
| 473 | Hunter's Ranch | Wheeler | 6,274 |
| 474 | Hunter's Ranch | Wheeler | 6,275 |
| 475 | Huntington, Mohave River | Wheeler | 2,899 |
| 476 | Hupps' Mill | Wheeler | 2,667 |
| 477 | Hyde's Union Sawmill | Wheeler | 5,288 |
| 478 | Illinois Ranch | Wheeler | 1,759 |
| 479 | Illinoistown | Toner | 2,234 |
| 480 | Independence, Camp | Wheeler | 3,957 |
| 481 | Independence, Camp | Smithsonian Inst. | 4,800 |
| 482 | Indian Gulch | Wheeler | 951 |
| 483 | Indian Valley | Toner | 3,280 |
| 484 | Indian Wells | C. P. R. R. | —20 |
| 485 | Indian Wells | Wheeler | 2,603 |
| 486 | Ingalls, Mount | Wheeler | 8,471 |
| 487 | Inskip Toll-gate | Wheeler | 4,803 |
| 488 | Ione | C. P. R. R. | 287 |
| 489 | Ivanpah | Wheeler | 4,238 |
| 490 | Jackson | Toner | 934 |
| 491 | Jacksonville | Wheeler | 602 |
| 492 | Jelly's Ranch | Wheeler | 360 |
| 493 | Joe's Peak | Wheeler | 9,712 |
| 494 | John's, Mount | Petermann | 8,000 |
| 495 | Johnson's Pass | Goddard | 6,752 |
| 496 | Johnson's Pass | C. P. R. R. Surveys | 7,374 |
| 497 | Johnson's Pass | Simpson | 7,222 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 498 | Johnson's Pass | Whitney | 7,339 |
| 499 | Johnson's Ranch | Wheeler | 3,460 |
| 500 | Johnson's Ranch, Bresser Creek | Wheeler | 5,643 |
| 501 | Jones, Fort | Med. Dept., U. S. A. | 2,570 |
| 502 | Jones' Mill, near Dutch Flat | | 3,416 |
| 503 | Junction House | Wheeler | 3,562 |
| 504 | Junction House, on Reno and Susanville road, near Beckwith's Pass | Wheeler | 4,639 |
| 505 | Junction with Oregon Branch | C. P. R. R. | 163 |
| 506 | Kaweah Peak | Whitney | 14,000 |
| 507 | Keg Spring, Willow Creek | Wheeler | 5,757 |
| 508 | Kern Lake | Pacific R. R. Reports | 398 |
| 509 | Kernville | Wheeler | 2,551 |
| 510 | Kettle Rock Peak | Wheeler | 7,843 |
| 511 | Keystone House | Wheeler | 1,093 |
| 512 | Keysville | | 2,558 |
| 513 | Kincaid's Flat | Wheeler | 1,589 |
| 514 | Kincaid's Ranch | Wheeler | 1,771 |
| 515 | King's Springs, Death Valley | Wheeler | —225 |
| 516 | Kingston | Petermann | 1,118 |
| 517 | Kirkwood's | Wheeler | 7,677 |
| 518 | Knight's Ferry Bridge | Wheeler | 180 |
| 519 | Knight's Landing | C. P. R. R. | 43 |
| 520 | Kress | Nev. Co. N. G. R. R | 2,857 |
| 521 | La Bayonne | Wheeler | 16 |
| 522 | Lagrange | Wheeler | 222 |
| 523 | Lake City | Wheeler | 4,624 |
| 524 | Lake City Pass | Wheeler | 7,035 |
| 525 | Lakeview | Wheeler | 4,851 |
| 526 | La Laguna Ranch | Wheeler | 129 |
| 527 | Lambert's Soda Spring | Wheeler | 8,558 |
| 528 | La Motte's | Wheeler | 6,491 |
| 529 | Lane's Crossing, Mojave River | Wheeler | 2,819 |
| 530 | Lankershin's Ranch | Wheeler | 563 |
| 531 | Lassen's Butte | Wheeler | 10,437 |
| 532 | Lassen's Butte | Whitney | 10,577 |
| 533 | Lathrop Junction with Visalia Division | C. P. R. R. | 26 |
| 534 | Latrobe | S. P. R. R. | 782 |
| 535 | Lava Bed Station | Wheeler | 446 |
| 536 | Lawrence | Toner | 66 |
| 537 | Leach's Point | Wheeler | 3,409 |
| 538 | Leek Spring | Wheeler | 7,242 |
| 539 | Lewis' Ranch | Wheeler | 966 |
| 540 | Lewis' Ranch, near Loyalton | Wheeler | 4,949 |
| 541 | Lievre Ranch | Wheeler | 3,756 |
| 542 | Lillie's Ranch | Wheeler | 3,647 |
| 543 | Lime Point Bluff | U. S. C. & G. S. | 495 |
| 544 | Lincoln | C. P. R. R. | 161 |
| 545 | Lion's Head | Wheeler | 1,693 |
| 546 | Little Yosemite | Wheeler | 6,442 |
| 547 | Livermore | C. P. R. R. | 485 |
| 548 | Livermore Pass | Whitney | 686 |
| 549 | Liverpool Landing, Colorado River | Wheeler | 606 |
| 550 | Lobos Point | U. S. C. & G. S. | 326 |
| 551 | Lobos Point | U. S. C. & G. S. | 378 |
| 552 | Lodi | C. P. R. R. | 55 |
| 553 | Lomo | Wheeler | 3,848 |
| 554 | Lone Pine | Wheeler | 3,810 |
| 555 | Longville | Wheeler (Theod.) | 4,309 |
| 556 | Lookout Hill | Wheeler | 4,214 |
| 557 | Lookout Mountain | Wheeler | 9,670 |
| 558 | Loomis' Ranch | Wheeler | 4,357 |
| 559 | Lopez Ranch | Wheeler | 3,248 |
| 560 | Los Angeles | C. P. R. R. | 265 |
| 561 | Los Angeles | Wheeler | 326 |
| 562 | Los Angeles | Pacific R. R. Reports | 250 |
| 563 | Los Angeles, San Pedro Dessa | L. A. & I. R. R | 260 |
| 564 | Los Angeles, Signal Station | U. S. Signal Office | 350 |
| 565 | Los Encinos Ranch | Wheeler | 772 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 566 | Los Pozos Ranch | Wheeler | 259 |
| 567 | Los Toros | Wheeler | 203 |
| 568 | Lott's Diggins | Wheeler | 6,310 |
| 569 | Luther's Pass | Goddard | 7,185 |
| 570 | Luther's Pass | Simpson | 7,505 |
| 571 | Lyell, Mt. | Wheeler | 13,190 |
| 572 | Lyell, Mt. | Whitney | 13,217 |
| 573 | Lyon's Ranch | Wheeler | 1,397 |
| 574 | McBride's | Wheeler | 5,561 |
| 575 | McBride's Peak | Wheeler | 13,441 |
| 576 | McConnahas' | Wheeler | 3,981 |
| 577 | McCumber's Mill | Pacific R. R. Reports | 3,491 |
| 578 | McDonald Peak | Wheeler | 7,954 |
| 579 | McDonald Ranch | Wheeler | 5,297 |
| 580 | McGill, Mt. | Wheeler (Theod.) | 9,214 |
| 581 | McKesick's Peak | Wheeler | 7,083 |
| 582 | McKesick's Ranch | Wheeler | 4,469 |
| 583 | McQuade's | Wheeler | 1,888 |
| 584 | Macon | Toner | 450 |
| 585 | Madeline Hat Peak | Wheeler | 7,676 |
| 586 | Madeline Pass | P. R. R. Reports | 5,667 |
| 587 | Malaga | Wheeler | 2,320 |
| 588 | Mapes | Wheeler | 5,039 |
| 589 | Mare Island, N. E. | U. S. C. & G. S | 283 |
| 590 | Mare Island, N. W. | U. S. C. & G. S. | 101 |
| 591 | Mare Island | U. S. C. & G. S. | 29 |
| 592 | Marin Island | U. S. C. & G. S. | 74 |
| 593 | Marion | U. S. C. & G. S. | 74 |
| 594 | Mariposa | Wheeler | 1,962 |
| 595 | Mariposa Town Hall | Wheeler | 1,971 |
| 596 | Mariposa Post Office | Wheeler | 1,942 |
| 597 | Mariposa Peak | Whitney | 3,700 |
| 598 | Markleeville | Wheeler | 5,525 |
| 599 | Marlett's Lake | Wheeler | 7,750 |
| 600 | Marlett's Peak | Wheeler | 8,631 |
| 601 | Marlett's Ranch | Wheeler | 8,074 |
| 602 | Marl Spring | Pacific R. R. Reports | 3,793 |
| 603 | Martinez, East | U. S. C. & G. S. | 187 |
| 604 | Martinez C. H. | U. S. C. & G. S. | 27 |
| 605 | Martin's | Monterey R. R. | 16 |
| 606 | Martin's | Monterey R. R. | 1,982 |
| 607 | Martin's Ranch | Wheeler | 2,055 |
| 608 | Marysville | C. P. R. R. | 67 |
| 609 | Marysville | Smithsonian Institute | 80 |
| 610 | Master's Hill | U. S. C. & G. S. | 2,445 |
| 611 | Matthews' Ranch | Wheeler | 6,294 |
| 612 | Maturango, Mt. | Wheeler (Theod.) | 8,844 |
| 613 | Mayfield | Toner | 34 |
| 614 | Mayhews | S. & P. R. R. | 58 |
| 615 | Meade, Mt. | Wheeler | 10,540 |
| 616 | Meadow Mountain | Wheeler | 11,734 |
| 617 | Meadow Valley | Wheeler | 3,757 |
| 618 | Melrose | C. P. R. R. | 18 |
| 619 | Menatchey Valley | Wheeler | 9,503 |
| 620 | Merced | C. P. R. R. | 173 |
| 621 | Merced Falls | Wheeler | 360 |
| 622 | Merced, Mt. | Wheeler | 11,413 |
| 623 | Merritt's | C. P. R. R. | 54 |
| 624 | Mesquite Spring | Wheeler | 2,010 |
| 625 | Mesquite Wells | | 3,674 |
| 626 | Middle Lake, Surprise Valley | Wheeler | 4,551 |
| 627 | Midway | C. P. R. R. | 356 |
| 628 | Mill Creek, Sonora road | Wheeler | 7,076 |
| 629 | Miller, Fort | Med. Dept., U. S. A. | 402 |
| 630 | Miller's Ranch | Wheeler | 4,055 |
| 631 | Mills of Madera Flume and Trading Co. | Wheeler | 4,499 |
| 632 | Milton | Wheeler | 376 |
| 633 | Milton | Wheeler | 5,845 |
| 634 | Mineral Bar | Toner | 1,121 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 635 | Mitchell's Ranch | Wheeler | 4,285 |
| 636 | Moccasin, Mt. | Wheeler | 2,791 |
| 637 | Modesto | C. P. R. R. | 93 |
| 638 | Mojave | C. P. R. R. | 2,751 |
| 639 | Mokelumne | Toner | 5,523 |
| 640 | Mokelumne, Mt. | Wheeler | 9,467 |
| 641 | Molate Island | U. S. C. & G. S. | 169 |
| 642 | Molate Point | U. S. C. & G. S. | 133 |
| 643 | Mono Lake | U. S. Geol. Survey | 6,730 |
| 644 | Mono Pass | Whitney | 10,765 |
| 645 | Monte | Toner | 354 |
| 646 | Monte Diablo | Whitney | 3,856 |
| 647 | Monterey | Monterey R. R. | 7 |
| 648 | Monterey | Med. Dept., U. S. A. | 140 |
| 649 | Moonlight Valley | Wheeler | 5,433 |
| 650 | Moquelumne Hill | Smithsonian Institute | 1,502 |
| 651 | Moran's Ranch | Wheeler | 3,984 |
| 652 | Mormon Bar | Wheeler | 1,630 |
| 653 | Morocojo | Monterey R. R. | 15 |
| 654 | Morongo Basin | Toner | 1,500 |
| 655 | Morrow, Mt. | Wheeler | 2,065 |
| 656 | Mosquito Spring | Wheeler | 2,010 |
| 657 | Mountain House | Wheeler | 5,641 |
| 658 | Mud Spring, Amador road | Wheeler | 5,973 |
| 659 | Mud Springs | Wheeler | 4,671 |
| 660 | Murphy | U. S. C. & G. S. | 2,703 |
| 661 | Murphy's Cabin, Lake Tenaiya | Wheeler | 7,971 |
| 662 | Murphy's Mining Village | Wheeler | 2,195 |
| 663 | Murphy's Ranch, Buffalo Salt Works | Wheeler | 3,845 |
| 664 | Myers' Ferry | Wheeler | 7,434 |
| 665 | Myers' Station | Wheeler | 3,759 |
| 666 | Nadean's Station | Wheeler | 2,394 |
| 667 | Napa | C. P. R. R. | 18 |
| 668 | Napa Junction | C. P. R. R. | 8 |
| 669 | Napa Junction (Adalante) | C. P. R. R. | 76 |
| 670 | Nash's Ranch | Wheeler | 4,431 |
| 671 | Nelson | Toner | 125 |
| 672 | Nevada City | Nev. Co. N. G. R. R. | 2,531 |
| 673 | Newbury Peak | Wheeler | 3,375 |
| 674 | Newbury Park | Wheeler | 830 |
| 675 | Newcastle | C. P. R. R. | 956 |
| 676 | Newhall | C. P. R. R. | 1,152 |
| 677 | Newhall's Ranch | Wheeler | 974 |
| 678 | New Pass | P. R. R. Reports | 3,164 |
| 679 | New York Tent | Wheeler | 1,143 |
| 680 | Niagara Creek, Sonora road | Wheeler | 6,690 |
| 681 | Nicholas (near) | Pacific R. R. Reports | 289 |
| 682 | Nichols Point | Wheeler | 6,262 |
| 683 | Niles Junction with San José Branch | C. P. R. R. | 88 |
| 684 | Nimshew | Wheeler | 2,451 |
| 685 | Noble's Pass | Wheeler | 5,963 |
| 686 | Noble's Pass | Williamson | 6,260 |
| 687 | Noman's Spring | Wheeler | 3,735 |
| 688 | Nora | C. P. R. R. | 153 |
| 689 | Nordhoff | Wheeler | 819 |
| 690 | North Dome (above valley 3,633) | Wheeler | 7,484 |
| 691 | North End Peak | Wheeler | 8,472 |
| 692 | Northups (Excelsior Hotel) | U. S. C. & G. S. | 4,519 |
| 693 | Norwalk | C. P. R. R. | 95 |
| 694 | Nott's Ranch | Wheeler | 7,110 |
| 695 | Null's Ranch | Wheeler | 1,299 |
| 696 | Oakdale | Wheeler | 149 |
| 697 | Oak Knoll | C. P. R. R. | 102 |
| 698 | Oakland | C. P. R. R. | 12 |
| 699 | Oakland Wharf | C. P. R. R. | 14 |
| 700 | Observation Peak | Wheeler | 8,009 |
| 701 | Ogburn's Ranch | Wheeler (Theod.) | 2,270 |
| 702 | Olancha Peak | Wheeler | 12,250 |
| 703 | Old Bony Mountain | Wheeler | 1,892 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 704 | Old Kimshew Settlement | Wheeler | 4,992 |
| 705 | Omjumi, Mountain | Whitney | 8,378 |
| 706 | Omjumi, Mountain | Wheeler | 8,292 |
| 707 | Orange | C. P. R. R. | 134 |
| 708 | Oroville | Wheeler | 188 |
| 709 | Oso Meadows | Wheeler | 5,982 |
| 710 | Oso Mountain | Whitney | 3,363 |
| 711 | Owens' River Bridge | Wheeler | 3,618 |
| 712 | Pacheco | U. S. C. & G. S. | 21 |
| 713 | Pacheco Pass | Whitney | 1,470 |
| 714 | Pacheco's Peak | Whitney | 2,845 |
| 715 | Pacific House | Wheeler | 3,451 |
| 716 | Pah Ute Mines | Wheeler | 6,607 |
| 717 | Pah Ute Peak | Wheeler | 8,342 |
| 718 | Pah Ute Springs | Wheeler | 2,849 |
| 719 | Pajaro | Toner | 22 |
| 720 | Paleta Peak | Wheeler | 4,507 |
| 721 | Palmer's Ranch | Wheeler | 2,346 |
| 722 | Pampa | Wheeler | 871 |
| 723 | Panamint | Wheeler | 6,605 |
| 724 | Panamint Station | Wheeler | 3,549 |
| 725 | Panoche Pass | Whitney | 2,500 |
| 726 | Panola | Toner | 48 |
| 727 | Paradise | Toner | 125 |
| 728 | Paris | C. P. R. R. | 400 |
| 729 | Park | L. A. & I. R. R. | 178 |
| 730 | Parker's Ranch | Wheeler | 4,136 |
| 731 | Parrott's (formerly Pandola) Ferry | Wheeler | 834 |
| 732 | Peach Spring | Wheeler | 5,303 |
| 733 | Peddler's Hill | Wheeler | 6,831 |
| 734 | Peña Blanca (Haigh's Ranch) | Wheeler | 1,807 |
| 735 | Peninsula Hill | U. S. C. & G. S. | 367 |
| 736 | Penole, Point | U. S. C. & G. S. | 68 |
| 737 | Penryn | Toner | 624 |
| 738 | Perkins | S. P. R. R. | 51 |
| 739 | Petalume Creek | U. S. C. & G. S. | 111 |
| 740 | Phillips' Ranch | Wheeler | 6,999 |
| 741 | Phillips' Ranch | Wheeler | 242 |
| 742 | Phillips' Station | Wheeler | 6,871 |
| 743 | Pilot Knob | Wheeler | 5,525 |
| 744 | Pilot Peak | Whitney | 7,605 |
| 745 | Pinos Mountain | Petermann | 9,500 |
| 746 | Pinto Rock | Wheeler | 3,903 |
| 747 | Piute Point | K. P. R. R. Surveys | 2,579 |
| 748 | Placerville | Toner | 2,109 |
| 749 | Placerville | Williamson | 1,965 |
| 750 | Placerville Post Office | Wheeler | 1,893 |
| 751 | Plainsburgh | Toner | 209 |
| 752 | Pleasanton | C. P. R. R. | 353 |
| 753 | Pleasant Valley | Wheeler | 2,405 |
| 754 | Point of Rocks | Wheeler | 2,542 |
| 755 | Porcupine Flat | Wheeler | 7,749 |
| 756 | Potraro | Wheeler | 1,028 |
| 757 | Prattville | Wheeler | 4,394 |
| 758 | Priest's Hotel | Wheeler | 2,558 |
| 759 | Princeton | Wheeler | 2,104 |
| 760 | Probasco's Ranch | Wheeler | 973 |
| 761 | Pulgas Base, East End | U. S. C. & G. S. | 19 |
| 762 | Pulgas Base, West End | U. S. C. & G. S. | 129 |
| 763 | Pyramid Mountain | Wheeler | 10,127 |
| 764 | Quincy | Wheeler | 3,381 |
| 765 | Quiqualmingo | Toner | 1,084 |
| 766 | Railroad Flat | Wheeler | 2,606 |
| 767 | Rancho del Chino y de Jurupa | Med. Dept. U. S. A. | 1,000 |
| 768 | Ravenna | C. P. R. R. | 2,347 |
| 769 | Rawhide Camp | Wheeler | 1,556 |
| 770 | Rawson | Wheeler | 228 |
| 771 | Read | U. S. C. & G. S. | 474 |
| 772 | Reading, Fort | Pacific R. R. Reports | 596 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 773 | Reading | Pacific R. R. Reports | 675 |
| 774 | Reading | Pacific R. R. Reports | 674 |
| 775 | Reading | Med. Dept. U. S. A. | 518 |
| 776 | Red Bluff | Wheeler | 307 |
| 777 | Red Bluff | Williamson | 370 |
| 778 | Red Bluff | C. P. R. R. | 308 |
| 779 | Red Bluff Signal Station | U. S. Sig. Office | 324 |
| 780 | Redding | C. P. R. R. | 556 |
| 781 | Red Hill Station | U. S. C. & G. S. | 188 |
| 782 | Redmans Ranch | Wheeler | 1,181 |
| 783 | Red Rock Station | Wheeler | 2,394 |
| 784 | Red Slate Peak | Whitney | 13,400 |
| 785 | Redwood City | Toner | 10 |
| 786 | Reilly's Station | Wheeler | 1,477 |
| 787 | Reservoir House | Wheeler | 1,013 |
| 788 | Reservoir in Concord Valley | Wheeler | 202 |
| 789 | Reynolds' Ferry | Wheeler | 543 |
| 790 | Rhett Lake | P. R. R. Reports | 4,014 |
| 791 | Richardson | U. S. C. & G. S. | 1,116 |
| 792 | Richmond Point | U. S. C. & G. S. | 192 |
| 793 | Rincon | Toner | 2,050 |
| 794 | Ripley Mountain | Petermann | 7,500 |
| 795 | Ritgers' Ranch | Wheeler | 4,345 |
| 796 | Roberts' Ferry | Wheeler | 184 |
| 797 | Robertson's | Wheeler | 819 |
| 798 | Roble | Toner | 179 |
| 799 | Rocklin | C. P. R. R. | 249 |
| 800 | Rock Spring | Pacific R. R. Reports | 4,898 |
| 801 | Rocky Island | U. S. C. & G. S. | 157 |
| 802 | Rook's Ranch | P. R. R. Reports | 4,181 |
| 803 | Rose Springs | Wheeler | 3,545 |
| 804 | Ross Mountain | U. S. C. & G. S. | 2,205 |
| 805 | Routiers | S. P. R. R. | 72 |
| 806 | Rowland's Ranch | Wheeler | 6,222 |
| 807 | Rutherford | C. P. R. R. | 168 |
| 808 | Sackett's Wells | Toner | 312 |
| 809 | Sacramento | C. P. R. R. | 30 |
| 810 | Sacramento | Smithsonian Inst. | 82 |
| 811 | Sacramento | Williamson | 81 |
| 812 | Sacramento Signal Station | U. S. Signal Office | 70 |
| 813 | Saddle (Malaga) Mountain | Wheeler | 2,896 |
| 814 | Saint Clair Ranch | Wheeler | 1,961 |
| 815 | Saint Helena | C. P. R. R. | 244 |
| 816 | Salinas City | | 42 |
| 817 | Salsbury | S. P. R. R. | 126 |
| 818 | Salt Wells | Wheeler | 117 |
| 819 | San Andreas | Wheeler | 1,033 |
| 820 | San Antonio Peak | U. S. C. & G. S. | 9,931 |
| 821 | San Antonio Peak | Wheeler | 10,191 |
| 822 | San Benito | Smithsonian Inst. | 140 |
| 823 | San Benito Pass | K. P. R. R. Surveys | 2,700 |
| 824 | San Bernardino | Wheeler | 950 |
| 825 | San Bernardino Mountain | Whitney | 11,600 |
| 826 | San Bernardo | Pacific R. R. Reports | 1,118 |
| 827 | San Bruno | Toner | 16 |
| 828 | San Ruenaventura | Toner | 12 |
| 829 | San Carlos Peak | Whitney | 4,977 |
| 830 | Sand Creek | C. P. R. R. | 2,315 |
| 831 | Sand Knoll | U. S. C. & G. S. | 227 |
| 832 | San Diego | Emory | 30 |
| 833 | San Diego Mission | Pacific R. R. Reports | 64 |
| 834 | San Diego Signal Station | U. S. Signal Office | 67 |
| 835 | San Emigdio Store | Wheeler | 788 |
| 836 | San Fernando | C. P. R. R. | 1,066 |
| 837 | San Fernando | Wheeler | 1,034 |
| 838 | San Fernando Pass | Pacific R. R. Reports | 1,940 |
| 839 | San Fernando Peak | Wheeler | 3,793 |
| 840 | San Fernando Tunnel, south mouth | Wheeler | 1,429 |
| 841 | San Felipe | Pacific R. R. Reports | 2,176 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 842 | San Felipe | Pacific R. R. Reports | 2,456 |
| 843 | San Francisco, Signal Station | U. S. Signal Office | 60 |
| 844 | San Francisco, Presidio | Med. Dept. U. S. A. | 150 |
| 845 | San Francisco | U. S. C. & G. S. | 384 |
| 846 | San Francisquito Cañon | Wheeler | 2,382 |
| 847 | San Francisquito Pass | P. R. R. Reports | 3,718 |
| 848 | San Gabriel | Wheeler | 419 |
| 849 | San Gabriel Church | Wheeler | 481 |
| 850 | San Gabriel Mine | Wheeler | 1,703 |
| 851 | San Gabriel Peak | | 6,232 |
| 852 | San Gabriel Range | Whitney | 4,500 to 6,500 |
| 853 | San Gorgonio | C. P. R. R. | 2,560 |
| 854 | San Gorgonio Pass | P. R. R. Reports | 2,800 |
| 855 | San Gorgonio Pass | T. & P. R. R. | 2,621 |
| 856 | San Isabel Rancho | Toner | 2,957 |
| 857 | San Jacinto Mountain | Wheeler | 10,987 |
| 858 | San José | C. P. R. R. | 91 |
| 859 | San José | U. S. C. & G. S. | 118 |
| 860 | San Leandro | C. P. R. R. | 48 |
| 861 | San Lorenzo | Toner | 35 |
| 862 | San Luis Obispo | Toner | 402 |
| 863 | San Luis Pass | P. R. R. Reports | 1,556 |
| 864 | San Luis Rey | Med. Dept. U. S. A. | 20 |
| 865 | San Mateo | Toner | 23 |
| 866 | San Miguel | Toner | 616 |
| 867 | San Pablo Point | U. S. C. & G. S. | 97 |
| 868 | San Pascual | Emory | 716 |
| 869 | San Pedro | Pacific R. R. Reports | 30 |
| 870 | San Pedro Point | U. S. C. & G. S. | 356 |
| 871 | San Pedro Hill | Wheeler | 1,462 |
| 872 | San Quentin, Point | U. S. C. & G. S. | 173 |
| 873 | Santa Ana | U. S. C. & G. S. | 3,620 |
| 874 | Santa Ana | C. P. R. R. | 137 |
| 875 | Santa Ann Hotel | Wheeler | 141 |
| 876 | Santa Barbara | Smithsonian Institute | 20 |
| 877 | Santa Buenaventura | Wheeler | 146 |
| 878 | Santa Catalene | Toner | 3,000 |
| 879 | Santa Clara | Smithsonian Institute | 98 |
| 880 | Santa Cruz Station | U. S. C. & G. S. | 359 |
| 881 | Santa Cruz Point | U. S. C. & G. S. | 32 |
| 882 | Santa Isabella | | 3,050 |
| 883 | Santa Isabella Rancho | Pacific R. R. Reports | 2,957 |
| 884 | Santa Monica | L. A. & I. R. R. | 20 |
| 885 | Santa Monica | Wheeler | 15 |
| 886 | Santa Paula | Wheeler | 384 |
| 887 | Santa Rosa Valley | Wheeler | 175 |
| 888 | San Vicente | L. A. & I. R. R. | 167 |
| 889 | Say-qui-to Spring | Wheeler | 5,553 |
| 890 | Schaffers, Mount | Wheeler | 6,864 |
| 891 | School House | S. P. R. R. | 109 |
| 892 | Schultz, Mount | Wheeler | 2,275 |
| 893 | Scodie's Ranch | Wheeler | 2,716 |
| 894 | Semi Pass | P. R. R. Reports | 1,577 |
| 895 | Sentinel Dome (above valley 4,160) | Wheeler | 8,011 |
| 896 | Sesma | Toner | 229 |
| 897 | Sevastapol Flat | Wheeler | 2,210 |
| 898 | Seven Palms | C. P. R. R. | 1,126 |
| 899 | Shafer's Station | Wheeler | 4,026 |
| 900 | Shasta | | 1,160 |
| 901 | Shasta, Mount | Whitney | 14,442 |
| 902 | Shasta, Mount (timber line on) | | 8,000 |
| 903 | Shaw's Flat | Toner | 2,270 |
| 904 | Shaw's Flat | Wheeler | 2,036 |
| 905 | Shaw's Ranch | Wheeler | 6,311 |
| 906 | Shear's Bridge | Wheeler | 2,007 |
| 907 | Sheep Head | Wheeler | 3,914 |
| 908 | Sheffer's Hot Springs | Wheeler | 4,094 |
| 909 | Sheridan | | 113 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 910 | Shingle Springs | S. P. R. R. | 1,427 |
| 911 | Shinn's Ranch | Wheeler | 5,040 |
| 912 | Shoo-fly Bridge | Wheeler | 3,071 |
| 913 | Shumway's Ranch | Wheeler | 5,067 |
| 914 | Sierra Valley | Wheeler | 4,910 |
| 915 | Sierravile, Junc. of S. T. and L. Road | Wheeler | 4,904 |
| 916 | Sierraville, Post Office | Wheeler | 4,880 |
| 917 | Silliman, Mt. | Whitney | 11,623 |
| 918 | Silver Creek | Toner | 3,700 |
| 919 | Silver Lake Hotel | Wheeler | 7,174 |
| 920 | Silver Mt. | Whitney | 10,934 |
| 921 | Silver Mountain City | Wheeler | 6,446 |
| 922 | Silver Mountain Pass | Whitney | 8,793 |
| 923 | Simi Ranch | Wheeler | 674 |
| 924 | Smith's Ranch | Wheeler | 1,047 |
| 925 | Smoke Creek Depot | Wheeler | 4,163 |
| 926 | Snelling Post Office | Wheeler | 252 |
| 927 | Snider's Store | Wheeler | 4,925 |
| 928 | Snow's Hotel | Wheeler | 5,217 |
| 929 | Soap Spring | Wheeler | 706 |
| 930 | Soda Lake | Pacific R. R. Reports | 1,002 |
| 931 | Soda Lake | Wheeler | 1,128 |
| 932 | Soledad City | Wheeler | 2,513 |
| 933 | Soledad Pass | A. & P. R. R. Surveys | 3,215 |
| 934 | Solfatara | Wheeler | 5,908 |
| 935 | Sonoma Mountain | U. S. C. & G. S. | 2,292 |
| 936 | Sonora Mountain | Wheeler | 11,478 |
| 937 | Sonora Pass | P. R. R. Reports | 10,115 |
| 938 | Sonora Post Office | Wheeler | 1,816 |
| 939 | Soto | Toner | 186 |
| 940 | South Dome (lip) (above valley 4,953) | Wheeler | 8,804 |
| 941 | South Fork Mountain | Wheeler | 7,408 |
| 942 | Spadra | C. P. R. R. | 705 |
| 943 | Spadra | Wheeler | 802 |
| 944 | Spanish Ranch | Wheeler | 3,636 |
| 945 | Sprague's Ranch | Wheeler | 2,950 |
| 946 | Springville | Wheeler | 48 |
| 947 | Stanford Mountain | Whitney | 9,175 |
| 948 | Starr King Mt. (above valley 5,171) | Wheeler | 9,022 |
| 949 | State Line Peak | Wheeler | 8,405 |
| 950 | Stevens Bar Ferry | Wheeler | 614 |
| 951 | Stevens Mountain | Wheeler | 10,011 |
| 952 | Stevens Ranch, Hope Valley | Wheeler | 7,382 |
| 953 | Stockton, Junc. with S. & V. & S. & C. R. R.'s | C. P. R. R. | 23 |
| 954 | Stockton's Cabin | Wheeler | 5,877 |
| 955 | Stockton Mill | Wheeler | 4,639 |
| 956 | Stokes Mountain | Wheeler | 2,069 |
| 957 | Stonebreakers | Wheeler | 4,360 |
| 958 | Stony Point | | 500 |
| 959 | Storms | Nevada County N. G. R. R. | 2,424 |
| 960 | Strawberry | Wheeler | 5,238 |
| 961 | Strawberry Station (toll house) | Wheeler | 5,695 |
| 962 | Strawberry Valley | Toner | 3,567 |
| 963 | Strawberry Valley | Williamson | 5,707 |
| 964 | Sugar Loaf Mountain | Wheeler | 8,416 |
| 965 | Sulphur Peak | U. S. C. & G. S. | 3,471 |
| 966 | Sulphur Spring Ranch | Wheeler | 4,466 |
| 967 | Summit Peak | Wheeler | 8,301 |
| 968 | Summit Post Office, west of Beckwith's Pass | Wheeler | 4,875 |
| 969 | Summit Station | Wheeler | 6,983 |
| 970 | Summit Valley | Toner | 6,765 |
| 971 | Sumner | C. P. R. R. | 415 |
| 972 | Sunday Peak | Wheeler | 8,335 |
| 973 | Sunday Peak | Wheeler | 11,089 |
| 974 | Sunoe | Toner | 264 |
| 975 | Surveyors' Wells | Wheeler | 3,567 |
| 976 | Susanville | Wheeler | 4,195 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 977 | Suspension Bridge, Mokelumne River | Wheeler | 2,092 |
| 978 | Sutler | Toner | 919 |
| 979 | Swann's Ranch, E. Walker River | Wheeler | 5,042 |
| 980 | Sweetwater Mountain | Wheeler | 11,778 |
| 981 | Sycamore | | 302 |
| 982 | Sycamore Grove | Wheeler | 447 |
| 983 | Tahoe City | Wheeler | 6,252 |
| 984 | Tahoe Lake | R. R. Reports | 6,247 |
| 985 | Tamalpais, Mount | Whitney | 2,597 |
| 986 | Tamarac | | 6,209 |
| 987 | Tamarack Flat | Wheeler | 6,234 |
| 988 | Tannery | Wheeler | 4,400 |
| 989 | Tapo Ranch | Wheeler | 1,373 |
| 990 | Tassett | | 83 |
| 991 | Taylor's Ranch | Wheeler | 1,047 |
| 992 | Taylorville | Wheeler | 3,479 |
| 993 | Tehachapai, Mount | Wheeler (Theod.) | 9,214 |
| 994 | Tehachapai Pass | Wheeler | 3,832 |
| 995 | Tehama | C. P. R. R. | 222 |
| 996 | Tejon, Fort | Med. Dept. U. S. A. | 3,240 |
| 997 | Tejon, Fort | Wheeler | 3,245 |
| 998 | Tejon Pass | P. R. R. Reports | 5,364 |
| 999 | Tejon Ranch | Wheeler | 1,450 |
| 1000 | Telegraph Hill | U. S. C. & G. S. | 300 |
| 1001 | Telescope Mountain | Wheeler (Theod.) | 10,937 |
| 1002 | Temescal Mountain | Wheeler (Theod.) | 5,730 |
| 1003 | Thomas Ranch | Wheeler | 3,772 |
| 1004 | Thompson | C. P. R. R. | 9 |
| 1005 | Thompson's | Wheeler | 2,114 |
| 1006 | Thompson's Ferry | Wheeler | 188 |
| 1007 | Thompson's Peak | Wheeler | 7,752 |
| 1008 | Thunder Mountain | Wheeler | 9,121 |
| 1009 | Tilley's Ranch | Wheeler | 2,609 |
| 1010 | Tipton | C. P. R. R. | 267 |
| 1011 | Todos Santos Pass | P. R. R. Reports | 637 |
| 1012 | Toolucha Peak | Wheeler | 7,022 |
| 1013 | Tomales Bay | U. S. C. & G. S. | 673 |
| 1014 | Topsail Rock | U. S. C. & G. S. | 81 |
| 1015 | Towler's, Napa Valley | | 369 |
| 1016 | Town Talk | Nev. Co. N. G. R. R. | 2,774 |
| 1017 | Tragedy Spring | Wheeler | 7,989 |
| 1018 | Trinchera | Wheeler | 7,567 |
| 1019 | Trinidad | | 5,820 |
| 1020 | Trout Meadows | Wheeler | 5,998 |
| 1021 | Truckee | C. P. R. R. | 5,819 |
| 1022 | Truckee | Wheeler | 5,795 |
| 1023 | Truckee Pass | P. R. R. Reports | 7,200 |
| 1024 | Truebody | C. P. R. R. | 88 |
| 1025 | Tulare | C. P. R. R. | 282 |
| 1026 | Tulare Lake | Pacific R. R. Reports | 398 |
| 1027 | Tull Flat | Wheeler | 5,594 |
| 1028 | Tullock | Toner | 106 |
| 1029 | Tuolumne Grove | Wheeler | 5,794 |
| 1030 | Turner's Ranch, Sierra Valley | Wheeler | 4,904 |
| 1031 | Tuttletown | Wheeler | 1,321 |
| 1032 | Twin Lake | Wheeler | 5,106 |
| 1033 | Twin Peak | Wheeler | 8,824 |
| 1034 | Twin Peaks | Whitney | 8,925 |
| 1035 | Twist's Ranch | Wheeler | 1,121 |
| 1036 | Tyler's Ranch | Wheeler | 4,802 |
| 1037 | Uhl's Ranch | Wheeler | 2,662 |
| 1038 | Union Camp | Smithsonian Institute | 54 |
| 1039 | Union Hill | Nev. Co. N. G. R. R. | 2,706 |
| 1040 | Vacaville | Toner | 175 |
| 1041 | Vala Citron | Emory | 1,539 |
| 1042 | Vallecito | Toner | 1,643 |
| 1043 | Vallecito Post Office | Wheeler | 1,748 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Authority. | Elevation. Feet. |
|---|---|---|---|
| 1044 | Vallejo | U. S. C. & G. S. | 87 |
| 1045 | Vallejo | U. S. C. & G. S. | 371 |
| 1046 | Vallejo (North) | C. P. R. R. | 26 |
| 1047 | Vallejo (South) | C. P. R. R. | 13 |
| 1048 | Vergennes Ranch | Wheeler | 940 |
| 1049 | Vina | | 211 |
| 1050 | Visalia | Williamson | 384 |
| 1051 | Visalia, Signal Station | U. S. Signal Office | 348 |
| 1052 | Volcano | Wheeler | 2,075 |
| 1053 | Wabler Lake House | Wheeler | 6,808 |
| 1054 | Wades' Meadows | Wheeler | 4,567 |
| 1055 | Wades' Peak | Wheeler | 7,153 |
| 1056 | Wahguyhe Mountain | Wheeler (Theod.) | 8,527 |
| 1057 | Walker's Pass | P. R. R. Reports | 5,302 |
| 1058 | Walker's Pass | Wheeler | 5,322 |
| 1059 | Wallace's Ranch, Warner Lake | Wheeler | 4,487 |
| 1060 | Walnut Grove | C. P. R. R. | 308 |
| 1061 | Warm Springs | C. P. R. R. | 46 |
| 1062 | Warm Springs, Sonora Road | Wheeler | 7,385 |
| 1063 | Warner's Pass | P. R. R. Reports | 3,870 |
| 1064 | Warner's Ranch | P. R. R. Reports | 3,021 |
| 1065 | Warren's Peak | Wheeler | 9,668 |
| 1066 | Washington, Mount | Wheeler | 10,802 |
| 1067 | Washington Quartz Mill | Wheeler | 1,032 |
| 1068 | Watsonville | | 45 |
| 1069 | Wancoba Peak | Wheeler | 11,267 |
| 1070 | Webster | C. P. R. R. | 24 |
| 1071 | Welden | Wheeler | 2,668 |
| 1072 | Welds | Wheeler | 2,217 |
| 1073 | Wellington Mountain | Wheeler | 7,665 |
| 1074 | West Point | Wheeler | 2,749 |
| 1075 | West's Ranch | Wheeler | 596 |
| 1076 | Wheatland | C. P. R. R. | 84 |
| 1077 | White Granite Mountain | Wheeler | 7,045 |
| 1078 | White Rock | S. P. R. R. | 495 |
| 1079 | Whitney | Wheeler | 10,051 |
| 1080 | Whitney Meadows | Wheeler | 9,371 |
| 1081 | Whitney, Mt. | Whitney | 14,898 |
| 1082 | Wellington Mountain | Wheeler | 7,665 |
| 1083 | Wild Rose Spring | Wheeler | 4,683 |
| 1084 | Wiley's Station, Amador Road | Wheeler | 5,027 |
| 1085 | Williamson River | Wheeler | 4,387 |
| 1086 | Williamson's Lake | | 2,588 |
| 1087 | Willow Lake | Wheeler | 5,382 |
| 1088 | Willow Ranch | Wheeler | 4,275 |
| 1089 | Willow Spring | Wheeler | 420 |
| 1090 | Willow Spring (head of Willow Creek) | Wheeler | 5,084 |
| 1091 | Willow Tree Spring | Wheeler | 2,500 |
| 1092 | Wilson's Ranch | Wheeler | 1,115 |
| 1093 | Woodford's | Wheeler | 5,676 |
| 1094 | Woodland, Junction with N. R. R. | C. P. R. R. | 63 |
| 1095 | Woodland | U. S. C. & G. S. | 58 |
| 1096 | Woods Peak | Whitney | 10,552 |
| 1097 | Workman's Hill | Wheeler | 1,363 |
| 1098 | Workman's Ranch | Wheeler | 362 |
| 1099 | Wright Lake | P. R. R. Reports | 4,470 |
| 1100 | Yellowbally | Petermann | 8,000 |
| 1101 | Yankee Jim's | | 3,185 |
| 1102 | Yerba Buena | U. S. C. & G. S. | 345 |
| 1103 | Yosemite Valley | Whitney | 4,060 |
| 1104 | Yosemite Valley (cliffs and domes about it range from 7,000 to 9,000 ft. above sea) | Williamson | 3,935 |
| 1105 | You Bet | Nev. Co. N. G. R. R. | 2,172 |
| 1106 | Yountville | C. P. R. R. | 97 |
| 1107 | Yountville | Cal. P. R. R. | 105 |
| 1108 | Yreka | Williamson | 2,731 |
| 1109 | Yreka Gap | Whitney | 6,642 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Elevation. Feet. |
|---|---|---|
| 1110 | Alleghany, Sierra County | 4,375 |
| 1111 | Altaville, Calaveras County | 1,577 |
| 1112 | American Mine, Nevada County | 1,843 |
| 1113 | Amador City, Amador County | 862 |
| 1114 | Angels, Calaveras County | 1,394 |
| 1115 | Aqueduct City, Amador County | 2,435 |
| 1116 | Argus Peak, Inyo County | 6,333 |
| 1117 | Atkinson's Grade, San Diego County, foot | 416 |
| 1118 | Atkinson's Grade, San Diego County, first bench | 726 |
| 1119 | Atkinson's Grade, San Diego County, summit | 1,220 |
| 1120 | Bald Mountain, Calaveras County, summit | 1,801 |
| 1121 | Bald Mountain, Sierra County, mouth of tunnel | 4,489 |
| 1122 | Ballena Valley, San Diego County | 2,440 |
| 1123 | Banner, San Diego County | 2,800 |
| 1124 | Birchville, Nevada County | 1,683 |
| 1125 | Blacksmith's Flat, El Dorado County | 3,831 |
| 1126 | Blue Tent, Nevada County | 3,108 |
| 1127 | Bonaparte's Hat, Placer County, summit | 8,661 |
| 1128 | Borax Flat, Inyo County | 1,800 |
| 1129 | Borax Works, Inyo County | 1,816 |
| 1130 | Boston Ranch | 1,500 |
| 1131 | Bottle Hill, El Dorado County, crest | 2,570 |
| 1132 | Bowman Dam, Nevada County | 5,393 |
| 1133 | Brady's, Yuba County | 211 |
| 1134 | Bridgeport, Nevada County | 1,500 |
| 1135 | Brownsville, Yuba County | 2,125 |
| 1136 | Buck's Bar, El Dorado County | 1,628 |
| 1137 | Bunker Hill, Sacramento County | 267 |
| 1138 | Burn's Ranch, El Dorado County | 2,518 |
| 1139 | Cajon Ridge, San Diego County | 510 |
| 1140 | Cajon Valley, San Diego County | 220 |
| 1141 | Cajon Valley, San Diego County, eastern rim | 375 |
| 1142 | Canada Hill, Placer County, summit | 7,091 |
| 1143 | Canada Hill, Placer County, Yank's Cabin | 6,217 |
| 1144 | Cave of the Catacombs, Calaveras County | 1,708 |
| 1145 | Centerville, Pilot Hill Post Office, El Dorado County | 1,191 |
| 1146 | Cherokee Flat, Butte County | 1,187 |
| 1147 | Cherokee, Nevada County | 2,575 |
| 1148 | Chili Bar, El Dorado County | 931 |
| 1149 | Christmas Hill, Nevada County, top of | 3,225 |
| 1150 | Cold Spring, Mountain Summit, Placer Couty | 3,679 |
| 1151 | Coleman's Grade, San Diego County, top, five miles from Julian | 3,400 |
| 1152 | Columbia Hill, Nevada County | 2,958 |
| 1153 | Coso, Inyo County | 5,884 |
| 1154 | Coso Mines, Inyo County | 6,000 |
| 1155 | Coso Peak, Inyo County | 8,425 |
| 1156 | Damascus, Placer County | 4,006 |
| 1157 | Dardanelles, Placer County, bed rock | 2,677 |
| 1158 | Dark Cañon, El Dorado County | 4,229 |
| 1159 | Deadwood, Placer County | 3,951 |
| 1160 | Dirty Flat, El Dorado County | 2,355 |
| 1161 | Dogtown (Magalia), upper, Butte County | 2,150 |
| 1162 | Dogtown (Magalia), lower, Butte County | 2,080 |
| 1163 | Doon's House, Butte County | 2,940 |
| 1164 | Douglas Flat, Calaveras County | 1,986 |
| 1165 | Downieville Trail, Summit of, between Rock Creek and Forest City, Sierra County | 5,404 |
| 1166 | Drytown, Amador County | 642 |
| 1167 | Eagle Borax Works, Inyo County | —69 |
| 1168 | Empire Flat, Nevada County | 1,716 |
| 1169 | Empire Ranch, Yuba County | 840 |
| 1170 | Fairplay, El Dorado County | 2,385 |
| 1171 | Fiddler's Green, Placer County | 4,123 |
| 1172 | Fiddletown, Amador County | 1,693 |
| 1173 | Forbestown, Butte County | 2,625 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Elevation. Feet. |
|---|---|---|
| 1174 | Forest City, Sierra County | 4,465 |
| 1175 | Forest Hill, Placer County | 3,237 |
| 1176 | Forney's, El Dorado County | 4,173 |
| 1177 | Foster's, San Diego County | 260 |
| 1178 | French Corral, Nevada County | 1,566 |
| 1179 | Funeral Mountains, highest peaks, Inyo County | 6,754 |
| 1180 | Georgia Slide, El Dorado County | 2,330 |
| 1181 | Geyser's Springs, Sonoma County | 1,900 |
| 1182 | Gibsonville, Sierra County | 5,500 |
| 1183 | Granite Chief, summit, Placer County | 9,144 |
| 1184 | Greenwood, El Dorado County | 1,610 |
| 1185 | Gregory Mountain, El Dorado County | 3,525 |
| 1186 | Grizzly Flat, El Dorado County | 3,949 |
| 1187 | Grizzly Flat, Placer County | 2,982 |
| 1188 | Gurley's, Yuba County | 172 |
| 1189 | Halfway House, San Diego County (road from San Diego to Julian) | 180 |
| 1190 | Highland Springs, Lake County | 1,700 |
| 1191 | Horse Camp Springs, Inyo County | 4,690 |
| 1192 | Howard Springs, Lake County | 2,225 |
| 1193 | Hunsaker's Grade, San Diego County (four miles from Nuevo) | 1,760 |
| 1194 | Hunsaker's Grade, San Diego County, summit | 2,230 |
| 1195 | Hyatt's, Nevada County | 1,259 |
| 1196 | Indian Diggings, Amador County | 3,162 |
| 1197 | Iowa Hill, Placer County | 2,873 |
| 1198 | Jackson, Amador County | 1,243 |
| 1199 | Jackson Valley, Buttes, summit of | 829 |
| 1200 | Jamison City, Plumas County | 4,800 |
| 1201 | Johnstown, or Garden Valley, El Dorado County | 1,951 |
| 1202 | Jones Hill, El Dorado County, summit of | 2,343 |
| 1203 | Julian City, San Diego County | 4,000 |
| 1204 | Keeler, Inyo County | 3,656 |
| 1205 | King's Hill, Placer County | 2,538 |
| 1206 | Lane's Springs, Calaveras County | 1,000 |
| 1207 | La Porte, Plumas County | 4,993 |
| 1208 | Last Chance, Placer County | 4,583 |
| 1209 | Little Grass Valley, Plumas County | 5,025 |
| 1210 | Little Spanish Hill, crest of, El Dorado County | 2,321 |
| 1211 | Little York, Nevada County | 2,839 |
| 1212 | Logtown, El Dorado County | 1,939 |
| 1213 | Lolo Montez Diggings, Nevada County | 2,489 |
| 1214 | Lone Star Hill, Inyo County | 4,911 |
| 1215 | Lookout Hill, Inyo County | 4,214 |
| 1216 | Malakoff, Nevada County | 3,173 |
| 1217 | Manzanita Hill, summit, Nevada County | 3,054 |
| 1218 | Marble Valley, El Dorado County | 925 |
| 1219 | Michigan Bar, Sacramento County | 227 |
| 1220 | Michigan Bluffs, Placer County | 3,491 |
| 1221 | Mohawk Valley, Knott's Ranch, Plumas County | 4,325 |
| 1222 | Monte Christo | 5,056 |
| 1223 | Montezuma Hill, Nevada County | 2,853 |
| 1224 | Mooney Flat Hill Summit, Yuba County | 1,170 |
| 1225 | Moore's Flat, Nevada County | 4,231 |
| 1226 | Morris Ravine, Butte County | 524 |
| 1227 | Mud Springs, El Dorado County | 1,658 |
| 1228 | Needle Peak, Inyo Connty | 7,086 |
| 1229 | Newtown, El Dorado County | 2,482 |
| 1230 | Nichols' House, Cave City, Calaveras County | 1,593 |
| 1231 | Nine-Mile Station, Inyo County | 2,510 |
| 1232 | North Bloomfield, Nevada County | 3,278 |
| 1233 | Nuevo, San Diego County | 1,200 |
| 1234 | Oliver Mountain Summit, El Dorado County | 3,221 |
| 1235 | Omega, Nevada County | 4,201 |

TABLE OF ALTITUDES—Continued.

| No. | Station. | Elevation. Feet. |
|---|---|---|
| 1236 | Onion Valley, Plumas County | 6,160 |
| 1237 | Ophir Mountain, Inyo County | 6,063 |
| 1238 | Oro Flat, Placer County | 2,842 |
| 1239 | Oroville, Butte County | 375 |
| 1240 | Pilot Hill (Summit), El Dorado County | 1,857 |
| 1241 | Pinto Peak, Inyo County | 7,267 |
| 1242 | Plugugly Hill (Summit), Placer County | 3,251 |
| 1243 | Pluto Summit, Placer County | 8,633 |
| 1244 | Post Office Spring, Inyo County | 1,294 |
| 1245 | Prospect Flat, El Dorado County | 2,214 |
| 1246 | Puckerville, Amador County | 1,037 |
| 1247 | Quaker Hill, Nevada County | 3,265 |
| 1248 | Reeds, Yuba County | 433 |
| 1249 | Rice's Bar, Placer County | 1,184 |
| 1250 | Rough and Ready, Nevada County | 1,901 |
| 1251 | Sailor Cañon, Placer County | 5,251 |
| 1252 | Sailor Flat, Nevada County | 3,050 |
| 1253 | St. Helena Mountain, Napa County | 4,343 |
| 1254 | St. Helena Mountain, Napa County, first bench above Toll House | 3,825 |
| 1255 | Salt Spring, Death Valley, Inyo County | —63.9 |
| 1256 | San Bernardino Hot Springs | 1,600 |
| 1257 | San Juan, Nevada County | 2,143 |
| 1258 | Santa Barbara Hot Sulphur Springs | 1,500 |
| 1259 | Santa Ysabelle Valley, San Diego County | 2,700 |
| 1260 | Sebastopol, Nevada County | 1,893 |
| 1261 | Secret Hill, Summit, Placer County | 6,536 |
| 1262 | Secret House, Placer County | 5,423 |
| 1263 | Sentinel Peak, Inyo County | 9,850 |
| 1264 | Sheep Ranch, Calaveras County | 2,273 |
| 1265 | Sierra City, Sierra County | 4,188 |
| 1266 | Smartsville, Yuba County | 758 |
| 1267 | Smartsville Hill, summit, Yuba County | 1,074 |
| 1268 | Snowy Mountain, Placer County, summit | 8,425 |
| 1269 | Soda Springs, Shasta County | 2,363 |
| 1270 | South Yuba Bridge | 420 |
| 1271 | Spanish Dry Diggings, El Dorado County | 2,158 |
| 1272 | Squaw Valley, Placer County | 6,304 |
| 1273 | Steep Hollow, Nevada County | 3,342 |
| 1274 | Sucker Flat, Placer County | 670 |
| 1275 | Summit, Soda Springs, Placer County | 6,009 |
| 1276 | Sugar Loaf, Butte County, summit | 1,647 |
| 1277 | Sugar Pine Pass, Placer County | 7,130 |
| 1278 | Surprise Cañon, Inyo County | 2,650 |
| 1279 | Sutter Creek, Amador County | 1,197 |
| 1280 | Table Hills east of Owen's Lake, Inyo County | 7,343 |
| 1281 | Table Mountain, Tuolumne County, summit | 2,214 |
| 1282 | Three Prong, Placer County, summit | 9,000 |
| 1283 | Timbuctoo, Yuba County | 441 |
| 1284 | Timbuctoo Mountain, Yuba County | 917 |
| 1285 | Todds Valley, Placer County | 2,750 |
| 1286 | Toll House, St. Helena Mountain, Napa County | 2,300 |
| 1287 | Tucker's Ranch, Plumas County | 4,100 |
| 1288 | Tuscan Springs, Tehama County | 600 |
| 1289 | Volcanoville, El Dorado County | 3,081 |
| 1290 | Water Station, Inyo County | 2,110 |
| 1291 | Webber Hill, El Dorado County, summit | 2,184 |
| 1292 | Whitesel's Ranch, Nevada County | 1,686 |
| 1293 | Wilcox Meadows, El Dorado County | 5,344 |
| 1294 | Wilcox Ravine, Nevada County | 2,799 |
| 1295 | Windy Gap, Inyo County | 2,053 |
| 1296 | Wisconsin Hill, Placer County | 2,936 |
| 1297 | Wilks' Ranch, El Dorado County | 3,386 |

## WATER POWER.

In a State like California, in which a large portion of the area is much above sea level, and where there are a multitude of streams, large and small, flowing from the high lands, there must be and are many localities where water power is abundant and available. This very important matter is just beginning to attract attention in California. At Grass Valley, in Nevada County, where gold mining has been the principal business and the support of the people, up to a recent date, steam was almost universally used to drive the quartz mills. But in 1882 the Idaho Company, although possessing the best quartz mine in the State, began to consider the advantage that would be derived from the substitution of water for steam power. They began to buy water from the South Yuba Canal Company, and after an experimental working for a year, found the annual saving over steam to be from $25,000 to $30,000. There are many localities in the mountains and foothills of California where may be found gold quartz veins, water power, and fertile hillside and mountain valley lands. This Piedmont region will support a large population, and is really the most beautiful part of the State. Mines that would hardly pay if steam power was employed, with cheap or free water power, all the operations of mining and milling may be performed, with but few hands. The same water that serves the mill will hoist the ore, pump, force air into the mine for ventilation and power drilling. Almost any quartz vein in California could be made to pay under these circumstances, and the application of this cheap power would add much to the prosperity of the State.

It will soon again be cheaper to move manufactured articles from water power to a market than to make them by steam elsewhere. Water is equally useful for irrigation and mining purposes after being used for water power, as long as it is not allowed to fall below a certain altitude.

## IRRIGATION.

Soon after the first excitement caused by the discovery of gold in California began to subside, attention was turned in a limited way to the agricultural resources of the State. It was first supposed—from the peculiar dryness of the summer months, during which rain seldom falls—that the country would never be an agricultural one in any general sense, but this theory was disproved by experience. At the same time it became evident that a different system of culture, suited to the climatic periods of excessive moisture alternating with equally excessive dryness, must be pursued. Experiment led to the adoption of a system of irrigation.

When the new method began to be understood, and intelligently carried out, it was found that most extraordinary crops were the result.

The dry valley lands of Fresno, San Bernardino, Kern, and other southern counties where water has been introduced, are found to be unusually fertile, and beautiful and prosperous settlements have sprung up in what was at first thought to be a desert. The subject of irrigation and the use of the waters of the State for other purposes than navigation, has grown in importance until it is admitted to be the most momentous question now before the people. The rights of riparian owners have been questioned and much useless legislation has been enacted without arriving at any satisfactory conclusion. The debris or mining question goes hand in hand with irrigation, and though seemingly different, is in fact only another phase of the same important subject. Judging from the trouble the ancients had with this same question, it will not be settled in California for some time to

come. The proper and just distribution of the surplus waters of the State, and the extraction of the vast deposits of gold known to exist in the foothills, are matters which have an important bearing on our material interests. To solve this problem, and protect the conflicting interests of those concerned, is work for future legislators, and the more the matter is agitated now, the sooner will a settlement be effected.

In some localities where it is difficult to obtain water from living streams, artesian wells are being sunk, and very successfully. From these wells, in some parts of the State, natural gas escapes in considerable quantities, giving hope that gas-wells similar to those now attracting so much attention in Pennsylvania may yet be discovered. A notable example of this at the present time is at the city of Los Angeles, where a vein of gas was struck in sinking a well. The gas became ignited from a cigarette, and blazed up to a height of ten feet. An article in the Los Angeles *Herald* assumes that a dozen wells sunk within the city limits would each of them yield gas which might be utilized.

The city of Stockton is supplied with water from artesian wells, some, if not all, of which also produce gas as well as water. The wells sunk for oil in various parts of the State, in perhaps a majority of cases, produce gas. This is a subject worthy the attention of scientific and practical men. May not these emanations of gas indicate vast bodies of coal, which we may at any day discover by sinking wells in search of water?

The State Mining Bureau should employ special persons to study and investigate these matters, and preserve in the State Museum sections of the various wells, which would enlarge our information as to the geology of the valleys, and throw light upon their origin.

Mr. George A. Raymond, more thoughtful than most persons engaged in the business of sinking artesian wells, has carefully preserved specimens of borings, and kept a register of the findings. This should be done officially by the State Mineralogist, and all the results published as frequently as possible, in the general interest. Mr. Raymond has donated to the State Museum samples of borings which are specially interesting. The following are copies of these tabulated records, exactly as kept by him on printed blanks.

## RECORD OF STRATA IN ARTESIAN WELL

*Drilled by Geo. A. Raymond for J. B. Haggin, Kern County, on Sec. 30, T. 29 S., R. 25 E., Mount Diablo Base and Meridian. Screw Casing 5 5-8 inches diameter.*

| Depth—Feet. | Thickness—Feet. | Character. | Remarks. |
|---|---|---|---|
| 12 | 12 | Black clayey soil | |
| 14 | 2 | Sand | Surface water. |
| 24 | 10 | Yellow clay | |
| 27 | 3 | Sand | |
| 49 | 22 | Yellow clay | |
| 57 | 8 | Sand | |
| 68 | 11 | Brown clay | |
| 80 | 12 | Sand | |
| 82 | 2 | Hard pan | |
| 130 | 48 | Sand | |
| 152 | 22 | Clay and cement | |
| 155 | 3 | Hard pan | |
| 185 | 30 | Sand | |
| 191 | 6 | Cement | |
| 193 | 2 | Yellow clay | |
| 220 | 27 | Sand | |
| 225 | 5 | Yellow clay | |
| 245 | 20 | Sand, cement, and hard pan | In streaks very hard. |
| 255 | 10 | Yellow clay | |
| 272 | 17 | Sand and cement | |
| 285 | 13 | White clay | Like potters' clay. |
| 287 | 2 | Sand | |
| 297 | 10 | White clay | Like potters' clay. |
| 330 | 33 | Sand | |
| 342 | 12 | Hard pan | Very hard. |
| 387 | 45 | Sand | |
| 395 | 8 | Hard pan | Very hard. |
| 403 | 8 | Sand | |
| 433 | 30 | Hard pan and clay | Very hard streaks. |
| 455 | 22 | Hard pan and cement | Very hard streaks. |
| 463 | 8 | Sand | |
| 475 | 12 | Yellow clay | |
| 493 | 18 | Sand and gravel | |
| 530 | 37 | Hard pan and sand | Very hard streaks. |
| 542 | 12 | Sand | |
| 602 | 60 | Hard pan, clay, gravel, and cement | *Streaks very hard—water. |
| 608 | 6 | Yellow clay | |
| 630 | 22 | Hard pan, clay, gravel, and cement | Streaks very hard—water. |
| 642 | 12 | Sand | |
| 648 | 6 | Yellow clay | |
| 650 | 2 | Sand | |

**Stopped work for the present May 20, 1886.**
*** Water rose to within seven feet of surface.**
**No flow at above depth.**
**This well will be carried deeper within a few months. Say about August or September, 1886.**

## RECORD OF STRATA IN ARTESIAN WELL

*Drilled by Geo. A. Raymond for J. B. Haggin, in Kern County, on Sections 29, 30, 31, 32, T. 30 S., R. 26 E., Mount Diablo Base and Meridian. Screw Casing 5 5-8 inches diameter.*

| Depth—Feet. | Thickness—Feet. | Character. | Remarks. |
|---|---|---|---|
| 4 | 4 | Dry sandy soil | |
| 96 | 92 | Quicksand | *First surface water. |
| 98 | 2 | Yellow clay | *No toughness or strength. |
| 280 | 182 | Quicksand and gravel | *Small streaks cement of no strength. |
| 283 | 3 | Blue clay | |
| 340 | 57 | Quicksand and gravel | †Small streaks cement and hard balls. |
| 344 | 4 | Blue clay | |
| 374 | 30 | Quicksand and gravel | †Hard balls. |
| 376 | 2 | Blue clay | |
| 412 | 36 | Sand and gravel | Hard streaks cement. |
| 421 | 9 | Blue clay | |
| 432 | 11 | Quicksand | |
| 440 | 8 | Blue clay | |
| 460 | 20 | Quicksand | Small flow water. |
| 464 | 4 | Blue clay | |
| 472 | 8 | Sand | Second flow water. |
| ---- | ----- | Blue clay | Bottom of casing in blue clay. |

**Sufficient flow of water for two thousand head of stock.**

***Equivalent to 280 feet of continuous quicksand, as the yellow clay was so thin and frail that it would not hold up the weight of the quicksand above.**

**†Samples of hard balls given to Mr. Hanks.**

**Well completed March 15, 1886.**

Some of the specimens taken from the wells, I have examined microscopically and otherwise, and found exceedingly interesting, but to publish an account of them in their present unfinished condition would be premature.

# MINERAL SPRINGS IN CALIFORNIA.

Numerous mineral springs are known to exist in California, some of which have gained celebrity, others are nameless and are only known by their localities. Some of the latter may eventually prove to be of great value. From the fact that it has been impossible to maintain a chemical laboratory in connection with the Mining Bureau, the official guide-book which was planned has not been made, and it has not been possible even to visit the most noted springs to study and publish their characteristics. The State Mineralogist has only been able to gather such information as could be easily obtained, and to condense it into the following list.

Among the many mineral products of the State the numerous mineral springs are not the least important. In Germany, Italy, Switzerland, England, France, Spain, Austria, Scotland, Ireland, Bohemia, and Portugal, in Europe, and New York, Virginia, Arkansas, Pennsylvania, West Virginia, Wisconsin, Kentucky, Ohio, Mississippi, Michigan, and Alabama, in the United States, and in Canada and elsewhere in the world, mineral springs are found. Mineral waters are generally divided into two principal groups—hot and cold. The principal subdivisions are—

| | |
|---|---|
| Salt waters. | Alkaline waters. |
| Iron waters. | Mud springs. |
| Sulphur waters. | Alkaline saline. |
| Lime waters. | Magnesian. |

A few more or less celebrated springs contain notable quantities of some special mineral or salt, to which they owe their peculiar character, as iodine, bromine, lithium, or fluorine.

California abounds in mineral springs more or less celebrated, but there seems to be no system in the use of the waters. People go to any spring which suits their taste or convenience, without knowing or seeming to care for the effect the water will have on them. This results from the fact that but few reliable analyses have been made, and physicians are at a loss how to prescribe for that reason. There should be an official guide book made by the State Mineralogist, which would be of very great utility to the State.

Such a work would necessitate the establishment and maintenance of a very complete chemical laboratory, and the employment of able assistants. The following are the most important known mineral springs in the State. There are many others of less note, but which may be of equal and possibly greater value and importance. The late Dr. Hatch published the best account and description of the mineral waters of California, that has been previously written.

### Alameda County.

#### (1) *Piedmont Springs.*

Situated three miles from Oakland. As far as I am aware, no analysis has ever been made of the water of these springs, although they have attained considable celebrity.

### Calaveras County.

#### (2) *Lane's Mineral Springs.*

These springs are located in the foothills of the Sierra Nevada, at an altitude of one thousand feet above sea level. They lie thirty-five miles east

of Stockton, from which place they may be reached by stage on alternate days; visitors are accommodated at a good hotel, besides which there are cottages for those who prefer them. The water in the springs is clear and cold, but no other information has been obtained, nor has any analysis been published as far as I know.

COLUSA COUNTY.

(3) *Simmon's Hot Sulphur Spring.*

This spring is situated in Sulphur Cañon, but the exact locality is not given. The water has a temperature of 170°, but no analysis has been received.

(4) *Wilbur Hot Sulphur Springs.*

The route to these springs is by rail to Williams, and thence by stage. An analysis by an unnamed chemist has been published. It is claimed that the waters possess curative properties specially applicable to the treatment of rheumatism and cutaneous diseases.

CONTRA COSTA COUNTY.

(5) *Byron Springs.*

There are said to be a number of springs at this locality, some of which are hot, while others are cold, some charged with carbonic acid gas, some with sulphuretted hydrogen. They are situated very near to Byron Station. There is a good hotel at the springs, and the accommodations are said to be first class. Trains leave San Francisco at 9 A. M. and 3 P. M., and Byron at 6:30 and 9:30 A. M. I have no reliable information as to the water of these springs, nor am I aware of any analysis having been made.

HUMBOLDT COUNTY.

(6) *A very remarkable mineral water*

Has been discovered in a nameless spring in the town of Eureka. The water issues from the bank at the edge of the bay. At high tide the waters of the bay rise and cover the spring. The Indians knew of this spring and ascribed to it remarkable curative powers. It was rediscovered accidentally by a workman while the steamer Humboldt was being built near by. The water is now used in Eureka and San Francisco.

The following analysis, not before published, reveals the remarkable character of this water:

SAN FRANCISCO, May 8, 1885.

Mineral water—one U. S. gallon.

| | | |
|---|---|---|
| Sodium chloride | 1403. | grains. |
| Magnesium sulphate | 211.3 | grains. |
| Magnesium chloride | 101. | grains. |
| Calcium sulphate | 42.5 | grains. |
| Sodium bromide | 14. | grains. |
| Potassium sulphate | 12.2 | grains. |
| Sodium carbonate | 10.1 | grains. |
| Calcium carbonate | 3.8 | grains. |
| Alumina | 1.3 | grains. |
| Silica | .95 | grains. |
| Carbonate of iron | .12 | grains. |
| Manganese | | Traces. |
| Boracic acid | | Traces. |
| Iodine | | Traces. |
| Lithium | | Traces. |

Contains a little carbonic acid, and is saturated with sulphuretted hydrogen. It is a sulphur, saline water, and should prove beneficial in affections of the glandular and lymphatic system, rheumatism, and diseases of the skin.

W. D. JOHNSON, M.D.

### (7) *Felt's Springs.*

The following from the *Humboldt County Standard* contains all the information I have been able to obtain concerning these springs:

FELT'S SPRINGS.

Situated about twenty-five miles from Eureka, near the head of Strongs' Valley. Dr. Felt of Hydesville, the fortunate proprietor of these notable mineral waters, must eventually realize a handsome sum for his property. Some years ago he built a good private road from the public highway to the springs, laid pipe, concentrated the waters, cleared off some ten acres of the dense forest surrounding the springs, and erected on the opening a comfortable hotel, large barn, and other necessary improvements. The place was resorted to by many people, some for pleasure, others hoping to be benefited by drinking the mineral water, which it was well known possessed medicinal virtues of a high order. From the springs and thereabouts exudes a species of gas, which Dr. Felt collected in a primitive gasometer and utilized for the purpose of illuminating the premises, and it answered this end well. The waters have been found to be beneficial for persons afflicted with or having dropsical tendencies, many being entirely relieved who were affected in this way. About the time these springs were beginning to be appreciated on their merits, an unfortunate conflagration swept off the improvements. Since the fire the place has remained unoccupied as a public resort. We apprehend, however, upon the completion of the Eureka and Eel River Railroad, the present year (which passes within a short distance of the springs), they will again be opened for patronage.

ANALYSIS OF THE WATER.

From an analysis, made in San Francisco of a quantity of the water of Felt's Springs, it was found to contain the following substances: Carbonate of soda, carbonate of lime, a trace of iron, chloride of potassium, chloride of magnesium, carbonate of magnesia, carbonate of manganese, sulphate of potassa, and chloride of sodium. The location of this property is very picturesque, and its climate cannot be surpassed for salubrity, and with railroad communication it will make a delightful resort for the pleasure seeker as well as the invalid. There are plenty of trout in the streams and game in the woods and valleys.

## Inyo County.

### (8) *Owens' Lake.*

While the water of Owens' Lake is a mineral water in every sense of the word, yet it is not a mineral spring. It results from the evaporation of the water brought down by Owens' River, which enters the valley pure, but takes up in its long passage to the lake, soluble matter from the soil.

The mineral matter in solution in the waters of the river and lake is augmented by small salt and alkaline streams and the seepage from a multitude of mineral springs which abound in the foothills of the Sierra Nevada and the Inyo Mountains. The waters so extensively sold and advertised on the Pacific Coast and elsewhere under the trade name of "*Castalian*" is taken from this lake. The engraving on the circulars of this company is a deception, as it shows an imaginary spring on an isolated hill or mountain, from which a small stream is figured flowing down to the plain. The circulars claim that it is a natural mineral water from the Castalian Spring, Inyo County, which it is not. Owens' Lake is one of the most remarkable sheets of water in the world, and it is well worthy of a visit by tourists and Californians. Descriptions have been given of it in previous reports of this office. The waters are highly alkaline, remarkably dense, and in effect a nearly saturated solution of valuable salts, which will certainly be turned to account in the near future.

The waters of this lake have been analyzed by several chemists; a very full one by Thomas Price of San Francisco is published on the circulars

of the Castalian Company. The following is an approximate analysis by a London chemist by the name of Philips:

| | Grains in an Imperial Gallon. |
|---|---|
| Chloride of sodium | 2,942.15 |
| Sulphate of soda | 956.80 |
| Carbonate of soda | 2,914.43 |
| Sulphate of potash | 35.74 |
| Silicate of potash | 139.54 |
| Organic matter | 16.94 |
| Pure water | 2,994.40 |
| | 10,000.00 |

Owens' Lake may be reached by rail from San Francisco or Reno to Keeler Station, which is the present terminus of the road. The town is situated on the eastern shore of the lake.

### (9) *Thermal Acid Springs.*

All the information this office has of these springs is contained in the following extract from the *Inyo Independent*, June 20, 1883:

These singular springs are situated in Inyo County, in the Coso Range of mountains, about sixteen miles southeast of Olancha Post Office. The springs have but a limited flow, and from crevices on the mountain side, through which steam is continually ejected, and thousands of tons of pure sulphur cover and surround the locality. The taste of the water is intensely sour, making it unfit for drinking purposes. It has no smell, but formerly there must have been large quantities of sulphureted hydrogen contained in it, as the sulphur deposit indicates. Large quantities of free sulphuric acid is found in the water, but the sulphur deposit, it is claimed by chemists, cannot be derived from this source. Chemists are at least unacquainted with a process by which free sulphuric acid would turn under the circumstances, such as the above, into sulphur. The composition is certainly a remarkable one, as will be seen from the following analysis. In one hundred thousand parts are contained parts:

| | |
|---|---|
| Free sulphuric acid | 78.4 |
| Potassium sulphate | 2.5 |
| Sodium sulphate | 15.1 |
| Calcium sulphate | 15.3 |
| Magnesium sulphate | 1.2 |
| Aluminium persulphate | 127.0 |
| Iron persulphate | 33.2 |
| Nitric acid | Trace. |
| Chlorine | Trace. |
| Ammonia | Trace. |
| Lithium | Trace. |

Springs or lakes of a chemical character like this are very rare; singular is also the small trace of chlorides in a water so strongly charged with mineral matters. The only known instance analogous to it is the Sour Lake in Texas, and a spring in the vicinity of the volcanoes in South American Cordilleros de los Andes.

## Lake County.

### (10) *Adams Springs.*

These springs are located in the pine mountains of Lake County, about eight miles south of Clear Lake, and two and a half miles from Siegler Springs, six miles from Harbin Springs, and twenty-eight miles from Calistoga. They are reached from San Francisco by rail to Calistoga, and thence by stage on alternate days. There is a good hotel at the springs. An analysis of the waters has been made, but the name of the chemist is unknown to me. The water is highly charged with carbonic acid gas, and is said to have a decided taste of petroleum. The waters are said to be good for rheumatism, and bilious diseases, and several cases of Bright's disease are said to have been improved by its use.

(11) *Allen Springs,*

Are located in a cañon near the head of Cache Creek, forty-five miles from Williams, which may be reached by rail from Sacramento. Communication between Williams and the springs is made by stage.

The waters of Allen Springs are cold, saline, highly charged with free carbonic acid gas, temperature 50°. An analysis made by W. T. Wenzell, whose name is a guarantee of its correctness, has been published.

(12) *Anderson's Springs.*

The character of these springs is hot sulphur and steam. They lie nineteen miles from Calistoga, and five miles from Middletown. There is a good hotel at the locality and a number of commodious cottages. No chemical analysis has been reported, and no further information obtained.

(13) *Bartlett Springs.*

These springs lie sixteen miles northeast of Clear Lake, in Lake county, and forty miles west of Williams, in Colusa county. They may be reached from San Francisco by rail to Calistoga, thence by stage. While no analysis has been published, the water is said to contain arsenic, by which reputed skin and other diseases are said to have been cured. The water is cold. It is largely bottled, and sold in San Francisco and elsewhere.

(14) *Bonanza Springs.*

There are several of these springs, about which, however, but little is known, aside from the fact that they are warm chalybeate; one is cold. There is also a cold plunge bath. No analysis has been made. Route from San Francisco is by rail to Calistoga, thence by stage to the springs.

(15) *Highland Springs.*

Situated twenty-five miles from Cloverdale, seven miles south of Lakeport, and four miles from Kelseyville, in sight of Clear Lake. Altitude, seventeen hundred feet. The springs are reached from San Francisco in ten hours by rail and steam to Cloverdale, thence by stage. There are several of the springs known by different names, as the "magnesia spring," the "magic spring," the "Dutch spring," and the "soda spring." The general character of the water may be learned by the following analysis:

Magic Springs, analyzed by Professor W. S. Rising, University of California. Temperature, 85°.

| | Grains per U. S. Gal. |
|---|---|
| Chloride of sodium | 1.290 |
| Bicarbonate of potash | 0.544 |
| Bicarbonate of soda | 21.763 |
| Bicarbonate of lime | 50.411 |
| Bicarbonate of magnesia | 70.243 |
| Bicarbonate of iron | 0.973 |
| Bicarbonate of manganese | Trace. |
| Silica | 7.398 |
| Alumina | 0.169 |
| Organic matter | Trace. |
| Free carbonic acid | 74.462 |
| Total | 227.253 |

BERKELEY, April 3, 1882.

The water from these springs has been bottled and sold in the State and elsewhere to a considerable extent.

(16) *Hot Borate and Ammonia Spring.*

This remarkable mineral spring is situated on the edge of Clear Lake near the Sulphur Bank Quicksilver Mine. An analysis made by Gideon E. Moore may be found in Geology of California, vol. 1, by J. D. Whitney, folio. The water is remarkable as containing large quantities of potassium, ammonia, bromine, and borax. The waters have been used medicinally, but as yet to no great extent.

(17) *Hough's Mineral Spring.*

This spring, of which but little is known, is reached by stage from Williams in Colusa County, by which daily communication is made.

(18) *Howard Springs.*

Located five miles from Adams' Springs, one and one half miles from Siegler Springs, and five miles north of Harbin. Altitude, two thousand two hundred and twenty-five feet. May be reached from San Francisco by Napa Valley Railroad to Calistoga, thence by stage. There is a good hotel at the springs, and commodious cottages. There are said to be fourteen springs, hot and cold; temperature from 58° to 109°. One spring is chalybeate, one is cold, sparkling, and highly charged with carbonic acid gas. No analysis reported. Information as to the character of the water of this spring to be obtained without an actual visit to the locality is meager and unsatisfactory.

(19) *Iodine Spring.*

In April, 1872, a remarkable mineral water was examined by Falkenau & Hanks of San Francisco, which was found to contain considerable iodine. Information has since been obtained to the effect that the spring is situated at the entrance of Grizzly Cañon, Lake County, five or six miles from Wilbur Springs. This subject has been alluded to in the fourth annual report of this office, folio 230.

(20) *Saratoga Springs—formerly Pierson's.*

Situated fourteen miles from Lakeport, one mile west of Witter Springs. They may be reached from San Francisco by rail to Calistoga, thence by stage to Lakeport and the springs. There is a good hotel and accommodations. The springs, of which there are several, are cold. The waters are sulphurous and alkaline, containing, it is claimed, sulphur, soda, iron, magnesia, and free carbonic acid gas. No analysis is reported. It is claimed that a multitude of diseases are cured or ameliorated by the use of the waters.

(21) *Siegler Springs (hot and cold).*

These somewht celebrated springs are situated in a cañon, said to have an elevation of two thousand five hundred feet. There is at the locality a good hotel and accommodations. The waters are alkaline and chalybeate. One spring is said to contain arsenic, and to be valuable for the

treatment of chronic cutaneous diseases. An analysis of the waters is reported, but as far as can be learned it has not been published.

These springs are reached by stage from Calistoga. Time from San Francisco, twelve hours.

(22) *Witter Springs.*

These springs are situated in the Coast Range of mountains, five miles from the town of Upper Lake, and fifteen from Lakeport, near the Blue Lakes. There are several springs which are cold. They are alkaline, sulphurous, and have considerable reputation as yielding healing waters. There is a good hotel on the grounds, and a number of commodious cottages for visitors. No analysis has been published.

LASSEN COUNTY.

(23) *Big Hot Springs.*

This spring lies about three miles north of Honey Lake. The exact locality is section twenty-three, township twenty-nine north, range fifteen east, Mt. Diablo meridian. It is called a boiling spring, which it practically is, its temperature being 200° F. The water rises with considerable force from an orifice equal to a foot square. From observations made by John Pfeninger, from a spout 4x18 inches, forty-five cubic inches flowed in one minute. The chemical character of the water is not known, as no analysis has been made. No medicinal properties are yet claimed for it.

LOS ANGELES COUNTY.

(24) *Fulton's Sulphur Wells.*

These artificial flowing wells yielding a mineral water claimed to be valuable, lie two miles north of Norwalk Station, on the Los Angeles and Anaheim railroad. An analysis is published in a circular issued by Dr. J. E. Fulton, from whom the wells are named. This shows the water to contain bi-carbonate of soda, lime, magnesia and iron, sulphate of soda, chloride of sodium, silica, traces of iodine and potash, and free carbonic acid, hydrosulphuric and nitrogen gases. The water flows from two wells three hundred to three hundred and fifty feet deep. The water is cold. There is a good hotel on the grounds, and good accommodations for visitors. A daily stage connects with the railroad at Norwalk.

MENDOCINO COUNTY.

(25) *California Seltzer Spring.*

This valuable spring I visited personally, and the following is the result of my observations. Analysis have been made and published by J. A. Bauer, Louis Falkenau, and by myself:

The spring is situated in Mendocino County, about one and one half miles from the Fountain House, which is twelve miles from Cloverdale, on the Ukiah road.

The distance from Cloverdale to the spring in a direct line is nine miles, and the direction, north forty-two degrees west.

The exact location may be stated as follows: It is on the southeast quarter of the northeast quarter of section five, township twelve north, range eleven west, Mount Diablo base and meridian.

The spring lies in a beautiful and picturesque valley, and the mountain scenery surrounding it is charming. A small frame building has been erected over the spring to protect it from the sun and rain. The water flows from a half-inch pipe, and I am informed by those who reside near the spring that the flow is continuous and equal throughout the

year. By careful experiment I found the discharge from the pipe to equal 45.89 wine gallons per hour, or 1101.36 gallons in twenty-four hours.

There are several points in the cañon where the same water issues from the ground, which is allowed to run to waste, all of which could be saved and turned to account.

When drawn from the spout, the water is cold, having a temperature of 61° Fahrenheit. At the time the temperature was taken that of the room was 98°.

The water, to the taste, is very agreeable. It contains such an excess of carbonic acid that that gas is continually being given off, like champagne. Carbonic acid gas is also continually bubbling up from the pool into which the water falls from the spout.

When first drawn the water is perfectly clear, but soon assumes a faint opalescence, and after standing for some time it lets fall an inconsiderable precipitate. At the exit there is a large deposit of a red sediment, which is seen on the sides of cisterns into which the water flows, and also on the stones in the bed of the stream.

The water does not act on all persons drinking it alike. To some it is a gentle cathartic, while others are not so affected.

When the water is shaken in a vessel there is a sudden evolution of free carbonic acid gas. When first drawn the water gives an acid reaction, owing to the carbonic acid; but after standing for some time, or after boiling, it becomes alkaline.

A large proportion of the solid constituents are held in solution by the free carbonic acid; these become insoluble, and precipitate, when the water is boiled.

The total solid constituents of the water in a wine gallon, obtained by evaporating that quantity of the water to dryness in a silver dish, was found to be 181.2311 grains.

## Mono County.

### (26) *Mono Lake.*

A wide spreading sheet of mineral water lies in Mono County, and is one among the many natural curiosities of our noble State, which should be more generally visited by tourists, which is now no hardship, as a first class narrow gauge railway runs within a short distance from its shores. This lake, which is more correctly an inland sea, resembles in many of its features the Dead Sea of the Holy Land. The same may be said of Owens' Lake, a description of which will be found in its proper place.

Mono Lake lies in a depression, in an extensive desert basin, which was probably in ancient times an extensive volcanic crater, and from which can be traced streams of ancient lava, which flowed in several directions.

The lake is fourteen miles, more or less, from east to west, and nine from north to south, but it varies in size, owing to temperature and the quantity of snow that falls during any year on the summits of the adjacent Sierras. When an unusually large quantity of snow falls the waters expand, and for the same reason they become more dilute. When the conditions are different the waters of the lake evaporate, and it shrinks. The waters becoming in proportion more dense and highly charged with salts, this fluctuation is marked on the shore by an amphitheater of low terraces.

At one time the lake was much larger than at present, as shown by magnificent terraces at a greater distance from the shores. The water derives its salts from rivers or creeks that flow into it. These collect from the volcanic soils the soluble parts, which they deposit in the lake. Having no outlet, the basin retains it, and by evaporation it becomes condensed. During a period of probably many centuries this lake has stored up vast quantities of valuable salts, which await the hand of man to gather and utilize.

These waters are intensely saline, but their exact constituents are not yet known; a careful and exhaustive analysis has been commenced by the Mining Bureau, the results of which will, no doubt, be duly published.

There are several islands in the lake, on one of which there are hot and mineral springs, a feeble remnant of the volcanic activity of former days. A few miles from the margin of the lake, may be seen several volcanic cones, expired years ago, but which have left lava and obsidian as a

memento of past volcanic energy. Great quantities of gulls and other aquatic birds flock to the shores of the lake to feast on the larvæ which abound in its waters.

The presence of worms and minute and curious living forms in the highly alkaline waters of the lake, is a striking example of nature's care for animal life. How these creatures can live in a solution so alkaline that it will attack the flesh of a human being, is one of the mysteries of the universe.

The water sent down to the Mining Bureau has been placed in a large vessel of crystal glass, and is now on exhibition in the Museum. When first received, on looking through it, one could see a number of strange animals swimming about in full possession of life and happiness; although preferring to swim on their backs, their motion resembled that of the oars of a Venetian gondola, or of the argo, as described in mythological fable. Yet, when the bottle is gently shaken, the water strikes against the sides of the vessel containing it like oil, or concentrated sulphuric acid. When evaporated this extraordinary water leaves behind a white saline mass equal to 2926 grains in an imperial gallon.

There is in my mind no finer view in the State than of the valley or desert in which Mono Lake lies, with the White Mountains for a background, as seen from the summit of Mono Pass. It is only a short distance from the Yosemite, which is visited by thousands of tourists annually. The route is by Lake Tenaya, Cathedral Peak, Tuolumne Valley, the Soda Springs, and the most romantic and highly interesting Mono Pass and Bloody Cañon. It is strange that more tourists do not avail themselves of the opportunity to visit these interesting localities.

The larvæ in the lake are thrown up by the sluggish waves, and accumulate in enormous quantities. They are gathered by the Indians and dried for food. To them they are as delightful a refection as locusts and wild honey of Bible fame.

The mineral salts contained in this vast depository should and will be utilized at no distant day. The reaction for boracic acid is so decided that it is almost safe to predict that crystals of borax will eventually be found in the mud at the bottom of the lake, as at Borax Lake, in Lake County, and it is to the interest of the State that an exhaustive analysis should be made of the waters.

The following analysis of Mono Lake water, by J. R. Murphy, was copied into the *Mining and Scientific Press*, vol. 12, fol. 59, from the *Reese River Reveille:*

ACIDS PRESENT.

*Quantitative.*

| | |
|---|---|
| Boracic | Large traces. |
| Carbonic | Abundant (free?). |
| Hydrosulphuric | Abundant (free?). |
| Phosphoric | Traces. |
| Silica | Traces. |

*Quantitative.*

| | |
|---|---|
| Chloride of sodium | 5.854. |
| Chloride of potassium | 1.581. |
| Chloride of calcium | 2.630. |
| Chloride of magnesium | 8.206. |
| Sulphate of lime | .402. |
| Sulphide of calcium | Traces. |
| Sulphide of magnesium | Traces. |
| Water | 81.327. |
| Total | 100.000. |

*Nameless Mineral Spring.*

Near Bridgeport. This spring, represented in State Museum by No. 1,576, has deposited a very large quantity of aragonite or calcite.

MONTEREY COUNTY.

(27) *Paraiso Hot and Cold Mineral Springs.*

These springs are situated six miles from Soledad, one hundred and forty-three miles from San Francisco, on the Southern Pacific Railroad; a stage connects daily with the station. There is a good hotel on the grounds and twenty-five two-story cottages. The altitude is said to be 1,200 feet above the valley. The waters flow from a number of springs which have the same general character, as shown in the following analysis made by a well known and reliable chemist:

CHEMICAL LABORATORY, SANTA CLARA COLLEGE, S. J., }
SANTA CLARA, CALIFORNIA, November 25, 1871. }

Mr. PEDRO ZAVALA: Your sample of water having been duly analyzed in our chemical laboratory, gave the following result: In one gallon of water were found—

| | Grains. |
|---|---|
| Matter volatile on ignition, so called organic matter | 5.25 |
| Silica | 2.62 |
| Alumina and iron | 1.60 |
| Magnesia | Trace. |
| Chloride of potassium | 0.35 |
| Chloride of sodium | 3.50 |
| Sulphate of soda | 35.50 |
| Carbonate of soda | 4.23 |
| Sulphate of lime | 4.32 |
| Carbonate of lime | 1.43 |
| Total | 58.80 |

Yours respectfully,

A. CICHI, S. J., Professor of Chemistry.

P. S.—The water contains 35.50 grains to the gallon of sulphate of soda. This sulphate of soda (written otherwise Glauber's Salt) is used universally as a cathartic.

NAPA COUNTY.

(28) *Calistoga Thermal Springs.*

These springs are in the town of Calistoga within a few minutes walk of the terminus of the Napa Valley Railroad. There are a number of them, all of which are warm; some very hot. Over the principal spring now stands a small, dilapidated, wooden building with no doors or windows. The spring from which steam escapes continually, is boxed up with boards; the box is about two feet square. The temperature of a bucket of this spring freshly dipped up when I visited it, was 196° F. by two observations, carefully taken. The temperature of the air was 86°. The water that overflows heats the surface water outside the building to 120°. The water in a small creek near by was 92°. The temperature of the old mud-bath was found to be 104°, and the spring that feeds it 148°. The plunge-bath spring was 132°, and the spring that supplies the bath house 173°. The chicken-soup spring had a temperature of 154°, and the water pumped up for baths at the Magnolia Hotel at Calistoga was 102°. The waters are used both for bathing and for drinking, but an analysis was made by J. T. Rudolph of Sacramento, and published in Dr. Hatch's report, showing that, with the exception of the rather large quantity of free hydrosulphuric acid, they contain no elements likely to give them much reputation for medicinal

virtues. But there is no locality that I know of in California where such facilities are found to make a delightful place of resort. The heat of the water, now going to waste, could be employed in manufacturing, specially for fruit drying, or conducted in pipes, would impart vitality to tropical plants. Conservatories so heated could be made to vie with the celebrated palm houses of Kew Gardens in London. Calistoga is a beautiful place, situated in a most delightful locality. With a judicious outlay of capital and labor, directed by men of taste, judgment, and ability, the grounds upon which these springs lie could be made an earthly paradise.

The springs seem to originate at the base of a conical mound or butte which rises on the grounds to an altitude of from seventy-five to eighty feet, which tends to give a landscape garden aspect to the grounds.

There are good hotels in Calistoga, and on the grounds there are a number of roomy cottages for the use of visitors; in front of each is a large palmetto tree which gives a tropical appearance to the grounds. At the time of my visit, all were deserted. The *chicken soup spring* is in no way entitled to the name. It is a trick of those interested, to take up a dipper of the water and to add pepper and salt, which, to a person of active imagination, does have somewhat the taste of soup. My experiments show that any warm water so treated has the same taste, and that it is to the pepper and salt and not to the water that the taste is due.

### (29) *Ætna Springs.*

I visited these springs in September, 1881, having been at the same locality when it was being worked as a quicksilver mine, a number of years before.

These springs lie in a small depression at the northern end of Pope Valley. The exact locality is sections one and two, township nine north, and range six west, Mount Diablo meridian. The altitude is said to be one thousand feet, but by barometer it seemed to be only seven hundred and sixty feet. It is fifteen miles east of St. Helena.

There are two springs which discharge a large quantity of water; one is from the old mining shaft of the Valley Quicksilver Mine. The shaft is one hundred and twenty-five feet deep. The Valley Mine was incorporated in 1867, certificate filed May sixteenth. The company made the serious mistake of sinking the working shaft in the bed of the creek, which necessitated costly pumping apparatus, and in the winter the mine was flooded by the waters of the creek. There was also much trouble caused from emanations of carbonic acid gas in the workings. At one time considerable ore was extracted, but owing to the difficulties the yield was but small.

The springs have gained quite a reputation. The number of visitors is given below for four years:

| | |
|---|---|
| 1878 | 300 |
| 1879 | 600 |
| 1880 | 900 |
| 1881 | 1,200 |

A full analysis of the water was made by Edward Booth, chemist of the State Mining Bureau, which is published in the second annual report of this office, folios 10 and 11. An analysis made by A. J. Bauer was published in Dr. Hatch's report. The water is perfectly clear; at the time of my visit, the temperature was 98°, that of the air being 78°. The first taste is pleasant but peculiar, and sparkling as if containing much carbonic acid gas. Both springs deposit ferruginous matter and in the dry bed of the

stream drop an alkaline incrustation. There is a distinct alkaline smell at both springs. When shaken in a bottle gas escapes. There is also a decided smell of hydrosulphuric acid when so shaken.

In one spring large bubbles of carbonic gas rise to the surface, and in a pool in the creek bed a constant bubbling takes place.

On the grounds there is a commodious hotel, and cottages for the use of visitors. The valley is warm and dry and the mountain scenery charming.

Much is claimed for the curative properties of the waters of these springs, with what truth I am unable to say.

(30) *Harbin Springs,*

Lie twenty miles more or less from Calistoga. They are reached by stage from the station. There are numerous springs. The temperature of the principal one is 118°. The waters are sulphurous and chalybeate. No analysis has been published. The springs have a good reputation and many visitors. The accommodations are said to be good. As usual in California, cottages are provided for the convenience of those who prefer them to the hotel.

(31) *Kellogg Springs.*

They lie near Calistoga. I have no other information concerning them that is reliable.

(32) *Napa Soda Springs.*

These are the oldest and the best known of any California mineral springs. For many years the waters have been bottled and sold all over the Pacific Coast. They lie on the slope of the mountains east of Napa Valley, and seven or eight miles north of Napa City. An analysis of the waters made by Dr. L. Lansweert, in May, 1856, has been published in Dr. Hatch's report. The buildings and accommodations for visitors are the most numerous and extensive of any in the State.

(33) *White Sulphur Springs.*

These springs, which lie only two miles from the Town of St. Helena, have become a fashionable and elegant place of resort. There is a good hotel, beautiful grounds, and cottages for the use of visitors. There are nine springs, having a temperature from 65° to 89° F. Analyses of three of them, made by Professor Le Conte of the University of California, have been published in the report of Dr. Hatch. The waters are used both externally and internally.

PLACER COUNTY.

(34) *Cornelian Hot Springs*

Lie on the margin of Lake Tahoe. There are several of them, hot and cold. The waters are used principally for bathing. They are said to be very efficient in the treatment of rheumatism and neuralgia. The springs are reached by railroad to Truckee, thence by stage. There is a good hotel and accommodations on the grounds. As far as I have been able to learn, no analysis has been made.

(35) *Summit Soda Springs.*

Situated twelve miles from Soda Spring Station, on the Central Pacific Railroad; thence by stage to the valley in which the springs lie. The

altitude is said to be six thousand and nine feet. The waters are alkaline, with an excess of free carbonic acid gas. An analysis, made by J. F. Rudolph of Sacramento, has been published in the report of Dr. Hatch.

### San Bernardino County.

#### (36) *Arrowhead Hot Springs.*

Located ten miles from Colton and six miles northeast of San Bernardino. Altitude over two thousand feet. First came into notice in 1858. It is claimed that the waters and climate will cure consumption. One spring actually boils, having a temperature of 210° F. An artificial pond for bathing has been prepared, the dimensions of which are one hundred by seventy-five feet. There are mud baths, also, which are deemed of great use in cutaneous diseases. No analysis has been published.

#### *Anti-Fat Spring.*

Situated twelve miles from Temescal, on the Santa Ana River. A sample of the water was brought to the State Mining Bureau and was entered on the catalogue No. 1,577. There being no laboratory, no analysis was made. The name indicates what is claimed for the water.

#### (37) *San Bernardino Hot Springs.*

These waters gush out from crevices in granite. Sufficient water flows from them to raise the temperature of a small stream near by to 130° F. The water so heated is ample to constitute an efficient water power. It would not be a new thing in California to see a mill wheel turned by hot water. There is a large hot spring near Blind Springs, in Mono County, which cannot, however, be classed as a mineral spring, which actually drove a quartz mill for several years. I have seen this myself. The water was scalding hot.

The San Bernardino Hot Springs are calcareous and form a deposit or incrustation on twigs and pebbles which is snow white. The temperature is from 108° to 172° F. The altitude of the springs is said to be sixteen hundred feet. No analysis of the waters has been made.

### San Diego County.

#### (38) *Aqua Caliente. Thermal Sulphur Springs.*

These springs are on Warner's ranch, fifty miles from San Diego. There are at least seven springs, varying in temperature from 58° to 142° F. They flow from small openings in a ravine, formerly the bed of a brook now diverted. Bubbles of sulphuretted hydrogen are continually escaping. The water, highly charged with this gas, has a pleasant acid taste. At one orifice a jet of steam issues with a hissing sound. No analysis of the waters has been made. Cures are claimed for dropsy, rheumatism, and cutaneous diseases. At last accounts these springs were in possession of a band of Indians, who let adobe huts or cottages to visitors.

There are other mineral springs in this county, near Elsinore. The following, from the San Diego *Union*, is all the information I have been able to gain:

> A wonderful little valley running through the town site, containing mineral springs of hot and cold water, sulphur, soda, white sulphur, magnesia, iron, borax, hot mud, fresh water, etc.—one hundred and eighty-six in number.

SAN LUIS OBISPO COUNTY.

(39) *Arroyo Grande Warm Springs.*

These springs are located fourteen miles south of San Luis Obispo, and fifteen miles from Port Harford, by which they are in communication by daily stage. Port Harford is reached by steamer from San Francisco. There are good accommodations to be obtained at all times. As in the case of all other mineral springs in the State, it is claimed that a large number of diseases are cured by the use of the waters.

(40) *Big Sulphur Spring.*

Of which nothing more is known, lies in section thirty-six, township thirty-two south, and range twenty-one east, M. D. M.

(41) *Bitter Water Spring.*

A spring so named is located in section four, township thirty-two south, range eighteen east. No further information has been obtained.

(42) *Black Sulphur Spring.*

Is situated in the same section.

(43) *Cameta Warm Springs.*

Lie in township twenty-nine south, range seventeen east, M. D. M. I have no other information concerning them.

(44) *Iron Mineral Spring.*

Located near the Huero-Huero Rancho, on section twenty-five, township twenty-eight south, range fourteen east, M. D. M. It is said to belong to a company, and to have much value as a curative agent.

(45) *Anonymous Mineral Spring.*

Township thirty south, range fourteen east, M. D. M. No other information obtained.

(46) *Newsom's White Sulphur Springs.*

Located fourteen miles, in a southerly direction, from the city of San Luis Obispo, and twelve miles southeasterly from Port Harford, and two miles from the Arroyo Grande stage station. This would place them near No. 39. They are within six miles of the ocean beach. Much is claimed for the medicinal virtues of these waters, and they are said to be a sure cure for nasal catarrh. There is a hotel on the ground and cottages for the use of visitors. This spring is represented in the State Museum by No. 1,572.

The five following springs, which are not yet named, are in the same neighborhood, are also represented in the State Museum. The catalogue numbers are also given:

(47)—1570—*Mineral Water.*

Spring No. 1, Cuesta Ranch, northwest quarter of the southwest quarter of section seven, township thirty south, range thirteen east, Mount Diablo meridian.

(48)—1571—*Mineral Water.*

Spring No. 2, Cuesta Ranch, northwest quarter of the southwest quarter of section seven, township thirty south, range thirteen east, Mount Diablo meridian.

(49)—1573—*Water.*

From the Arroyo Grande Warm Springs, sulphur water No. 2, Santa Manuella Rancho.

(50)—1574—*Water.*

From the Arroyo Grande Warm Springs, sulphur water No. 3, Santa Manuella Rancho.

(51)—1575—*Mineral Water.*

Arroyo Grande Warm Springs, sulphur water No. 4, Santa Manuella Rancho.

(52) *Paso Robles Thermal Sulphur Springs.*

Located twenty-three miles very nearly north of San Luis Obispo, township twenty-six south, range twelve east, Mount Diablo meridian. These springs have a widespread reputation, not only for the medicinal properties of the waters, but also for the fine climate and beautiful surroundings. They lie in a natural grove of oaks, from which the name is derived. There is a good hotel, and the best of accommodations to be had. There are several springs having a temperature of from 110° to 140° F. The waters are used for drinking and bathing. When largely used they are laxative, otherwise tonic, and are specially recommended for rheumatism, malarial affections, and cutaneous diseases. Two analyses have been published in the report of Dr. Hatch, one from a clear thermal spring and one of a mud bath. The name of the chemist is not given. The water is charged with gas. About the principal spring an inclosing wall of freestone has been built. The water is clear, but smells strongly of hydrosulphuric acid gas. The water of some of the springs is nearly cold. The mud baths are artificially prepared.

SANTA BARBARA COUNTY.

(53) *Santa Barbara Hot Sulphur Springs.*

Altitude, about one thousand five hundred feet. There are seven springs at the locality, nearly all of which are of the same general character. They are said to contain free sulphur (if so it must be held in suspense), and an excess of hydrosulphuric acid (sulphuretted hydrogen). Temperature, from 114° to 117° F. The waters are held in high esteem for the cure of cutaneous diseases, rheumatism, and paralysis. An artifical bath has been constructed, which is deep enough for a plunge. The springs are accessible by steamer to Santa Barbara; thence by stage. Distance, about five miles. No analysis has yet been made of the water. A thick incrustation of sulphate of alumina forms at the outlet of one of these springs.

## Santa Clara County.

### (54) *Gilroy Hot Sulphur Springs.*

These springs are situated twelve miles east of Gilroy, from which they may be reached by stage. There is said to be but one principal spring, located near Coyote Creek. The water is clear and hot. It is used both for bathing and drinking. There is a good hotel at the springs, which affords excellent accommodations. No analysis has been published, to my knowledge.

### (55) *Alum Rock Sulphur Springs.*

Situated in Penitentiary Cañon, seven miles from San José. The character of the springs is given as sulphur, soda, and salt springs. The temperature is 85°. A partial analysis has been published in Dr. Hatch's report. There is a good hotel at the springs, and good accommodations. From San Francisco these springs may be reached by rail to San José; thence by stage.

### (56) *Pacific Congress or Saratoga Springs.*

Locality in the Coast Range, ten miles west of Santa Clara. The water is quite extensively bottled and sold in the State. The springs are chalybeate and alkaline. If the water is freely used it acts as a purgative, otherwise the effect upon the system is tonic. Two analyses have been made—one by J. A. Bauer, and one by James Howden, which are published in the report of Dr. Hatch. The best of accommodations at the hotel or in cottages, according to the taste or desire of visitors. The springs may be reached by rail to Los Gatos; thence by stage.

### (57) *New Almaden Vichy.*

This spring has long been known. It is situated near the New Almaden Quicksilver Mine. Many years ago the waters were largely bottled and sold. It was specially a favorite with the French population. An analysis by E. Pique, of San Francisco, was published as an advertisement by those who made a business of the sale of the water. The analysis is given below:

One bottle (two pounds) contains one hundred and eight grains and sixteen hundredths of solid matter, as follows:

| | |
|---|---|
| Acide carbonique (carbonic acid) | 28.02 grains. |
| Bi-carboate de soude (bi-carbonate of soda) | 50.03 grains. |
| Bi-carbonate de chaux (bi-carbonate of lime) | 8.00 grains. |
| Oxyde de fer (oxyd of iron) | 1.02 grains. |
| Sulfate de chaux (sulphate of lime) | 10.05 grains. |
| Sulfate de magnésia (sulphate of magnesia) | 3.00 grains. |
| Chlorure de sodium (chloride of sodium) | 8.04 grains. |
| Silice (silica) | Traces. |
| | 108.16 grains. |

It is claimed these waters possess curative properties in case of rheumatism and gout, and to be a valuable tonic. It is curious to note that an unusual number of the best mineral springs in the State are in the near vicinity of quicksilver mines.

### (58) *Magnetic Mineral Spring.*

Near Watsonville; no reliable information could be obtained concerning this spring without a visit to the locality.

SHASTA COUNTY.

(59) *Soda Springs.*

These springs are situated in the cañon of the Sacramento River at an elevation of two thousand three hundred and sixty-three feet. The waters are chalybeate. As they run from the springs they deposit an extensive bed of iron. There is an excess of carbonic acid gas in the waters, which are cold; temperature, 52°. They may be reached from San Francisco by rail to Redding; thence by stage. The locality and the springs are described in Geology of California (Whitney), vol. 1, folio 332.

SOLANO COUNTY.

(60) *Tolenas Spring.*

Situated five miles north of Suisun. The waters are saline alkaline, but in the absence of any analysis no further information can be given. The water has, to a limited extent, been charged with carbonic acid, bottled, and sold. The spring may be reached from San Francisco by rail to Suisun, and thence by stage or private conveyance.

(61) *Fairmont Mineral Spring,*

On Whitman's Ranch, four miles east of Cloverdale. No analysis has been made that I can obtain information of.

(62) *Litton Seltzer Springs.*

These justly celebrated springs are situated near Healdsburg; the waters contain carbonated alkali, and an excess of carbonic acid gas. They are pleasant to the taste, and many cures are accredited to their use. The water is largely bottled, and sold in this city and State. There is a good hotel, and first class accommodations on the grounds, which are near a railroad station. When freshly drawn, the water is slightly acid; after standing, it becomes alkaline. One wine gallon contains 228.69 grains of solid constituents, which consist of the following:

| Acids. | Bases. |
|---|---|
| Boracic. | Alumina. |
| Carbonic. | Ammonia. |
| Hydrochloric. | Iron. |
| Sulphuric. | Lime. |
| Silicic. | Silica. |
| | Magnesia. |
| | Potash. |
| | Soda. |
| | And organic matter. |

There is a large quantity of free carbonic acid which escapes on standing. The water in the spring is abundant. When it is required in bottles it is forced into a receiver with considerable pressure, from which it is drawn into bottles and quickly corked. No carbonic acid gas is added artificially to the water.

(63) *Geyser Spa or Geyser Soda Spring.*

This spring is situated four miles from Geyserville, and very near the Litton Springs (No. 62). Large quantities of the water is bottled and sold in the city and State. There are agencies also in Sacramento, Oakland,

Santa Rosa, and San Rafael. These waters were thus sold twenty-four years ago. The business was resumed last November. An analysis published by Dr. Hatch in his report shows the water to be very nearly identical with that of Skaggs Spring.

(64) *Mark West Hot Sulphur Spring.*

Located eight miles from Santa Rosa on the road to Cloverdale, township eight north, and range eight west, by Bancroft's map. Beside the hot spring there are cold sulphur and iron springs. No analysis of the waters have been published. There is a good hotel and cottages on the grounds which furnish first class accommodations.

(65) *Skaggs Springs.*

Located eight miles southwest of Geyserville, in township ten north, range eleven west, Mount Diablo meridian. There are two springs of hot water, and a cold soda spring. The principal spring is situated in the bed of a dry creek. The temperature is 130° to 140° F. An analysis by Professor E. W. Hilgard, of the University of California, has been published. Besides those mentioned above there is a chalybeate well. A good hotel and commodious cottages offer ample and excellent accommodations. The waters are recommended for neuralgia, rheumatism, sciatica, dyspepsia, and chronic diseases of the kidneys.

(66) *Geysers.*

The group of mineral springs known by this name, of which there are three hundred in number, covering an area of one thousand acres, are counted among the natural wonders of California. The altitude is given as one thousand nine hundred feet above sea level. Some of the springs are hot, others cold. One blows off steam like the escape pipe of a steamboat, from which it takes the name of the "Steamboat Geyser." The springs were discovered in 1847, since which they have been visited by many persons. No sufficient analysis or analyses have ever been made of the waters of these springs, nor have the waters ever been bottled for sale. The springs are situated on the Pluton River, which empties into Russian River, near Cloverdale.

There are two routes to these springs. By rail, either to Cloverdale or Calistoga, and thence by stage. There are ample hotel and bathing accommodations. The temperature of the springs, of which there are three classes—aluminous, sulphurous, and chalybeate—is from 200° to 210° F.

(67) *Santa Rosa White Sulphur Springs.*

They lie only two miles from Santa Rosa. Hot and cold sulphur baths are offered to visitors. No further information has been obtained.

TEHAMA COUNTY.

(68) *Tuscan Springs.*

Lie in section thirty-two, township twenty-eight north, range two west, nine miles from Red Bluff. There are three principal springs of *cold sulphur waters.* The water for bathing is heated by burning the carburetted hydrogen gases given off by the springs. The temperature of

three springs is thus given: Black sulphur, 68° F.; white sulphur, 70° F.; red sulphur, 80° F. The waters are said to contain large quantities of iodine, lithium, and of potash, and to be effective remedies in treatment of rheumatism, cutaneous diseases, and intermittent fevers. They are said also to resemble the Blue Lick waters of Kentucky.

### (69) *Lick Spring.*

This is one of the Tuscan Springs (No. 68), which was discovered by Dr. John A. Veatch in January, 1856, in what was then Shasta County. The subject is referred to on folio 15 of Part II, third annual report of this office, 1883. An analysis was made by Dr. L. Lanszwert and published by Dr. J. B. Trask, first State Geologist, in his report of 1856, folio 61. By referring to this analysis it will be seen that it was of a most surprising nature, but Dr. Veatch states that it is unreliable. Still, the practical results obtained were very extraordinary. In January, 1856, Dr. Veatch, while evaporating the water in course of a chemical examination, obtained several pounds of borax crystals, which were deposited in the museum of the California Academy of Sciences, where they probably still remain. This was the first borax known to exist on the Pacific Coast. By a reference to the former reports of this office it will be seen how important that discovery really was.

### Tuolumne County.

### (70) *Cold Soda Spring.*

This very important mineral spring, which I have visited, is situated in Tuolumne Valley, on the Mono trail from the Yosemite to Mono Lake. It is located on Holt's map in township one south and range twenty-four east, M. D. M. The water is cold, sparkling, and delightful to the taste. The surroundings are charming. No analysis has, to my knowledge, been made of the water. At some not very far distant time this will become a favorite place of resort.

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## CALISTOGA SILVER MINES.

For many years indications of silver have been found in the vicinity of Calistoga, in Napa County. The hot springs described elsewhere are evidences of active solfatara, which elsewhere in the State have produced mineral veins of greater or less value. In the strata exposed by the upheaval of Mount St. Helena, there are veins or deposits which are without doubt the result of solfataric action. Silverado, on the mountain above the toll house, was at one time the scene of considerable mining excitement. A mill was erected and much work done on the mine. While it is claimed that considerable silver was extracted from the ores, it has never been shown by figures that this was the case. Some years ago, but after the mine was abandoned and while the mill stood idle, I examined very closely some ore left on the platform, and found it to be very poor, from which I drew the inference that work was discontinued because the ores were practically worthless.

Afterwards, in 1865, I again visited the locality and made a very careful examination of the ore on the dump and in the workings of the Venus Mine at Silverado. My impression was that as far as developed the ores

were of very low grade, but from indications ore bodies of some value might eventually be discovered. The following is the result of an assay of sample of ore from this locality:

CALIFORNIA ASSAY OFFICE, WM. IRELAN, JR., ASSAYER AND CHEMIST,
ROOMS 47, 48, AND 49 MERCHANTS' EXCHANGE, SAN FRANCISCO, September 5, 1885.

Memorandum of assay of ores made for H. G. Hanks, State Mineralogist, of ores marked "Dump, Calistoga or Venus Mine," and "Average from Calistoga—Museum No. 6,518."

*Dump, Calistoga or Venus Mine.*

| | |
|---|---|
| Silver, per ton | Troy ounces, 2.18 |
| Gold, per ton | Troy ounces, 0.03 |

*Average from Calistoga—Museum No. 6,518.*

| | |
|---|---|
| Silver, per ton | Troy ounces, 4.37 |
| Gold, per ton | Troy ounces, 0.15 |

Respectfully submitted.

WM. IRELAN, JR.

I afterwards visited the Grizzly Mine, near the town of Calistoga, and was surprised to find a considerable quantity of good ore taken out, some of which was very rich, as may be seen by the following assay of sample brought to San Francisco and placed in the State Museum:

CALIFORNIA ASSAY OFFICE, WM. IRELAN, JR., ASSAYER AND CHEMIST,
ROOMS 47, 48, AND 49, MERCHANTS' EXCHANGE, SAN FRANCISCO, August 27, 1885.

Memorandum of assay of ore made for Henry G. Hanks, Esq., State Mineralogist.

| | |
|---|---|
| Silver, per ton | Troy ounces, 514.79 |
| Gold, per ton | Troy ounces, 0.5 |

Respectfully submitted.

WM. IRELAN, JR.

This result is very remarkable, and seems to justify the hope that valuable if not extensive silver mines may yet be found at this locality. The Calistoga Mining District is situated in section twenty-four, township nine north, range seven west, M. D. M. The altitude of the Grigsby Mine is two hundred and sixty feet above Calistoga, or five hundred and ninety-one feet above sea level. The Ida Easley Mine is still higher, but in the same district. This mine is not yet worked to any great extent. It would be hard to predict what developments may yet be made at this very interesting locality.

The little hill, or butte, at the thermal springs, mentioned elsewhere, is an outlier of the mountains which contain the silver ores.

### ARROW MINING DISTRICT, SAN BERNARDINO COUNTY.

A new gold and silver district has recently been brought to notice, located and named as above. The name is derived from the arrow weed springs, so called, because they furnish the Indians with rush-like stems, which grow in abundance on the margin of the springs, and which they use for the shafts of their arrows. The district lies about twenty-eight miles northwest from Fenner Station, on the A. & P. R. R.

The veins, or ledges, bear north by east, and can be traced on the surface for several miles. The principal vein is a contact, the west wall being described as porphyry, and the west quartzite, or granite.

The ore contains gold 760 fine, stained also with copper, and gives indications of silver, aside from that occurring alloyed with the gold. There were eleven locations made on the principal vein at the time of the visit of

my informant, Mr. E. Wolleb of San Francisco, who examined the district in February, 1886. The Arrow and the Red Cloud are the principal veins. But little work had been done. Water from the Arrow springs could be used for mining and milling purposes, but the excessive dryness of the locality it is feared will form a serious impediment to the working of the mines.

## MOUNT ST. HELENA.

On the twenty-third of August, 1885, I started from the toll house to ascend Mount St. Helena. This station is about two thousand one hundred and thirty-seven feet above Calistoga, or about two thousand four hundred and sixty-eight feet above the sea level. There is no wagon-road, but a good trail, leading by a circuitous route up the sloping side of the mountain. The distance from the toll house to the summit is about four miles. The first bench has an approximate altitude of one thousand five hundred and seventy-five feet above the toll house, or three thousand nine hundred and ninety-three feet above the sea level. From this point, the mountain top may be seen at the distance of a mile or so. The ascent from this bench is not difficult.

Before reaching the foot of the highest peak, a depression may be seen to the left, through which a view of the valley beyond is obtained. On the right hand side of this ravine, there is a fine outcropping of basalt in distinct columns, which average about eighteen inches in diameter; some, however, being three feet.

On the summit, the basalt occurs—the columns being broken off square and forming the extreme top of the mountain. This rock is peculiar and very interesting. It is somewhat brecciated or spotted, light colored, yellowish in places, in others a pale, undecided green; the latter seems to have changed from olivine. On the weathered surfaces, the iron has become peroxidized, and a reddish or tawny color is the result. There seems no doubt that the character of the rock has changed, and that it is now decidedly metamorphic. Under the microscope, the crystals imbedded in the magma forming the rock, are not distinct and have lost their luster. It is much to be regretted that it has been impossible to give this rock the careful study and thorough chemical and optical examination it deserves.

The sides of the mountain near the summit are covered with a greenish colored sand, resulting from the disintegration of the basalt. Lower down, near the toll house, the lava rocks, probably basalt, are dark brown, and inclose nodules resembling stone axes. If one of these only had been found, it would not be difficult to believe that it was made by human hands. One had a groove, very roughly cut, which the finder claimed had been made by human beings previous to the flow of the lava. Before I visited the locality, having seen this one only, I was inclined to the same opinion; but finding several resembling it on the same ground, I concluded that the grooving was the work of very recent hands.

On the summit of the mountain there are two brick columns that supported scientific instruments used by the Coast Survey, which had a station there for several months. There is also a bar of copper, marking the junction of Lake, Napa, and Sonoma Counties. The summit is nearly bare of vegetation, and is covered with broken blocks of basalt.

The elevation of Mount St. Helena, as determined by the Coast Survey, is four thousand three hundred and forty-three feet; Calistoga is three hundred and thirty-one, the Toll House about two thousand four hundred and sixty-eight, and the first bench three thousand nine hundred and

ninety-three feet. From the top of the mountain the view is very fine; on a clear day even grand. If a good grade should be made from the toll house, an easy matter, the locality would soon become a favorite place of resort.

There is reason to believe that St. Helena was once an active volcano, although the summit does not now present a crater-like appearance. That the action has not yet ceased is evinced by the hot springs at Calistoga and elsewhere, the emanations of carbonic acid in Clear Lake, especially at the remarkable spring at Soda Bay, the sulphur bank and quicksilver mines, and the ammoniacal springs near by.

June 12, 1841, this mountain was ascended by Wosnessensky, a Russian naturalist, sent out by the Academy of Science of St. Petersburg. He placed an engraved copper plate on the summit, which was removed by some vandal who found it there. It came into the possession of Dr. J. A. Veatch, who presented it to the California State Geological Survey. It would be interesting to know where it is now.

About Clear Lake there are great quantities of obsidian, from which the Indians for many years have not only made arrow and spear points, but have exported the material, or the manufactured articles, to distant tribes.

After thinking the matter over since my visit to this very interesting locality, and knowing of the evidences of recent volcanic action (recent in a geological sense only), I see no reason why the mountain may not again break out into active eruption at any time. It is not an uncommon circumstance for volcanoes to remain dormant for centuries, and then, without any special preliminary symptoms, to break out into violent eruption. Our frequent earthquakes are another evidence that the stupendous piles of eruptive matter, the result of volcanic action in centuries past, were thrown out by subterranean forces not yet extinct. Ætna remained dormant for several hundred years at a time; once, within historical period, for four hundred years; another interval was three hundred and fifty years. Vesuvius had been inactive for ages, when it suddenly burst into flames in the year 78 A. D., at which time the cities of Pompeii and Herculaneum were destroyed. It now rises only two thousand three hundred feet above the sea level; but in 1868, when augmented by the piling up of eruptive matter, its summit reached the height of four thousand two hundred and fifty-three feet—nearly that of St. Helena at present.

I would advise tourists in California to visit the hot springs of Calistoga, Clear Lake, and the summit of Mount St. Helena.

# SAN DIEGO COUNTY.

Having found it convenient to visit the western part of San Diego County I am enabled to give some general information concerning it. It was my intention to commence at the Mexican line, and to have made a geological and mineralogical reconnoissance of the whole State to the northern boundary, but I was not able to carry out my plans. On several occasions during the last six years I have examined the eastern portion of this very interesting and important county, the results of which may be found in preceding reports.

I left San Francisco, May eighth, by steamer. The weather at this time of year is delightful on the coast, and a coasting voyage is always one of pleasure and interest. Passed Monterey at 4 P. M., and Point Sur, an outlying promontory, and arrived at Port Harford, San Luis Obisbo County, May ninth, at 2 A. M. Left this port at 7 A. M. and ran down by Point Sal and Conception. At 2 o'clock passed Goleta, and saw petroleum spreading over the sea, rising from submarine springs. As the ship throws aside the water in her passage, a strong smell of coal oil is observed. I had often heard of this locality and the oil springs, but I did not realize the extent of surface covered, or the signification from an economic standpoint. The smell is not of asphaltum, but of light coal oil, which to the experienced sense is distinctly different. This locality should be studied, and wells sunk at Goleta, in the hope that the source of these springs may be tapped and the oil utilized. At 3 o'clock P. M. the ship arrived at Santa Barbara, where she remained long enough to allow the passengers to see the town. I noticed a yellow or buff colored sandstone, which is now used for building purposes. It has been fully described under the head of Rocks and Building Stones. It is not very durable, which is evidenced by the decay of the Mission buildings, which are partially built of it. May tenth arrived at San Diego. In entering the harbor a striking feature is observed. The sea is covered with kelp, which, growing from the rocks beneath, spreads its flat leaves on the surface, and in time of storms is said to act like oil on the troubled waters, and to prevent the waves breaking as violently as they would otherwise do.

### AREA OF SAN DIEGO COUNTY.

Assuming Bancroft's map of California, dated 1882, to be correct, San Diego County has an area of fourteen thousand four hundred and twenty-eight square miles, equal to nine million two hundred and thirty-three thousand nine hundred and twenty acres. There are eight States of the American Union that have less area than this one California county, as follows:

| | |
|---|---|
| Rhode Island, square miles | 1,306 |
| Delaware, square miles | 2,120 |
| Connecticut, square miles | 4,750 |
| Massachusetts, square miles | 7,800 |
| New Jersey, square miles | 8,320 |
| New Hampshire, square miles | 9,280 |
| Vermont, square miles | 10,212 |
| Maryland, square miles | 11,124 |

For seventy-five miles inland from the seacoast, the country is broken into irregular spurs and short mountain chains. The Colorado Desert

extends for about one hundred miles beyond this point to the Colorado River. The dividing ridge seems to be the San Jacinto Mountains, the highest elevation of which is eleven thousand feet. A portion of the Colorado Desert is below the sea level. The lowest depression, two hundred and sixty-two feet, is on section twelve, township ten south, and range twelve east, S. B. M., or very near that locality. The mud volcanoes lie in the northern part of section fifteen, township eleven south, and range thirteen east. This very interesting locality is fully described on folio 227 of the second annual report of the State Mineralogist, and a map of the region is also published in that volume. Beyond the basin of the dry lake the surface rises again, and is broken into isolated buttes which, from the almost total absence of water, have not been prospected, but appearances lead to the hope and expectation that valuable minerals will be found in them.

Since the discovery of carboniferous fossils, it is not unreasonable to expect, or at least to hope, that beds of true coal will eventually be found. A large bed of coal crops out on the seashore fifteen miles or thereabout, north of San Diego. At Elsinore also a bed of coal or lignite has been discovered on section twenty-six, township five south, and range five west, S. B. M., but no systematic exploration has been made. An approximate analysis of the latter will be found under the head of lignite. Salt is known to be very abundant, and since my last report extensive works have been undertaken along the shore of the ancient lake. I am informed by those interested that the enterprise is so far a success. My examination of the desert in 1881 led me to hope that nitrate of soda would be found. Other salts, in beautiful crystals, observed in the mud at that time should be examined by a competent chemist in the interest of the State. The so called desert lands are known to be very fertile, wanting water only to change them into a paradise. The climate is tropical, but exceedingly dry; rain seldom falls. The mountain divide separates two very distinct climates. To the east the country is hilly, and to a rather limited extent is traversed by streams of pure water. The hills are green and covered but rather sparsely with timber. The valleys are very fertile and well adapted for settlement, and the rainfall is sufficient to insure a crop nearly every year. This portion of the county has an approximate area of six thousand and eighty-four square miles, or three million eight hundred and ninety-three thousand seven hundred and sixty acres—a surface larger than the State of Connecticut.

Along the seacoast the climate is delightful. This portion of the county will undoubtedly support a large population. San Diego harbor is second only to that of San Francisco. The city is destined to become a great commercial center at no very distant day. The western slope of the divide is gradual, while that to the east is abrupt. This is the general character of all the mountain chains in California. The prospect of this county becoming a prolific gold-producing locality increases with the developments that have been made. Mines known to be productive have been discovered in the county in the Julian, Pinacate, and Carga Muchacho Mining Districts, while a vast area of unprospected country remains to be looked after.

The Carga Muchacho Mines, from discovery to June 17, 1882, worked fourteen thousand tons, which yielded $167,000, since which time the district has been idle. The mines lie in sections nineteen, twenty, twenty-nine, thirty, and thirty-two, in township fifteen south, range twenty-one east. Pinacate District is in the northwest corner of township five south,

range three west. The locality of Julian District will be given elsewhere. Besides gold and silver, the following minerals have recently been found in San Diego County: asbestus, clay, gypsum, mica, ocher, orthoclase, pegmatite, quartz. There are no doubt may others which will eventually be found and utilized.

The stage road from San Diego to Julian Mining District, sixty miles more or less distant, crosses a fertile and beautiful country. It passes through a succession of fine valleys—Cajon, Nuevo, Ballena, and Santa Ysabel. The ascent is so gradual that the stage is able to make the distance without difficulty in one day.

The following are roughly approximate altitudes taken with a good aneroid barometer, but by a single reading only:

| | |
|---|---|
| Halfway House | 180 |
| Ridge near Cajon | 510 |
| El Cajon Valley | 220 |
| Rim of Cajon Valley, east | 375 |
| Fosters | 260 |
| Foot of Atkinson's grade | 410 |
| First bench | 720 |
| Head of grade | 1,220 |
| Summit | 1,215 |
| Nuevo | 1,200 |
| Foot of Hunsacker grade, four miles from Nuevo | 1,760 |
| Top of grade | 2,230 |
| Ballena Valley | 2,240 |
| Santa Ysabel Valley | 2,700 |
| Top of Coleman's grade, five miles from Julian | 3,400 |
| Julian City | 4,000 |
| Banner | 2,800 |

For the first ten miles from San Diego heavy banks of drift, coarse gravel and bowlders are met with. Then a large outcrop of coarse granite may be seen, which presents a singular appearance, from spots or blotches of a darker color.

Santa Ysabel Valley is circular. It contains much good land. At the time of my visit it was covered with a luxuriant growth of wild oats. The rocks from this point to Julian seem to be syenitic. On Hunsacker's Grade there is a large outcrop of orthoclase and pegmatite, of a quality suited for the manufacture of fine pottery. At the town of Julian, near the Owens mine, coarse granite with mica crystals crops out. The country about Julian is generally mica schist, and of a quality bearing a striking resemblance to that about Dahlonega, in Georgia. I was struck with a marked likeness in other respects between the two districts.

### JULIAN MINING DISTRICT.

This district, formerly called also Cuyamaca Mining District, was discovered and located in November, 1869, by Mike Julian, Webb Julian, James A. Bailey, and D. D. Bailey. These men had been prospecting in Arizona and Montana with indifferent success. In December placer mines were found, and worked in a small way. The first quartz mine discovered was the Van Wirt; the next the George Washington. Both were located on the same day, February 22, 1870.

The first Julian District, organized February 15, 1870, was bounded as follows, taken from the Recorder's books:

Beginning one thousand yards west of Harrold's Store and running north five miles and south five miles, and four miles west in width.

M. S. JULIAN, District Recorder.

| | |
|---|---|
| | 910 |
| | 260 |
| | 410 |
| | 720 |
| | 1,220 |
| | 1,215 |
| | 1,200 |
| from Nuevo | 1,760 |
| | 2,230 |
| | 2,240 |
| | 2,700 |
| om Julian | 3,400 |
| | 4,000 |
| | 2,800 |

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Then a large outcrop of coars
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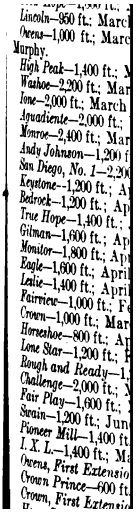

The following is a statement by the Recorder of mines located up to August 30, 1870:

CERTIFICATE OF MINING LOCATIONS.

STATE OF CALIFORNIA, } ss.
County of San Diego. }

I, M. S. Julian, Mining Recorder in and for Julian District, in the said County and State, do certify that the record books of the said district in my possession show that the following claims were taken up in pursuance of the laws and resolutions of the said camp, and that the names of the claimants are as given below, and that the quantity claimed and the date of the claim are as hereinafter given—that is to say:

*George Washington*—400 ft.; February 22, 1870; H. C. Bickers, etc.
*Otilia*—2,000 ft.: February 26, 1870; Mark Garrett, etc.
*Wall Rock*—2,400 ft.; February 20, 1870; John Fetherstone, etc.
*Hammell*—1,200 ft.; February 22, 1870; Wm. H. Hammell, etc.
*Ida*—1,200 ft.; February 22, 1870; Levi Hammell, etc.
*Van Wirt*—1,200 ft.; February 22, 1870; Calaway Putman, etc.
*War Path*—2,000 ft.; March 14, 1870; A. B. Woods, etc.
*Hayden*—1,000 ft; March 4, 1870; Paul Hayden, etc.
*Good Hope*—1,800 ft.; March 7, 1870; Geo. W. Swain, etc.
*Lincoln*—950 ft.; March 9, 1870; H. D. Young, etc.
*Owens*—1,000 ft.; March 11, 1870; James Kelly, J. E. Pember, Barney Owens, Francis Murphy.
*High Peak*—1,400 ft.; March 4, 1870; S. Southerimer, etc.
*Washoe*—2,200 ft.; March 6, 1870; Felix Fitzpatrick, etc.
*Ione*—2,000 ft.; March 2, 1870; D. D. Bailey, etc.
*Aguadiente*—2,000 ft.; March 21, 1870; H. E. Bingham, etc.
*Monroe*—2,400 ft.; March 24, 1870; Charles F. Monroe, etc.
*Andy Johnson*—1,200 ft.; March 22, 1870; John Bush, etc.
*San Diego, No. 1*—2,200 ft.; March 2, 1870; John P. Chambers, etc.
*Keystone*—1,200 ft.; April 2, 1870; J. M. Broom, etc.
*Bedrock*—1,200 ft.; April 2, 1870; John W. Pace, etc.
*True Hope*—1,400 ft.; June 6, 1870; J. B. Wells, etc.
*Gilman*—1,600 ft.; April 13, 1870; L. S. Gilman, etc.
*Monitor*—1,800 ft.; April 4, 1870; S. W. Black, etc.
*Eagle*—1,600 ft.; April 5, 1870; Wm. J. Moran, etc.
*Leslie*—1,400 ft.; April 6, 1870; Robert Leslie, etc.
*Fairview*—1,000 ft.; February 22, 1870; F. Scarborough, etc.
*Crown*—1,000 ft.; March 16, 1870; Frank Able, etc.
*Horseshoe*—800 ft.; April 4, 1870; C. R. Philips, etc.
*Lone Star*—1,200 ft.; February 28, 1870; J. Parsons, etc.
*Rough and Ready*—1,200 ft.; May 17, 1870; M. Martin, etc.
*Challenge*—2,000 ft.; May 10, 1870; O. P. Powers, etc.
*Fair Play*—1,600 ft.; May 26, 1870; R. J. Carroll, etc.
*Swain*—1,200 ft.; June 8, 1870; W. H. Swain, etc.
*Pioneer Mill*—1,400 ft.; May 1, 1870; James McMechan, etc.
*I. X. L.*—1,400 ft.; May 27, 1870; William Estes, etc.
*Owens, First Extension*—1,000 ft.; June 15, 1870; G. V. King, etc.
*Crown Prince*—600 ft.; April 2, 1870; R. Shelton, etc.
*Crown, First Extension*—800 ft.; June 29, 1870; D. Lipman, etc.
*Home Stake*—1,000 ft.; April 12, 1870; Joseph Moss, etc.
*Farley*—1,000 ft.; March 28, 1870; Richard M. Farley, etc.
*Hudson*—600 ft.; June 14, 1870; E. C. Phelps, etc.
*Golden Rule*—1,200 ft.; June 21, 1870; A. Pauly, etc.
*North America*—1,000 ft.; July 5, 1870; E. A. Ary, etc.
*Sullivan*—1,000 ft.; June 28, 1870; D. O. Sullivan, etc.
*Victoria*—1,000 ft.; July 11, 1870; M. Jones, etc.
*San Francisco*—1,200 ft.; March 21, 1870; J. P. Wealand, etc.
*Minnesota*—1,000 ft.; July 18, 1870; S. A. Coolidge, etc.
*Little Giant*—2,000 ft.; April 12, 1870; A. P. Dodge, etc.
*Shamrock*—1,000 ft.; April 23, 1870; John Madin, etc.
*O'Connor and Ryan*—2,200 ft.; April 4, 1870; David O'Connor, John Ryan, etc.
*Owens' Ext. East*—400 ft.; April 13, 1870; George McNier, etc.
*Sonoma*—1,800 ft.; March 28, 1870; B. T. Williams, etc.
*Roanoke*—1,400 ft.; March 28, 1870; Eli McDaniels, etc.
*Hayden, First E. Ext.*—1,200 ft.; April 11, 1870; Eugene Kelly, etc.

And I further certify, that the said claims are within the said Julian District, in the said county and State. In witness whereof I have hereunto set my hand and affixed my private seal, there being no public seal for said district, this third day of August, A. D., 1870.

[SEAL.] M. S. JULIAN, Recorder.

The Present Julian District, called JULIAN MINING DISTRICT, consolidates *Julian*, *Banner*, and several other mining districts. The following com-

mittee reported March 27, 1881: D. D. Bailey, Robert Gardner, George V. King, Committee.

The district is bounded as follows: commencing at the northeast corner of section four, township twelve south, and range four east, San Bernardino meridian, and running three miles west, to the northwest corner of section six; thence south three miles, to the southwest corner of section eighteen; thence east one mile, to the southeast corner of section eighteen; thence southwest along the line of the Santa Ysabel grant, to the southeast corner of said grant; thence along the line of said grant, in a westerly direction, four miles; thence in a direct line to the northwest corner of the Cuyamaca grant; thence along the north boundary of said grant, to the northeast corner; thence along the line of said grant, five miles; thence east five miles; thence north to the southwest corner of San Felipe grant; thence along the westerly line of said grant, to the place of beginning.

## MINING LAWS OF JULIAN DISTRICT IN 1870.

At a meeting of the miners of Julian Mining District, held April 27, 1870, in pursuance of a notice given, by posting same in three public places, five days previous to said meeting, M. S. Julian acted as Chairman, and L. B. Hopkins, Secretary. The meeting being called to order, the committees appointed to revise and amend the mining laws of the district, reported the following:

Substitute for Article IV of the present laws, and the following additional laws:

ART. IV. All locations shall be recorded within ten days from the date of location, and shall have at least one day's work done on the claim prior to recording, and shall have at least one day's work done for each name on the notice or record within thirty days from date of record; and two days' work for each name so recorded done within sixty days from date of record; shall hold the claim and ledge free from relocation for one year from date of record, provided, said work be measured and recorded by the District Recorder.

ART. VI. All persons locating claims in this district shall erect a stake or monument on a prominent point on his claim, at least two feet high, upon which he shall place a notice defining the extent and boundaries of his claim, with the name of the ledge, and each owner in the same, and keep the same up permanently; and the same rule shall apply to all claims now located; and, further, that all claims that shall fail to have a stake, monument, or notice for the space of fifteen days consecutively, shall be subject to forfeiture, unless the party owning shall be able to prove sickness or other inability to comply with said law.

ART. VII. These laws can be altered or amended by a general meeting of the miners, called by a notice posted in three public places in the city, naming time, place, and object of the meeting, and signed by ten miners of the district.

ART. VIII. These laws shall take effect and be enforced from and after their passage.

On motion, the above report and laws were received and adopted for the future government of the district.

April 27, 1870.

M. S. JULIAN, Recorder and Chairman.
L. B. HOPKINS, Secretary.

Julian City, once a thriving town, was at the time of my visit somewhat dilapidated; some of the houses were empty, but a new brick building had just been erected, a ten-stamp quartz mill was being built at the Owens Mine at the edge of the town, and other signs of renewed prosperity were manifested. The town is nearly at the summit of the Santa Ysabel Mountains. On a clear day, Point Loma at San Diego, and the Coronado Islands may be plainly seen. From the Oriflamme Mine, a short distance east, the desert, sloping away to the east, is in full sight. The principal street in Julian bears N. 63° west, magnetic.

In 1871 the town had a population of five hundred, and there were one hundred occupied houses. In 1873 the excitement which followed the discovery of the district began to subside. The cause was said to be prejudice against the lower country, and threatened litigation as to the boundaries of the Cuyamaca grant. This was eventually decided in favor of the miners.

In 1870 there were two quartz mills, of fifteen stamps Washoe pattern, at work. The gold was richer on the surface. Placer mines were worked in the low hills of the Santa Ysabel Valley, but they did not pay very well.

Bullion began to be shipped from Julian in April, 1871. Up to the middle of September $10,341 had been sent forward by Wells, Fargo & Co., and $5,580 by others. The gold was worth $18 per ounce. The following table, from the report of Rosseter W. Raymond for 1870, will give a good idea of the character of the district at that time:

MILLING RESULTS OF LOTS OF ORE FROM VARIOUS MINES IN JULIAN DISTRICT.

| Name of Mine. | Tons Crushed. | Value per Ton. | Value of Crushing. |
|---|---|---|---|
| Lone Star | 5 | $70 00 | $350 00 |
| Owens | 16 | 51 00 | 816 00 |
| High Peak | 10 | 42 00 | 420 00 |
| Hayden | 19 | 40 00 | 760 00 |
| Pride of the West | 1½ | 31 00 | 46 50 |
| San Diego | 19 | 15 00 | 285 00 |
| Forty-nine | 12 | 12 50 | 150 00 |
| Lone Star | 7 | 7 00 | 49 00 |
| Keystone | 4 | 7 00 | 28 00 |
| San Diego | 51 | 6 00 | 306 00 |
| Sherman | 4 | 4 82 | 19 28 |
| North Star | 6 | 4 50 | 27 00 |
| North America | 6 | 4 00 | 24 00 |
| Monitor | 6 | 4 00 | 24 00 |
| Shamrock | 7 | 3 50 | 24 50 |
| Hannon | 3 | 3 50 | 10 50 |
| Eagle | 10 | 2 90 | 29 00 |
| Eagle | 5 | 2 75 | 13 75 |
| Ella | 3 | 1 25 | 3 75 |
| White Fawn | 3 | 0 37 | 1 11 |
| | 197½ | | $3,387 39 |
| Average per ton | | | $17 15 |

At the time the prosperity of this mining district was at its heighth, the San Diego *Union* estimated yield of gold for 1871 at $175,919, and for 1872 at $488,670.

After a careful examination of Julian Mining District, I am led to the following conclusions:

The quartz veins are generally rather narrow but remarkably rich. First and last there has been an important output of bullion from the district. I have not had time to arrange statistics obtained, in shape to be of much service. Wood and water are scarce; none of the mines have yet been opened or explored sufficiently to prove their capacity to yield gold. Considering the present condition of things in California, these mines can be worked to greater advantage than when first opened. Milling near Julian City cannot be conducted without very considerable difficulty, owing to the altitude, and consequent scarcity of fuel and water, but at Banner, six miles distant by graded road and twelve hundred feet lower in altitude, there is a beautiful valley through which a considerable stream of water—the San Felipe River—flows, affording sufficient water-power to drive several small mills or one large one, during the year; the water is more abundant during the winter months.

If first class reduction works should be placed at Banner, with ample capital, and all the ores from the district be worked in them, an era of

prosperity would probably be the result which would exceed any before experienced in this district, employment would be given to many miners and tributors to the advantage of the district, the county, and State. The locality is a delightful one, and a desirable place for residence, which is not always the case where gold mines are found.

Julian City lies in sections five and six, township thirteen south, range four east, S. B. M.

### BANNER DISTRICT

Is situated on sections two and three, township thirteen south, and range four east, and joins Julian on the east. It was discovered in August, 1870, by a party of men from Julian who were looking for wild grapes. A mine afterwards called the Redman was discovered on a sloping mountain side in San Felipe Cañon. BANNER DISTRICT was soon afterward organized. The district now incorporated with Julian has many advantages, the most important being the presence of water in abundance for milling and sufficient for limited water power, limited to season only, for in the winter and spring, I was informed, it is ample for any future requirements of the district. As mentioned before, Banner is twelve hundred feet lower than Julian, from which it is distant three and a half miles by trail and six miles by graded wagon road. To work the mines of the consolidated districts to the best advantage all the milling and concentration should be done by water power in San Felipe Cañon, and the ores from all the upper mines brought down by a tram road for reduction. By this plan all the present difficulties would be overcome. From appearances, ores could be supplied to such general reduction works for many years to come. There is more silver and less gold in the bullion produced in Banner than that taken from the Julian veins. In 1870, when many mines were being worked in both districts, bullion from Julian sold at the stores for $16 per ounce, while Banner bars brought only $12 to $14. The following table shows the condition of the principal mines in Banner during the early mining excitement. The information is compiled from various publications and reports:

| NAME OF MINE. | Average Yield. | Width of Vein. | When Discovered. | Remarks. |
|---|---|---|---|---|
| Golden Chariot | Most productive in the district. 100 tons yielded $32,000; 50 tons, $8,100; 52 tons, $13,261. | 2 to 4 feet. | February, 1871. | Contact vein, country slate and granite. In July, 1874, cleaned up $9,500 in 12 days, with 10 stamps. |
| Kentuck | $40 per ton. | 16 inches. | October, 1870. | Shaft 80 feet deep. |
| Madden | $75 per ton. | At 80 feet, 14 inches. | September 10, 1870. | |
| Ready Relief | 10 tons yielded $980. | From 2 to 8 feet. | August, 1870. | Tunnel 130 feet, claim 1,000 feet in length. |
| Redman | | 6 to 10 feet. | August, 1870. | First mine discovered in the district. Shaft 80 feet deep, and tunnel connecting. |

At the time of my visit only one mill was running on the ores of the Ready Relief or Bailey Brothers' Mine. Some other mines were being prospected in a small way, but with what success I was not able to learn. In 1874 there were seventy-five stamps running in Julian and Banner.

When I was at Julian City there was no mill running, but at the Owens Mine, almost in the Town of Julian, a new and good ten-stamp mill was being built. The vein in this mine is small, but the quartz is rich in gold. A pile of ore has been accumulated which contained several hundred tons, and looked and prospected well; from which it is fair to predict that enough gold will be taken out to pay for the mill and leave a surplus. While the new mill is running the mine will be well prospected, and there is reason to hope and expect that considerable bodies of ore will be found. There is no special or well defined croppings to be seen on the surface. The old workings have fallen in. There is a shaft down one hundred and eighty feet in depth, well timbered, through which the ores are hoisted. The mine lies three hundred feet above the town, and very near the summit of the ridge. To the left is a gap through which the road to Banner runs. On a hill near the town, and to the left of the road, may be seen some old workings in which there are some splendid quartz croppings, but in small detached fragments, in a schistose formation dipping at a steep angle. I was struck with the resemblance of this formation to that in Findley Ridge, at Dahlonega, in Georgia, and was led to the inquiry if it would not pay to pipe it down as they do there. A full description of the methods employed in Georgia may be found in the fifth annual report of this office, folio 142.

The Owens Mine was located March 11, 1870. The old workings were quite extensive. There was a shaft two hundred and seventy-five feet, from which levels ran east and west. The first level, one hundred feet below the surface, ran east two hundred feet and west one hundred feet. The second level, two hundred feet deep, ran two hundred feet east and one hundred and eighty feet west. Third level, at bottom of shaft, ran east two hundred and sixty feet and west two hundred feet. In eight months, ending June, 1873, gold to the value of $42,319 50, was taken from nine hundred and twenty tons of quartz. The company was incorporated with a capital stock of $500,000. In 1873 there were fine hoisting works at the mouth of the shaft—now removed.

### READY RELIEF MINE, BANNER.

The Ready Relief Mine, the only one now being profitably worked in old Banner District, was discovered in August, 1870, immediately after the Redman, of which it is an extension. It is generally known as the Bailey Brothers' Mine. The southerly extensions of the Ready Relief Mine are the Hubbard and the South Hubbard. The claim is one thousand by two hundred feet. The ledge is from eighteen inches to eight feet in width. The vein is interstratified with the clay slate formation. The slaty cleavage of the country rock is undoubtedly due to lateral pressure, which has also distorted and plicated the vein so that it is found in folds, which are technically called "rolls." I am inclined to the opinion that the vein was formed by solfataric action in a plastic mud before the mountains were elevated, and that the vein has become plicated by its own weight while still in a soft condition. After visiting the mud volcanoes in this county—and not many miles distant—now in action, it is not difficult to conceive such an idea. These mud volcanoes are described in the second annual

report of this office, folio 227, to which the reader is referred. The plications of the vein are unlike anything I have ever seen or read of.

The engraving conveys a good idea of one of these folds as seen at the end of the upper tunnel. The slates are highly aluminous. In the tunnels the sides are soon coated with an incrustation of alum.

The ore in the Ready Relief Mine is blue ribbon quartz, much resembling that of the Sheep Ranch Mine in Calaveras County. The gold is free. The sulphurets are concentrated and saved, but I have no information as to their value. Some of the clay slate contains gold; it resembles the ores of the Black Hills in Dakota, and those of the old Oso Mine in Mariposa County. These slates should be thoroughly prospected and cross-cuts made from both sides of the vein. It might be found that they would pay to crush in large water-power mills with economical management. The general direction of the vein is south southeast. The dip is at almost any angle, owing to the folds before mentioned.

In 1874, the mine was opened by three tunnels, one two hundred feet, the others one hundred and fifty feet each; at the end of the upper tunnel there was a shaft to the surface, one hundred and ten feet above. The mine at present is worked by an upper tunnel of five hundred feet, and a

shorter one sixty feet below, through which ores are conveyed to the mill. Owing to the uprise shaft, the ventilation in the mine is perfect.

The mill is in rather a dilapidated condition, but is still doing good work. It consists of two batteries of five stamps, and driven by steam. The stamps weigh about seven hundred pounds. Each battery is supplied with an automatic ore feeder. Below the aprons there are three Hendy's concentrators, which save a considerable quantity of sulphurets. The mill is only run ten hours per day, during which seven tons of ore are crushed. Wood costs $1 50 per cord for cutting, and $2 for hauling to the mill. The mill is forty feet below the lower tunnel, from which the ores are carried in chutes. The dump of the mine, in which the rejected vein matter is piled, contains some good ores, and I am of the opinion that it would all pay in a large, economical mill. A great deal of low grade ore could be obtained from the hill alongside of the vein. An inexpensive experiment would reveal the value of this ore, and decide if it could be made to pay or otherwise.

In 1876 one hundred tons of ore yielded $30 per ton. The present average yield is not stated, but is admitted to be satisfactory. It is claimed that the output to the present time exceeds $350,000. The gold is worth $14 50 per ounce.

Mr. Charles J. Sauer thinks the water in the south fork of San Felipe River runs twelve miners' inches in summer, and much more in winter. I visited, with Mr. Bailey, a spring which gushes from the hillside at an elevation of five hundred feet above the mill. At the time of my visit, in May, the quantity flowing was at least thirty inches, and Mr. Bailey informed me that the flow was nearly the same all the year round. With the great altitude, this water would afford power sufficient to run extensive reduction works.

The Oriflamme Mine is situated in what was formerly the Desert Mining District, now incorporated in Julian. It belongs to a Boston Company, "*The San Diego Development Company.*" Their ten-stamp mill has recently made a run which Mr. Henry M. Dow, the Superintendent, informed me yielded from $4 to $10 per ton. Water and wood are scarce, and mining and milling are conducted under difficulties. From this mine the Great Colorado Desert may be seen for many miles to the eastward. The sight is a very grand and interesting one.

The STONEWALL MINE, formerly the *Stonewall Jackson*, is situated in the northern part of the Cuyamaca Grant about seven miles distant from Julian District in a direct line. By road it is considerably further. If the United States section lines were run out, it would lie in section four, township fourteen south, and range four east. It is not in the Julian District, as may be seen by referring to the map published with this. It has the reputation of being the largest vein in the mining region about Julian City. I regret that for want of time I could not visit this mine.

In 1870 the Stonewall was reported to be twenty feet wide. Dr. J. E. Fulton, one of the present owners, informed me that the width varied from six to forty feet. The country rock is said to be like that of Julian District—a mica schist with coarse granite. The ores are now being crushed in a steam-driven mill of ten stamps. I am informed that the mine has produced in nine months $85,000. The last clean-up yielded $40 per ton. The United States Mint has bought gold from this mine for $18 per ounce. The mine is opened by a vertical shaft one hundred and fifty-five feet deep, from which levels are driven. The lay of the country is such that there is no way to drain the mine by adit. Water for milling and for the steam

boiler is brought in iron pipes a mile or more, from the mountains. In 1871 the mine had a shaft one hundred feet deep, and a level at sixty feet running one hundred and eighty feet to the north and one hundred feet to the south. Stoping had not then commenced.

This promising mine has always been worked under difficulties. In 1871, the small mill then in operation could only run five hours each day for want of water. At that time the mine is said to have yielded from $12 to $20 per ton. During my stay in San Diego County I heard the mine invariably well spoken of.

# CALIFORNIA MINERALS.

Mineral species known at the present time to exist in the State of California, carefully revised and corrected and brought up to date, intended to be a check list and foundation for future work. All technical or scientific descriptions have been omitted except in case of minerals not mentioned in former reports, or where some special work has been done, or some interesting feature discovered or noticed. The list has been arranged alphabetically for convenience of reference.

1. AGALMATOLITE. Minerals resembling agalmatolite occur in San Luis Obispo County, and at Greenwood, El Dorado County, the latter in a vein or stratum from six inches to a foot in thickness.

AGATE—See Quartz.

ALABASTER—See Gypsum.

2. ALBITE. Soda feldspar, a specimen in which quartz crystals are imbedded, was found in the San Lucas Mine, Inyo County. It is now in the private cabinet of Dr. Gould at San Diego. Dana gives as a locality the vicinity of the Murchie Mine in Nevada County, with gold and pyrite. The abundance of soda in the desert soils in California would indicate albite in the crystalline rocks.

3. ALTAITE. Telluride of lead, said to exist in Rawhide Ranch Gold Mine, Tuolumne County; in the Frenchwood Mine, Robinson's Ferry, Calaveras County, with petzete, calaverite, and other tellurium minerals; also in the Morgan Mine, Carson Hill, Calaveras County, in large masses, with free gold; at the Adelaide Mine and the Golden Rule Mine, in Tuolumne County, and elsewhere in the State.

4. ALUM. Occurs in mineral waters; as an incrustation, ten miles north of Santa Rosa, Sonoma County; near Newhall, Los Angeles County; near Auburn, Placer County; in thick incrustations at the Sulphur Bank Quicksilver Mines, Lake County; said to occur at Silver Mountain, Alpine County; at Howell's Mountain, Napa County; at the mud volcanoes, San Diego County, and at numerous locations, as an incrustation on rocks; I have noticed it on the bedrock laid bare by hydraulic streams, near Dutch Flat, Placer County, in a crystalline state.

AMIANTHUS—see Amphibole.

5. AMPHIBOLE. Actinolite, anthophyllite, amianthus, asbestus, hornblende, mountain cork, mountain leather, tremolite, etc.

ACTINOLITE. Abundant in counties bordering on the Bay of San Francisco; found in bowlders, or rolled masses, in Alameda and Contra Costa Counties, which show, when broken, beautiful green radiating crystals; found in rocks of the Coast Range; near Knight's Ferry, Stanislaus County; at Petaluma, Sonoma County, with garnets; on the Mariposa estate, Mariposa County, in fine needle crystals; in Quartz Eagle Gulch, Plumas County; twelve miles from Gilroy, Santa Clara County; Eureka, Humboldt County; Santa Rosa, Sonoma County; Reed's Ranch, Marin County; and in the Lone Mountain Cemetery, San Francisco.

ANTHOPHYLLITE has been found in Slate Range, San Bernardino County.

ASBESTUS—

*Butte County.* Eighteen miles south of Oroville.

*Calaveras County.* Salt Spring Valley and Jenny Lind Hill.

*Del Norte County.* Exact locality not stated.

*Fresno County.* French Gulch, Potter Ridge Mining District, near Fresno Flat; Fine Gold Gulch.

*Inyo County.* Numerous localities in the Inyo Mountains.

*Los Angeles County.* Near Newhall.

*Mariposa County.* Mount Bullion and Bear Valley.

*Placer County.* Swiss Boy and Leed's claims, one mile below Rice's bridge.

*San Diego County.* Seven miles east of Elsinore, section six, township five south, range three west, S. B. M. This deposit is now being worked and boiler covering, etc., manufactured at Elsinore.

*Shasta County.* Exact locality unknown.

*Tulare County.* White River.

*Yolo County.* California Mine.

HORNBLENDE—

*Calaveras County.* At Vallecito.

*Contra Costa County.* At San Pablo.

*Monterey County.* At Soledad.

*Sacramento County.* At Folsom.

*Sonoma County.* At Healdsburgh, and as a constituent of rocks in numerous localities in the State.

MOUNTAIN CORK has been found in Butte County, at Red Hill, and in Tuolumne County.

MOUNTAIN LEATHER. Amador County, in Little Grass Valley Mine, Pine Grove District, and in Mariposa and Tuolumne Counties.

TREMOLITE. Found white and fibrous in limestone at Columbia, Tuolumne County, and in Santa Cruz Mountains, Santa Cruz County.

6. ANDALUSITE. Found in abundance in the slates in Fresno and Mariposa Counties. In the former county, on the Chowchilla River, near the road to Fort Miller, or Millerton. In the latter, at Hornitas, at Moore's Hill, twelve miles south of Mariposa, and near the Ne Plus Ultra Mine.

ANDRADITE—see Garnet.

7. ANGLESITE. Sulphate of lead. This is rather a common mineral in southeastern California, and specially so in Inyo County. In the Cerro Gordo it has yielded a very considerable portion of the lead bullion sent from that locality. It occurs with bindheimite and linarite and galena, at the Modoc Mine, and with geocronite and argentiferous galena and sinerite at the Santa Maria Mine, and the Eclipse Mine in the same county.

8. ANHYDRITE. Anhydrous sulphate of lime, found near Anaheim, in Los Angeles County, and in pale blue fibrous specimens in the Inyo Mountains, near Lone Pine; lately found in considerable quantity in the gypsum beds in Santa Barbara County—gray, very dense and heavy, compact to granular; shows signs of sedimentary origin.

ANHYDROUS SULPHATE OF SODA—see Thenardite.

ANTHRACITE—see Mineral Coal.

ANTIMONY—see Cervantite and Stibnite.

ANTIMONY OCHRE—see Cervantite.

ANTIMONY SULPHIDE—see Stibnite.

9. APATITE. Phosphate of lime. According to the report of the San Jacinto Tin Mining Company of San Bernardino County, this mineral, rare in California, has been found near the company's property in San Bernardino County. No special description is given of the mineral or its occurrence.

10. ARAGONITE. Carbonate of lime, found in beautiful transparent crystals in Colusa County in the Candace Copper Mine; New Almaden Quicksilver Mine, Santa Clara County; Inyo County, Cerro Gordo Mines; Colusa County, ranch of J. M. Pugh, near Smithville.

ONYX MARBLE, a variety of aragonite, is found also in numerous localities, as follows:

*Kern County.* Six miles from Kernville.

*Los Angeles County.* Santiago Cañon, twenty-five miles from Santa Ana, in a ledge twelve feet thick.

*Placer County.* At Gold Run.

*San Luis Obispo County.* On section nine, township thirty-two south, range fifteen east, and at several other localities.

*Siskiyou County.* Near Soda Springs Hotel, and near Yreka.

*Solano County.* Near Suisun; near Vacaville, and elsewhere in the county.

*Tehama County.* In township twenty-five north, and range seven west, in a vein four feet thick.

ARAGOTITE—see Petroleum.

ARENACEOUS LIMESTONE—see Calcite.

11. ARGENTITE. Silver glance, vitreous silver, sulphuret of silver, found in Inyo County, in the Minietta Belle Mine; in the Kearsarge Mountains, near Independence, in cubical cystals; in Deep Spring Valley, at a depth of sixty feet from surface.

In *Mono County*, eight miles south of Benton.

12. ARSENIC. Metallic arsenic has been found at the Alisal Mines, twenty-five miles from the Mission of San Carlos.

ARSENICAL PYRITES—see Arsenopyrite.

13. ARSENOLITE. Exchequer Mine, Alpine County, after enargite; at the Armagosa Mines, San Bernardino County, in large masses.

14. ARSENOPYRITE. Mispickel. This mineral is quite abundant in California, but generally in thin seams rich in gold. The following are localities where it is found in uncommon masses, or of superior quality:

*Calaveras County.* Eureka Mine, with gold.

*El Dorado County.* With gold, near Georgetown.

*Inyo County.* Several localities.

*Nevada County.* Betsey Mine, Grass Valley.

*Placer County.* Near Auburn, with tellurium and gold.

*San Diego County.* Rich in gold.

*Sierra County.* North fork claim, Forest City, rich in gold.

ASBESTUS—see Amphibole.

ASPHALTUM—see Petroleum.

15. ATACAMITE. Chloride of copper. Locally given in Dana's Mineralogy, Inyo County; this is doubtful. I am familiar with the county, and have never seen or heard of a specimen being found.

AVENTURINE—see Quartz.

16. AZURITE. Azure copper ore, chessy copper, blue malachite, mountain blue. It is quite common in the Inyo Mountains, from the White Mountain to Coso, with cerusite, bindhermite, anglisite, and linarite; in the Modoc Mine, in Inyo County, and with chalcopyrite and bornite at Copperopolis, Calaveras County.

17. BARITE. Barytes, cawk, heavy spar, terra ponderosa, etc. This mineral is known to exist in at least six counties in the State, as follows:
*Alpine.* Morning Star Mine.
*Calaveras.* Satellite Copper Mine.
*Inyo.* In White Mountain Range; in a vein in Alabama Range.
*Nevada.* With gold, Malakoff Hydraulic Mine, North Bloomfield.
*Plumas.* With lead and copper ores, north arm of Indian Valley; with tetrahedrite, Irby Holt Mine, Indian Valley.
*San Bernardino.* Milk white and honey yellow, Calico silver mines.

18. BERNARDINITE. Near Santa Monica, Los Angeles County, described by J. M. Stillman, in American Journal of Science and Art, third series, volume 18, folio 57. It has since been found near Santa Rosa, in Sonoma County.

19. BINDHEIMITE. Hydrous antimoniate of lead. This rare mineral has been found at the Union Mine, Cerro Gordo, Inyo County, and with anglesite at the Modoc Mine, in the same county. There is some doubt as to the identity of the specimens.

20. BIOTITE. Hexagonal mica. Grass Valley, Nevada County. A specimen was seen by Professor Blake in the cabinet of C. W. Smith, Grass Valley.
BISMUTH—see Bismutite.

21. BISMUTITE. Hydrous carbonate of bismuth, stream bismuth. Found at a single locality in the State, on Big Pine Creek, Inyo County, found in drift while sluicing for gold.
BITUMEN—see Asphalt, under head of Petroleum.
BLACK JACK—see Sphalerite.
BLACK SANDS—see Magnetite.
BLENDE—see Sphalerite.
BLOODSTONE—see Quartz.
BLUE MALACHITE—see Azurite.
BORACIC ACID—see Sassolite.

22. BORATE OF STRONTIA. Mentioned in a letter written by Dr. John A. Veatch to the California Borax Company, quoted in full in the third annual report, part 2, folio 15.

23. BORAX. Borax was first discovered in California in the waters of Tuscan Springs, in Tehama County, January 8, 1856. The water was brought to San Francisco by Dr. Trask, State Geologist, and the analysis made by L. Lanszweert. The crystals then obtained were sent to the museum of the California Academy of Science. Borax Lake was discovered by Dr. John A. Veatch, in September, 1856. This deposit was worked from 1864 to 1868, during which time it produced 1,181,365 pounds of borax. Borax fields were discovered in San Bernardino County, February 14, 1873. These deposits have been worked by the San Bernardino

Borax Mining Company, who have produced very large quantities of borax. This valuable mineral has since been found at a number of localities in the State: In Death Valley, Inyo County, 1873; at Desert Springs, called also Cane Springs, in Kern County, February 15, 1872, from whence a considerable quantity has been extracted. The dry lake in which the borates are found is situated in township thirty south, range thirty-eight east, Mt. Diablo base and meridian. Borax and the borates have been found in considerable quantities in San Bernardino County, near Calico, which deposit is at the present time being worked.

The reader is referred to former reports of this office, especially the third annual report, for information concerning this mineral and its production in the State.

24. BORNITE. Erubescite, horseflesh ore, purple copper ore, variegated copper ore, etc.

*Calaveras County.* At Copperopolis and Campo Seco.

*Fresno County.* With chalcopyrite and pyrite, at King's River.

*Inyo County.* Inyo Mountains.

*Plumas County.* Light's Cañon, Genesee Valley, and at the Siegel Mine.

*Santa Clara County.* Near Lexington.

*Shasta County.* At Copper City.

25. BRONZITE. For localities, see Enstatite.

BUHR STONE—see Quartz.

BUILDING STONES, there not being many species, they have been described under a special heading.

26. BROMINE. Said to occur with free iodine in the serpentine rocks, at Point Lobos, near San Francisco. Report on the geology of the coast mountains, etc., J. B. Trask, State Geologist, 1884, folios 26 and 92.

Bromine occurs as bromide of potassium in the waters of San Francisco Bay, and in the bitterns or concentrated mother liquors, from which bay salt crystallizes out in the proportion of 1.090 parts in 1000 as shown in analysis made in 1879, by Fr. Gutzkow, and quoted in the second annual report of this office, folio 223.

27. CALAVERITE. Telluride of gold and silver. This mineral occurs sparingly in the mines of Carson Hill, near Angel's, at the Morgan Mine with massive gold, at the Melones Mine, and at the Golden Rule Mine, Calaveras County.

28. CALCITE. Anthraconite, arenaceous limestone, carbonate of lime, calcareous spar, calc spar, dogtooth spar, Iceland spar, limestone, lithographic stone, marble, stalactite, stalagmite, travertine, tufa, thinolite, etc. This mineral is abundant in California, and occurs in many forms. It is found not only in extensive beds, but as distinct varieties, resulting from changes well known to mineralogists. It is a common mineral in veins of silver, lead, copper, zinc, and quicksilver, and sparingly in gold mines. It would be impossible and useless to enumerate all the localities in the State, but the following are given as the most important and best known:

*Amador County.* Black calcite, near Volcano.

*Butte County.* Blue limestone and anthraconite, at Pence's ranch.

*Calaveras County.* *Anthraconite*, near newly discovered caves at Murphys. The odor of this mineral is remarkable. Sitting one day in the hot sun, and breaking while studying the rock, I noticed with much

interest the penetrating and actually fetid smell that arose every time a blow of the hammer was made. I was annoyed at the same time by swarms of flies, but did not immediately connect their presence with the smell. After a time the idea occurred to me that they were attracted by the odor, which I immediately proved to be the case by the following experiment: Leaving my seat, I retired to a distance and awaited the dispersion of the flies. Returning, I laid some fragments on a larger piece and crushed them quickly with rapid blows. The flies immediately reappeared and settled in large numbers on the powdered rock. After a time, the smell having gone, the flies departed as before. This was repeated a number of times, and was witnessed with interest by the parties who were visiting the cave at the time.

*El Dorado County.* A large deposit of limestone at the Alabaster Cave and lime works, where it is very extensively burned for lime; near Mud Springs.

*Inyo County.* Thinolite found in considerable quantity near Owens' Lake, and on the Mohave Desert, in the beds of ancient lakes; and in Death Valley, at Cerro Gordo; fine crystals of dogtoothspar and blue calcite occur; at Darwin, Iceland spar, very transparent and fine; at Palma Mine, fine crystals; with gold and other ores at Modoc Mine.

*Kern County.* With malachite and melaconite, San Amedio Ranch. Lithographic stone on section twelve, township thirty-two south, range thirty-four east, Mount Diablo meridian.

*Lassen County.* Several localities.

*Mariposa County.*

*Mono County.* Thinolite, valley of Mono Lake, where it has been burned to an inferior quality of lime.

*Placer County.* Near Clipper Gap; extensively burned to lime at Cave Valley, five miles south of Auburn.

*San Bernardino County.* Near Colton, burned for lime by hydrocarbon furnace, in which California petroleum is used as fuel.

*San Diego County.* Thinolite, Colorado Desert.

*San Francisco County.* Peninsula near the city, dogtooth crystals in fissures of metamorphic rocks.

*Santa Clara County.* Hills back of Mayfield, burned for lime. Good specimens of Iceland spar are sometimes found; with quicksilver ores in the New Almaden, Guadalupe, and Chapman Mines.

*Santa Cruz County.* Near Felton and Santa Cruz, extensive beds of crystalline limestone occur, which is burned in a large way for lime.

*Siskiyou County.* Arenaceous limestone, found in Middleton's tunnel, under the bed of the Klamath River.

*Santa Catalina Island.* On the coast of Los Angeles County, pink calcite is found, with quartz, etc.

Tufa, or travertine, is found in several localities, but it has not been studied.

MARBLES occur in numerous localities in the State; some of them are of excellent quality, and a few are exceptionally fine.

*Amador County.* Near Ione, a red marble is found which resembles the Rosso Antico, so much prized in ancient Rome. This marble is fully described under the heading of Building Stones. Nine miles from Ione a white marble of good quality is found.

*Butte County.* A blue variety crops out for miles near Pence's Ranch; it is known to be carboniferous.

*Calaveras County.* Near Cave City, a beautiful marble of a pleasing, soft pearl-gray color with darker markings; takes a fine polish; is compact and without flaws; it is an elegant ornamental and desirable building stone.

*El Dorado County.* At Alabaster Cave a nearly white marble is found, but it has not as yet been carefully studied; a gray mottled variety from near the same locality takes a good polish, and is a good building material.

*Humboldt County.* Seven miles from Eureka, a handsome mottled gray marble of uniform texture; takes a high polish; soluble in acids; contains but little magnesia, and seems to be an excellent stone. It is located on the timber claim of Flanegan & Brosman.

*Inyo County.* Numerous marbles have been observed in the Inyo Mountains, from white to black, but little is known of them. At Big Pine, at the foot of the Sierra Nevada Range, there is a cropping of beautiful white marble, but it has never been examined chemically and may be dolomite. In Death Valley a blue limestone is found in bowlders among the float filled with what seems to be fossil coral; if cut and polished it would probably be found to be a fine marble.

*Kern County.* A water-worn bowlder of marble of good quality was found in the bed of Poso Creek; the source is not yet known. A brecciated marble resembling Giallo antico is found three miles from Tehachapi, and a soft yellow and really very beautiful marble is found in a valley nine miles west of the town of Tehachapi. It is found in large masses. There is one large block at the station at Tehachapi which was never shipped. The marble is fine grained and beautifully mottled. These marbles are described in detail under the head of Building Stones. They are worthy of special attention.

*Los Angeles County.* There are two varieties of marble known to occur in this county; one light colored, the other dark. But little is known otherwise of them.

*Monterey County.* Near Carmello Bay, a white compact marble is found which is said to exist in very large quantities. A company was incorporated some years ago to work it, known as the Pacific Carrara Marble Company.

*Nevada County.* On Bear Creek, near Colfax, a dark gray-veined marble is found. Another locality is ten miles south of Grass Valley.

*Placer County.* Near Clipper Gap, gray-veined marble of good quality; takes a high polish; occurs in large quantities. Analyses of two varieties are published in the fourth annual report of this office, folio 111. A white marble occurs at and near the cave, in the vicinity of Auburn.

A white saccharoidal marble is found near the iron furnaces, in section fifteen, township fifteen north, range eight east. It could be obtained in large blocks or slabs if required. An analysis may be found on folio 111, fourth annual report of this office.

A very beautiful black marble, veined with white, has been found near Colfax, on the Central Pacific Railroad. It is an excellent ornamental and building stone, and should be utilized.

A large cropping of light gray marble, with veins and markings of darker gray, has been opened in a lime quarry near Auburn. It is in very large quantity. It is compact, of uniform structure, and takes a high polish. An analysis appears on folio 111 of the fourth annual report.

*Plumas County.* Limestones and marbles have been found at Devil's Elbow. This office has no information as to quality or quantity.

*San Bernardino County.* Near Colton, in Slover Mountain, half a mile from town. The marble is white and of good quality, but I am informed that it has not yet been found of a quantity that will admit of large blocks being quarried. It is extensively burned for lime.

*San Luis Obispo County.* Marbles in many varieties are said to occur in this county, but this office has no special information.

*Santa Cruz County.* At the lime works mentioned elsewhere, a crystal-limestone is found that has some of the properties of marble.

*Shasta County.* Marbles are found in the Gray Mountains, along the McCloud River. No specimens have been sent to the Mining Bureau.

*Tuolumne County.* This county is rich in marbles and limestones. A beautiful dark marked variety is found near Abbey's Ferry; the exact locality is not known. In the bed of the Tuolumne River, at Sonora, a large water-worn outcap of a blue and white marble is laid bare in placer mining.

CARBONATE OF COPPER—see Malachite and Azurite.

CARBONATE OF IRON—see Siderite.

CARBONATE OF LEAD—see Cerusite.

CARBONATE OF MAGNESIA—see Magnesite.

CARBONATE OF SODA—see Trona.

CARNELIAN—see Quartz.

29. CASSITERITE. Binoxide of tin.

Tin has been found in at least three localities in California. In the Temescal Mountains, San Bernardino County, lies the only known deposit in the State, having a prospective value. In Plumas County, in the bed of the middle fork of Feather River, three miles above Big Bar, a single specimen was found by Mr. Thomas Lane of La Porte, and given to Professor W. P. Blake, and by him described as resembling the stream tin from Durango, Mexico. Another specimen was found some years ago near Weaverville, Trinity County, in the loose soil, and presented to Professor J. D. Whitney, then State Geologist. The vein from which it came was never found.

Grossularite, lime garnet, a common mineral in Southern California, resembles crystals of cassiterite, and has often been mistaken for it by Cornish miners. A number of reported tin discoveries have turned out to be this mineral. The temescal tin mines are in the Temescal Mountains, whence the name, on section two, township four south, range seven west, San Bernardino meridian; distant fifty-five miles east of Los Angeles, and thirty-five miles from Anaheim Landing.

CAT'S EYE—see Quartz.

30. CERARGYRITE. Chloride of silver.

Cerargyrite is rather a common mineral in some of the southern counties of the State, associated with embolite, but seldom in masses sufficiently large to form good cabinet specimens. Microscopic crystals of great beauty are not uncommon, but the mineral generally occurs in very thin crusts.

It forms the chief silver mineral in Slate Range, Inyo County. The finest microscopic crystals are found in the Modoc Chief Mine, Inyo County. Cerargyrite is a valuable silver mineral, and is easily reduced by the most simple metallurgical process.

It has lately been found in the Silver King Mine, four miles west of Redding, Shasta County. The ore contains minute, but very perfect, crystals of cerargyrite. An assay showed silver to be present to the extent of 140 ounces to the ton. The ore resembles the best from Calico District, in San Bernardino. The specimens were sent to the Mining Bureau by B. B. Miner.

31. CERUSITE. White lead, carbonate of lead, white lead ore, etc.

This mineral is very easily distinguished, and is rather common in California, seldom in crystals, but generally associated with galena, anglesite,

azurite, linarite, chrysocolla, malachite, silver minerals, and gold. Fine crystallized specimens, with the associates above mentioned, are found in the Modoc Mine, and in many other localities, in the Inyo and Coso Mountains, Inyo County; in the Russ District, in the same county, in large crystals resembling those from Siberia, and at Great Basin Mine, near Mohave River (Blake). It is a valuable ore of lead, and in certain localities an indication of silver ores. A considerable proportion of the lead ores worked at the Cerro Gordo Mines were cerusite. Thirty-two thousand tons of lead were produced in these mines.

32. CERVANTITE. Antimony ochre.
This is a rare mineral in California. It occurs with stibnite in San Emedio Mountain, Kern County. (Blake.)

33. CHALCANTHITE. Native sulphate of copper, blue vitriol.
Results from the decomposition of copper sulphide ores and is rare in nature. It sometimes occurs in old copper mines in California when the waters do not flow from the workings, and old tools such as picks, gads, hammers, etc., left by accident in the old works, have been found changed to metallic copper, or very heavily coated with that metal. Specimens in the State Museum are from the Peck Mine, Copper City, Shasta County, and from Sweetland, Nevada County.
The waters of a copper spring near Glenbrook, Lake County, deposit copper on a knife blade.
CHALCEDONY—see Quartz.

34. CHALCOPYRITE. Copper pyrites. This mineral is quite abundant in California, being found in greater or less quantities from north to south. It is a valuable ore of copper; but its metallurgy presents so many difficulties that it is found generally more profitable to concentrate it and ship it to England than to work it here. Under some circumstances it has been found economical to reduce it to a matte by a single furnace operation, and ship it in that condition. It is also worked somewhat extensively at Campo Seco, Calaveras County, and at Spenceville, Nevada County. The following California localities are represented in the State Museum:
*Calaveras County.* Campo Seco, Copperopolis, and Lancha Plana.
*Colusa County.* Stony Creek.
*Contra Costa County.* In the rocks of Mount Diablo.
*Inyo County.* Beveridge District.
*Los Angeles County.*
*Mariposa County.* Near Hornitos.
*Nevada County.* At Spenceville.
*Plumas County.* Bullion District and Light's Cañon.
*San Bernardino County.*
*San Diego County.*
*San Francisco County.* In specks in the jaspers of the peninsula.
*Santa Clara County.* At Lexington.
*Shasta County.* Copper City.
It occurs also in small quantities with ores of gold and silver, and is almost universal in its distribution over the State.

35. CHALCOSITE. Vitreous copper, copper glance.
It is found with other ores of copper in the State, more frequently in the southern counties. It is sometimes argentiferous, and merges into stromeyrite, which see. It occurs in the silver ores in Inyo and San Bernardino

Counties; in Genesee Valley (in basalt), Plumas County; in San Diego County; in Los Angeles County; at the Maris Mine, in grains and irregular masses, in syenitic granite, containing silver (Blake); in San Luis Obispo County; and in the Enterprise Mine, Bullion District, Plumas County.

CHESSY COPPER—see Azurite.

CHLORIDE OF SILVER—see Cerargyrite and Embolite.

CHLORO-BROMIDE OF SILVER—see Embolite.

CHLORO-CARBONATE OF LEAD—see Phosgenite.

CHROME IRON—see Chromite.

36. CHLOROPAL. Nontronite.

This mineral has been found recently at two localities in California, one near Hite's Cove, Mariposa County, and in lava at Bath, in Placer County. A specimen from the former gave the following reaction: Color, piscatio green; cuts like soap; easily indented or cut by the finger nail; lumps under the pestle; gives water in closed tube; with borax on platinum wire, gives iron reaction; on charcoal, in reducing, flame turns black and becomes strongly magnetic. Partly soluble in hydrochloric acid; dissolves in caustic soda, leaving a black residuum.

37. CHROMITE. Chromic iron, chrome ore, etc.

This mineral is very abundant in California. Its occurrence and production have been fully described in the fourth annual report, folio 126.

It is known to exist in at least twenty-six counties in the State, as follows. Nearly all the localtties are represented in the State Museum:

*Alameda County.* Near the Town of San Antonio; in Livermore Valley, nine miles southeast from section thirteen, township three south, range two east; 1,500 tons 48 per cent shipped to Philadelphia; 60 tons sold at $6; 500 tons offered at $5, without sacks.

*Amador County.* Near Jackson, one mile from Mountain Spring House.

*Butte County.* Mount Hope District, near Forbestown.

*Calaveras County.* French Gulch; near Domingo Creek; near Campo Seco; near Murphy's; in San Diego Gulch, on the east of the highest hill opposite the Noble Copper Mine, in very large masses.

*El Dorado County.* Two miles from Coloma; two miles northwest of Shingle Springs; ten miles west of Shingle Springs; near Latrobe.

*Fresno County.* Near the New Idria Quicksilver Mine; twenty miles from Fresno City.

*Lake County.* At Lower Lake; on the road from St. Helena to Knoxville; at Glenbrook, a large quantity. Mr. H. Aldrich thinks 1,000 tons could be obtained from this locality.

*Los Angeles County.* Lang's Station, Soledad Cañon; occurs with magnite, in the form of sand.

The Los Angeles papers assuming the mass to be chrome iron, estimate the quantity at 50,000 tons, which is without doubt a mistake. It is not uncommon in California to find chromite with magnetic sands, but not in such large proportion.

*Mendocino County.* At Stanley's Ranch.

*Monterey County.* Near San Benito River.

*Napa County.* Near St. Helena, in Chiles Valley; 170 tons delivered at St. Helena, sold for twelve dollars per ton.

*Nevada County.* Deer Creek, Coyote Diggings, near Colfax.

*Placer County.* Near Alabaster Cave, Michigan Bluffs, within one mile of Auburn, on section twelve, township fourteen north, range nine east, seven miles east of Iowa Hill.

*Plumas County.* Spanish Creek, Meadow Valley.

*Sacramento County.* Seven miles east of Folsom, near south fork of American River; nine miles from Folsom; 2,800 tons have been shipped from this locality.

*San Francisco County.* Several unimportant deposits are known on the peninsula, one on the ocean beach below outlet of Lake Merced, one on the hills south of the city.

*San Luis Obispo County.* Chrome iron is abundant in this county. The Flores deposit has been extensively worked. The Pick and Shovel Mine is six miles northeast of the town of San Luis. The London Mine is four and a half miles northeast of the town. Extensive mines lie five miles southeast of San Luis. Very large quantities of chrome ores have been shipped from this county. The county papers estimate the product at over twenty-eight thousand tons.

*San Mateo County.* Chrome ores are found in this county, on the Pacific Slope of the redwoods. The deposits are said to be large.

*Santa Clara County.* Five miles east of San José; Los Gatos.

*Sierra County.* Vicinity of the Mountain House, near Downieville; Cherokee Creek, one fourth of a mile southeast of Brandy City.

*Siskiyou County.* Half a mile from the town of Yreka—a high grade ore.

*Solano County.* Near Fairfield.

*Sonoma County.* Near Litton Springs, in large quantities; at Hood's ranch.

*Tehama County.* A large deposit has recently been found in township twenty-five north, and range seven west, by J. A. Heslwood; a company has been incorporated.

*Tulare County.* Deer Creek, near Plano, and ten miles from Portersville.

*Tuolumne County.* The Engel Mine at Yorktent, near Chinese Camp, has been worked for many years.

CHROME SPINEL—see Picotite.

38. CHRYSOCOLLA. Silicate of copper. Rather an abundant mineral in southern California. It is regarded in Owens' Valley as an indication of silver mines. It is found as a blue stain on ores of copper and silver, and in the vicinity of mines of these metals. Fine specimens are found in the Copper World Mine, San Bernardino County; in the Lundy Mines, Mono County, associated with ceragyrite and cuprite, and in the Union Mine, Inyo County, and forty miles south of Colton, San Bernardino County. It occurs also near San Carlos, Inyo County; at the Eclipse Mine, same county; in the White Mountains, Mono County; in San Diego and San Luis Obispo Counties, and elsewhere in the State. It is a valuable ore of copper, for the reason that it can easily be reduced in the water jacket furnace to metallic copper.

39. CHRYSOTILE. This is a magnesian mineral, a variety of serpentine, having no economic value. It occurs in veins or seams in serpentine, and is not uncommon in the State where the serpentines occur.

40. CINNABAR. There are in this State many deposits of cinnabar. The counties most distinguished for their wealth in this mineral being Santa Clara, Fresno, San Luis Obispo, Trinity, Napa, Sonoma, and Lake, all containing mines that have been more or less, and in some of which mines are still being worked. The localities are so numerous that like those of gold it would be tedious and unnecessary to mention them all. Under the head of *Mineral Springs*, it will be seen that the influences which have led to the deposition of cinnabar, pyrite, native mercury, calcite, aragonite, quartz, sulphur, bitumen, and gold, are still in active operation, and as cinnabar is the mineral from which most of the quicksilver has been extracted in California, it is proper to give under this head the following statement of the product of that remarkable and useful metal for the years 1885–6, furnished by Mr. J. B. Randoll; by referring to the same subject in former reports, the entire yield for California may be learned:

## PRODUCTION OF QUICKSILVER IN CALIFORNIA FOR THE YEAR 1885-86.

(*Black figures are the production of 1886.*)

| | Ætna. | Napa C. | Great Western. | Guadalupe. | New Idria. | Sulphur Bank. | Redington. | Great Eastern. | Various. | Total—flasks. | New Almaden. | Grand Total—flasks. | Price in San Francisco—per flask. Highest. | Price in San Francisco—per flask. Lowest. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 189<br>**162** | 131<br>**147** | 172<br>**339** | 0<br>**0** | 190<br>**70** | 24<br>**100** | 40<br>**42** | 37<br>**73** | 0<br>**34** | 783<br>**967** | 1,700<br>**1,431** | 2,483<br>**2,398** | $33 00 | $32 50 |
| February | 96<br>**132** | 180<br>**192** | 245<br>**274** | 35<br>**0** | 70<br>**175** | 85<br>**108** | 24<br>**24** | 75<br>**53** | 0<br>**45** | 810<br>**1,003** | 1,506<br>**1,100** | 2,316<br>**2,103** | $32 50 | $32 50 |
| March | 88<br>**209** | 145<br>**218** | 314<br>**236** | 0<br>**0** | 80<br>**20** | 83<br>**91** | 0<br>**21** | 33<br>**43** | 19<br>**75** | 762<br>**903** | 1,500<br>**1,522** | 2,262<br>**2,425** | $32 50 | $31 00 |
| April | 142<br>**328** | 145<br>**172** | 340<br>**115** | 0<br>**0** | 80<br>**90** | 69<br>**172** | 0<br>**36** | 37<br>**62** | 0<br>**62** | 813<br>**1,037** | 2,003<br>**1,256** | 2,816<br>**2,293** | $31 00 | $30 00 |
| May | 62<br>**228** | 190<br>**128** | 259<br>**99** | 0<br>**0** | 75<br>**101** | 194<br>**36** | 0<br>**18** | 0<br>**76** | 3<br>**95** | 793<br>**781** | 2,000<br>**1,600** | 2,793<br>**2,381** | $29 00 | $28 50 |
| June | 112 | 250 | 330 | 0 | 62 | 91 | 50 | 63 | 5 | 963 | 1,750 | 2,713 | $30 00 | $29 00 |
| July | 45 | 191 | 321 | 0 | 75 | 209 | 43 | 50 | 10 | 944 | 1,750 | 2,694 | $30 00 | $29 75 |
| August | 118 | 175 | 324 | 0 | 80 | 150 | 49 | 0 | 47 | 943 | 2,104 | 3,047 | $29 75 | $29 50 |
| September | 201 | 180 | 347 | 0 | 95 | 85 | 57 | | 77 | 1,042 | 1,936 | 2,978 | $30 50 | $29 50 |
| October | 52 | 185 | 236 | 0 | 85 | 123 | 42 | 65 | 82 | 870 | 1,598 | 2,468 | $30 50 | $30 00 |
| November | 54 | 190 | 292 | 0 | 122 | 61 | 43 | 43 | 87 | 892 | 1,576 | 2,468 | $30 00 | $29 75 |
| December | 150 | 235 | 279 | 0 | 130 | 122 | 37 | 43 | 62 | 1,058 | 1,977 | 3,035 | $32 00 | $30 00 |
| Totals | 1,309 | 2,197 | 3,469 | 35 | 1,144 | 1,296 | 385 | 446 | 392 | 10,673 | 21,400 | 32,073 | $32 00 | $28 50 |
| Production in 1884 | 2,931 | 1,376 | 3,292 | 1,179 | 1,025 | 890 | 881 | 332 | 7 | 11,913 | 20,000 | 31,913 | $35 00 | $26 00 |
| Production in 1883 | * | 5,890 | 3,869 | 84 | 1,606 | 2,612 | 1,894 | 1,669 | 101 | 17,725 | 29,000 | 46,725 | $28 50 | $26 00 |
| Production in 1882 | | 6,842 | 5,179 | 1,138 | 1,953 | 5,014 | 2,171 | 2,124 | 241 | 24,662 | 28,070 | 52,732 | $29 05 | $27 35 |
| Production in 1881 | | 5,552 | 6,241 | 5,228 | 2,775 | 11,152 | 2,194 | 1,065 | 584 | 34,791 | 26,060 | 60,851 | $30 75 | $27 90 |
| Production in 1880 | | 4,416 | 6,442 | 6,670 | 3,209 | 10,706 | 2,139 | 1,279 | 1,600 | 36,461 | 23,465 | 59,926 | $34 45 | $27 55 |

***Production of Ætna and Napa Con. not segregated in former years.**

CLAY—see Kaolinite.
COAL—see Lignite.
COBALT—see Erythrite and Millerite.
COBALT BLOOM—see Erythrite.

41. COCCINITE. Iodide of mercury.
Locality given by Dana, San Emidio Cañon, Kern County.
COLEMANITE—see Priceite.

42. COPPER. Copper in the metallic state has not been found in any considerable quantity in California. The following are the known localities:

*Calaveras County.* Found sparingly in the Keystone, Napoleon, Lancha Plana, and Union Mines. The Satellite Mine, the Lancha Plana under a new name, has produced a fine lot of specimens which were exhibited by Horace D. Randlett at a late exhibition of the Mechanics' Institute at San Francisco.

*Del Norte County.* With cuprite, Pearl Mine.

*Napa County.* Near St. Helena.

*Nevada County.* Meadow Lake, with cuprite.

*Plumas County.* At Mumford's Hill, with rhodonite.

*Sacramento County.* Cosumnes Mine.

*San Luis Obispo County.* Pieces of float copper have been found in the Coast Range, sometimes associated with cuprite; one mass weighed 37.3 pounds.

*Santa Barbara County.* In grains in serpentine rocks (Blake).

*Shasta County.* Cow Creek and Iron Mountain.

*Trinity County.* With cuprite.

43. COPPERAS. Coquimbite in part, hydrous sulphate of iron, occurs in several localities in the State, and is generally the result of solfataric action, as at the Sulphur Bank, in Lake County, where it is very abundant. No analysis has been made of it, so that its exact composition is unknown. Dr. Trask, in his report of 1854, fol. 56, says it is found in large quantities near the town of Santa Cruz, in such quantity that it could be extensively manufactured as an article of commerce. I formed the same opinion as to the Sulphur Bank before mentioned. A sample of saturated solution of sulphate of iron was sent to the Mining Bureau recently, leached from ground sulphurets that the party who sent it states could be obtained at the rate of seventy gallons per ton. This is only another evidence of the enormous waste that is permitted in the metallurgy of ores in California.

COPPER—Blue Carbonate—see Azurite.
COPPER GLANCE—see Chalcosite.
COPPER—Green Carbonate—see Malachite.

44. CORUNDUM. According to Baron Richthoven it is found in the drift in the San Francisquito Pass, Los Angeles County.

45. CUBAN. Sulphide of copper and iron. It is said to be found on Santa Rosa Creek, San Luis Obispo County. One mass weighed 1,000 pounds. I consider this statement as doubtful.

46. CUPRITE. Red oxide of copper. Cuprite is rather a common mineral in California. The following are the most important localities:

*Colusa County.* Candace Mine.

*Del Norte County* Pearl Copper Mine, with native copper.
*Kern County.* San Emedio Ranch, with malachite.
*Mono County.* Kerrick Mine, with azurite, malachite, partzite, and native silver.
At Lundy, in microscopic crystals, with cerargyrite and chrysocolla.
On the borders of Mono Lake and at Mammoth.
*Napa County.* Near St. Helena, in masses of considerable size, with native copper.
*Nevada County.* At Meadow Lake, with native copper.
*Placer County.* Near Lincoln.
*Plumas County.* Reward Mine.
*Shasta County.* Peck Mine, Copper Hill, in microscopic crystals.
*Trinity County.* With native copper, exact locality unknown.
*Tulare County.* May Flower Mine, Mineral King District.
And at numerous localities in the Inyo Mountains, Mono, and Inyo Counties.
According to Blake, it occurs sparingly in thin crusts and sheets with the surface ores of the principal copper mines in Calaveras County, especially the Union and the Keystone; in Mariposa County, at La Victoire Mine, with green and blue carbonates of copper; in Del Norte County, at the Evoca, Alta, and other mines, in very good cabinet specimens, the cavities being lined with crystal; in Plumas County, and in the upper parts of most of the copper veins of the State.

47. GUPROSCHEELITE. Tungstate of lime and copper. This new and interesting mineral was first found in California in the Green Monster Copper Mine, in Kern County, about twelve miles east of White River Post Office. It is generally associated with black tormaline. A large crystal was found at this locality, which is the only one of this mineral known. In 1879 a fine specimen was sent to San Francisco from Fresno County, but the exact locality was not given.

48. DATOLITE, OR DATHOLITE. This mineral has, as yet, been found at one locality only, but from the universal distribution of boracic acid in the State, it is likely to be found elsewhere. The locality is a mining tunnel near San Carlos, Inyo County. It occurs with grossularite in fine crystals, the datholite being the matrix in which the grossularite is embedded. This mineral was first noticed by the late J. Lawrence Smith, and an account of it published in the *American Journal of Science* a number of years ago.

49. DIALLOGITE. Rhodochrosite, carbonate of manganese. This mineral is represented in the State Museum by a single specimen, No. 3584, in beautiful pink crystals, from the Colorado Mine, No. 2, Monitor District, Alpine County.

50. DIAMOND. For the details of the occurrence of diamonds in California, and of general history, the reader is referred to the fourth annual report of this office, folio 157. The following are the known localities in the State:
*Amador County.* A very interesting stone was found in July, 1883, by George Evans, on the surface of the ground at Rancheria, a small mining camp, about four miles northwest of Volcano. It weighs about 255 milligrams. Its length is 0.315 inches; thickness, 0.215 inches. It is irregularly globular in form, all the faces being convex. It is pale straw colored, very

brilliant, and, as far as can be distinguished even under the microscope, is without a flaw. Jackass Gulch, near Volcano, and Indian Gulch, Gopher Hill, near Fiddletown, and other localities. Diamonds have been found at Volcano in a peculiar volcanic formation, described by Professor Whitney as "ashes and pumice cemented and stratified by water." The crystals had the form of the icositetrahedron, with faces curved in the manner peculiar to the diamond.

*Butte County.* A fine crystal was found some years ago in the west branch of Feather River. It was about four millimeters in diameter. It was afterwards lost. A number of diamonds have been found at Yankee Hill, but the exact number is not known.

A fine diamond from the Spring Valley Mine, Cherokee, has been presented to the State Museum, No. 4033, by Mr. G. F. Williams, Superintendent. Mrs. Harris has a beautiful Cherokee rough diamond set in a ring. Mr. Harris, who was formerly Superintendent of the Spring Valley Hydraulic Mine, has another, which has been cut. Of the two, I consider the natural crystal the most interesting and beautiful. Mrs. W. C. Hendricks of Morris Ravine, near Oroville, also has a fine Cherokee diamond set in a ring.

In August of 1883 I visited Cherokee, Butte County, specially to study that celebrated diamond locality. Mr. A. McDermott, druggist of Oroville, says that a diamond was sent to him in 1862 which was as large as a small pea. It was nearly globular and obscurely crystallized and of yellow color. He does not know the subsequent history of the stone, where it was found, or the owner's name.

At Cherokee, diamonds and zircons are found in cleaning up sluices and undercurrents. The first notice of diamonds at this locality dates from 1853, the largest discovered, which was two and a quarter carats (nine grains), is now in the possession of John More. There have been from fifty to sixty found, from first to last; some were rose colored, some yellow, others pure white, and all associated with zircons, platinum, iridium, magnetite, gold, and other minerals.

*El Dorado County.* Mr. W. A. Goodyear is quoted in Whitney's "Auriferous Gravels of the Sierra Nevada of California" as follows: "He saw a diamond in the possession of Mrs. Olmstead, at Dirty Flat, near Placerville, which measured nine thirty-seconds of an inch maximum diameter, and weighed one and a quarter carats—$5\frac{61}{100}$ grains. It was found by Mr. Olmstead in cleaning up the sluices of the Cruson tunnel, Dirty Flat.

At the McConnell & Reed claim, on the south side of Webber Hill, a diamond the size of a small white bean was found. This diamond was discovered a few feet above the bedrock. Mr. McConnell thinks on a previous occasion he had thrown away a diamond as large as the end of his thumb, in ignorance of its true character. Two other diamonds were found in another claim, also on the south side of Webber Hill.

Three or four diamonds were found near White Rock. Mr. Goodyear purchased a crystal of Mr. Thomas Potts. It weighed half a carat—two grains; had a slight yellowish tinge, and was found in washing the gravel which came from a tunnel driven into White Rock. Near the same locality three diamonds were found in gravel by the Wood Brothers, in 1867. The largest was valued by a San Francisco dealer at fifty dollars.

An interesting letter from Placerville to the State Mineralogist, from W. P. Carpender, gives much information on this subject. It is published in full in the fourth annual report, folio 169.

*Nevada County.* French Gulch—one crystal weighed $7\frac{1}{2}$ grains.

*Trinity County.* An examination of the platinum sands of the Trinity

River was made by Professor F. Woehler, of Gottingen, who found diamonds in them. After removing gold, platinum, chromic iron, silica, rhuthenium, etc., by the usual methods, he examined the residue microscopically, and observed colorless, transparent grains, which he presumed to be diamonds. Subsequent combustion in oxygen and precipitation from solution of baryta, by the carbonic acid evolved, convinced him that the microscopic crystals were true diamonds.

DIATOMACEOUS EARTH—see Quartz.

51. DOLOMITE. Carbonate of lime and magnesia. Inyo marble.

Dolomite is rather abundant in California. The following are the most important localities at present known:

*Amador County.* In narrow, snow-white veins, traversing talcose and chlorite rock bearing coarse, free gold. (Blake.)

*Calaveras County.* In the Winter, Hill's, and other mines, with quartz and free gold, sometimes in cavities, in fine crystals. (Blake.)

*Inyo County.* Dolomite is very abundant in the Inyo range of mountains, from White Mountain to Coso, and in very large deposits. The White Mountain Peak is named from its white appearance. The summit, which seems to be of this rock, is often supposed to be covered with snow, when it is not. Attention has lately been called to the white variety of this marble, which resembles the finest Carrara marble, from which the name "*Inyo marble*" has been taken. A technical description of this dolomite marble has been given under the head of Building Stones.

*Los Angeles County.* Tejunga Cañon, San Gabriel Mountains.

*Mendocino County.* Exact locality unknown.

*Napa County.* Mount Catherine.

*Plumas County.* With pyrite at Mumford's Hill.

*San Bernardino County.* In the Armagosa Mines, with free gold; also in the wash of the Armagosa River, in white bowlders, which, broken, resemble the finest Italian marble.

*San Luis Obispo County.* At Morro, in nodules resembling fossil coral; from less than an inch to several feet in diameter. Some have cavities lined with crystal.

52. DUFRENOYSITE. A mineral composed of sulphur, arsenic, and lead. Said to be found in the Union Mine, Cerro Gordo, Inyo County (doubtful).

ELECTRUM—see Gold.

53. EMBOLITE. Chloro-bromide of silver. It is rather an abundant mineral in southern California, but is seldom found in masses of any considerable size, being generally disseminated throughout the other ores of silver, or occurring in crusts. It is almost always associated with cerargyrite, for which it is often mistaken. It is found in the Minnie Mine, Sweetwater Range, Mono County, and in the Indiana Mine, near Swansea, Inyo County. A large specimen of silver ore in the State Museum (brecciated), a large portion of which is covered with embolite, is from the Alhambra Mine, Calico District, San Bernardino County.

EMERALD NICKEL—see Zaratite.

54. ENARGITE. Sulpho-arsenide of copper, sometimes containing antimony, iron, silver, or zinc. It occurs at least at one place in California, where it is abundant, associated with pyrite and other minerals. It has a disposition to change to arsenious acid and sulphate of copper, a reference

to which has been made under the head of arsenolite. The locality is the Morning Star Mine, Monitor District, Alpine County, from which there are fine specimens in the State Museum. One remarkably fine specimen from the Stella Mine was presented by Lewis Chalmers. It is a nodular mass, surrounding a nucleus of pyrite. It is coated white on the surface from the decomposed mineral. The inner nucleus is in part amorphous, partly crystalline, of a pale gray color; where it joins the enargite it is pale yellow.

55. ENSTATITE. Bronzite.

Silicate of magnesia, alumina, iron, lime, manganese, etc. The variety Bronzite is found in Alameda County, in the Berkeley Hills.

56. EPIDOTE. Silicate of alumina, lime, iron, etc. Occurs sparingly in California, at Long Valley, on the Mohawk Road, Plumas County, and in Miners' Ravine, Placer County. It has been found with copper ores in Calaveras and El Dorado Counties, but the exact localities are uncertain.

57. EPSOMITE. Epsom salt, hair salt, sulphate of magnesia.

This rather rare mineral occurs in the Redington Quicksilver Mine, Napa County, in curved porous crystals several inches long, white color, nearly wholly soluble in water, gives much acid water in closed tube, and a black sublimate of sulphide of mercury which is present as an impurity. B. B. on ch. melts in its water of crystallization, and becomes pink on addition of nitrate of cobalt at a red heat.

A qualitative analysis shows it to contain alumina and traces of iron. The small residue left after solution in water was examined microscopically and found to consist of black, yellow, and transparent particles, some sulphide of iron (pyrites), and a small amount of cinnabar. The black particles proved to be magnetite, the yellow free sulphur, and the transparent, selenite—altogether an interesting association, and one that will be studied more carefully in the future.

*Epsomite* has been found in an old drift in Ventura County, at Rincon. The tunnel is in two hundred to three hundred feet, and the mineral forms on the roof and sides in acicular needles two inches long. Specimens have been presented to the State Museum by Dr. Stephen Bowers, of Ventura. It is very soluble in water.

ERUBESCITE—see Bornite.

58. ERYTHRITE. Arsenite of cobalt.

This rare mineral has recently been found in California and Nevada. It is found as a rose-red incrustation on a grayish earthy mineral at the Kelsey Mine, Compton, Los Angeles County. It was described by Professor William P. Blake in "Contributions to the Mineralogy of California," in the appendix to the second annual report of the State Mineralogist, 1882.

FELDSPAR—see Albite, Labradorite, and Orthoclase, and special paper on rocks and building stones.

59. FLUORITE. Fluor spar, fluoride of calcium.

Found only sparingly in small white cubes, with copper ore, at Mount Diablo, Contra Costa County (Blake).

FLUOR SPAR—see Fluorite.

FRENCH CHALK—see Talc.

FREIBERGITE—see Tehahedrite.

60. GALENA. Galenite, sulphide of lead.

Galena is a common ore of lead and very abundant in California. It is found in the northern part of the State with pyrite and blende, in the gold mines, and in the south with silver ores; sometimes disseminated through the ore, at other times in distinct veins, and in masses of considerable size. The time will come when by a proper system of concentration this mineral will be gathered and will add largely to the lead production of the world.

The following are some of the very numerous localities in the State; most of them are representated in the State Museum:

*Amador County.* Rising Sun Mine, near Aqueduct City.

*Calaveras County.* At Murphy's, in the Star of the West Mine, Blue Mountain District and Gold Hunter claim.

*Inyo County.* New Coso, Modoc, Brown Monster, and Hidalgo Mines, the latter showing radiated structure. In the Cerro Gordo Mines where a large quantity of lead has been produced, and at many other localities in the Inyo Mountains. All the ores containing this mineral are argentiferous.

*Mariposa County.* Marble Springs.

*Mono County.* In the May, Lundy, and Homer Districts, and with native silver and partzite, Tower Mine near Benton; there are numerous other localities in the county.

*Nevada County.* In several of the most noted mines with gold, and at Meadow Lake with gold and blende.

*Plumas County.* Light's Cañon and Granite Basin.

*Sacramento County.* At Michigan Bar, with blende and pyrites.

*San Bernardino County.* In many localities.

*Santa Catalina Island.*

*Tehama County.* At Cow Creek.

*Tuolumne County.* In white quartz, with coarse gold, pyrite, and blende; Soulsby Mine.

61. GARNET. Andradite.

Garnets are found in a number of localities in California, but no stones suitable for jewelry work, or which should be called gems, are known.

Garnets have been found in the following localities in the State:

*Calaveras County.*

*El Dorado County.* At Fairmount Mine, three miles from Pilot Hill, in large blocks and masses two feet thick or more (Blake); Rogers' claim, Hope Valley, with copper ores.

*Fresno County.* Near New Idria (chrome garnet).

*Inyo County.* Coso Mining District. Specimens have been brought to San Francisco, under the impression that they were tin ore.

*Los Angeles County.* Mountain Meadows, with copper ores.

*Marin County.* Reed's Ranch, in mica schist.

*Mono County.* Near Mono Lake.

*Plumas County.* Long Valley.

*San Bernardino County.* Near the Temescal Tin Mines.

*San Diego County.* Soledad Mine, near Santa Ysabel.

*Santa Clara County.* Thirty miles northeast of San José, in mica schist.

*Sonoma County.* Mouth of Russian River—near Petaluma, associated with specular iron, pyrite, chalcopyrite, calc spar, actinolite, and steatite.

*Ventura County.* Pine Mountains.

62. GAY-LUSSITE. Carbonate of lime and soda, found in alkaline lakes in fine crystals. It has no present economic value. Thinolite, which

forms mountains in Nevada and elsewhere in the Great Basin, is believed to be a pseudomorph after gay-lussite; if this is so, the quantity of carbonate of soda set free must also have been very great. This subject forms the substance of several chapters in the "Geology of the Fortieth Parallel," Clarence King. Gay-lussite is found in California at Borax Lake, San Bernardino County, and probably elsewhere.

63. GEOCRONITE. Sulphide of lead and antimony, has been observed with galena in small masses in the Inyo Mountains, Inyo County. A specimen was exhibited in the California collection at the Paris Exposition of 1878.

64. GLAUBERITE. Sulphate of lime and soda, was found at Borax Lake, Lake County, in blue clay at a depth of forty feet, having been obtained in an artesian boring (Dana). It is reported also in San Bernardino County, at the borax works, and it is said to exist at the Geysers in Sonoma County.

65. GLAUCOPHANE (Wichtisite). This mineral occurs in a rock matrix, widely distributed in California, and associated with serpentine. The rock was first observed in 1877, when sections were cut for microscopic observation. A specimen was exhibited at the Paris Exposition of 1878, and when seen by M. Michel Levy was recognized as the "Mica schiste a glaucophane de Syra, Greece," figured in his "Mineralogie micro-graphique des Roches Eruptive Françaises," planche 1, Fig. 2. This rock is represented in the State Museum by No. 4259. The wall rock of the Collier Mine, six miles northeast of Murphy's, Calaveras County, and microscopic slide from near the Wall Street Quicksilver Mine, Lake County. A slide from this was exhibited in Paris.

66. GOLD. Gold exists in nearly every county in California. To enumerate all the localities in detail would be useless. All the information this office has been able to gain concerning this most valuable of all metals may be learned by consulting previous reports of the State Mineralogist, the museum catalogues, and a special paper in this volume.

A very interesting specimen of gold imbedded in a quartz crystal has been exhibited at the State Museum. The following description is the result of a careful examination of this curious and interesting association. It is from Tuolumne County, and was one of several obtained at the same locality. It is now in the private collection of Mr. J. Z. Davis.

The gold is, within and without the crystal, projecting from a perfect face. It does not fill a cavity, but extends like a diaphragm through the quartz. The length of the quartz crystal is 42 millimeters, thickness 13 and 20 millimeters; weight, 14.670 grams; specific gravity, 2.699. According to the table given in Phillips' Metallurgy of Gold and Silver, the proportion of gold is .0429, or by weight—

| | |
|---|---|
| Gold | 0.629 |
| Quartz | 14.041 |
| Total | 14.670 |

Attached to the large crystal are two smaller ones, of smoky quartz, joined to the larger one by the gold. One of these crystals is very minute, the other is somewhat larger; the diameter of the smaller is, in decimals of an inch, .003, the larger is .0375.

The gold is bright, crypto-crystalline, leaf-like, curved in some parts like the gold found in some quartz mines in the State, specially the Cedarberg. The large crystal of quartz is well terminated at one end; the base is shattered and irregular. At the junction of the gold with the quartz the quartz is somewhat fractured, but the gold extends into the body of the crystal into the solid quartz. The face of the crystal which appears fractured, when examined under the microscope, seems to be a confused conglomerate of imperfect crystals of quartz in which some minute half-formed crystals of gold are imbedded. It is interesting to speculate as to the manner of the formation of this crystal, and to theorize how the gold came to be imbedded in it. At first thought it would seem to be conclusive that the gold was formed first and that the quartz crystallized about it; but they may be cotemporaneous, another evidence that quartz is deposited in a gelatinous state, from which it hardens into massive and even crystalline quartz.

It has long been known that gold existed in small quantities on the peninsula of San Francisco, within the city limits. A handy panner, or one skilled in the use of the improved batea, can at any time obtain one or more colors of gold in a panful of sand from the ocean beach or the shores of San Francisco Bay. A few ounces of gold have been extracted from the black sands on the beach near Lake Merced. A small portion of this gold has been obtained, rolled out into a ribbon, and placed in the museum as a specimen of gold from San Francisco County. It has been numbered 6530 in the museum catalogue. Some day this specimen will be prized as a relic of the golden era in California. Half an ounce of gold should be bought from every county in the State while it is possible, and carefully preserved in the State Museum.

67. GRAPHITE. Plumbago, black lead, etc.

The following are the known localities in the State:

*Alpine County.* Near Summit City.

*Calaveras County.* Near Big Tree Grove, in crystalline scales (Blake), probably molybdnite, for which it is frequently mistaken.

*Fresno County.* At Borer Hill.

*Kern County.* Near Fort Tejon.

*Los Angeles County.* Tejunga Cañon, twenty-five miles from Los Angeles, and twelve miles from S. P. R. R.

*Sonoma County.* Knights Valley, Guerneville, and near Pine Flat.

*Tuolumne County.* One mile south of Sonora, Gold Springs.

And reported in Marin, Plumas, and Sierra Counties.

No deposit of any considerable value has as yet been found in the State, and the quality is very inferior. Some of the specimens from localities given above, may be molybdenite, and this is even probable.

GRAY COPPER—see Tetrahedrite and Chalcosite.

68. GROSSULARITE. Lime garnet.

Is quite abundant in California, especially in the southern counties, where it has often been mistaken for tin by Cornish miners who have seen it, and several tin excitements have had their origin in this mistake. It is found also with copper ore in the Roger's claim, Hope Valley, El Dorado County (Dana), and, with datholite, near San Carlos, Inyo County.

69. GYPSUM. Alabaster, selenite, satin spar, plaster of Paris.

Gypsum is an abundant mineral in California. It has been found in numerous localities as follows:

*Alameda Countg.* Union Salt Works, a deposit left in the tanks in the preparation of bay salt.

*Kern County.* With stibnite in the Antimony Mines, San Emidio, near Breckenridge, Buena Vista, and Posa Creek.

*Los Angeles County.* Near the entrance of Soledad Cañon, and at a locality recently discovered.

*Monterey County.* Several unimportant localities.

*Nevada County.* Near Truckee Pass.

*San Diego County.* One or two miles from Elsinore, near Dos Palmas Station, banks of Carizo Creek.

*San Luis Obispo County.* Arroya Grande Mountains.

*Santa Barbara County.* With anhydrite.

The deposit in Santa Barbara County is of great excellence and very extensive, possesses the further advantage of being located within two miles of Point Sal, a shipping station on the coast for this portion of the county. This gypsum is of the white or Nova Scotia variety, being a kind well suited for making plaster of Paris, and which is said to occur abundantly at only a few other points in the United States. Since the discovery three years ago, five thousand tons have been brought to San Francisco and manufactured by Lucas & Co., who inform me that the supply cannot be exhausted in many years.

*Stanislaus County.* Near Hill's Ferry.

*Ventura County.* Ojai Ranch, Lockwood Creek.

ALABASTER—

*Los Angeles County.* Arroyo Grande, San Luis Obispo County, and Point Sal, Santa Barbara County.

*Sonoma County.* In fine crystals, Santa Rosa.

*San Luis Obispo County.* Cholame.

SELENITE—

*Kern County.* Antimony mines, San Emidio; Buena Vista.

*Lake County.* Robinson's Ranch.

*Lassen County.* Near Susanville, in large slabs.

*Los Angeles County.* Soledad Cañon, in large slabs.

*Mariposa County.* Bear Valley.

*San Bernardino County.* At and near Calico.

*San Diego County.* Dos Palmas Station, Southern Pacific Railroad.

*Santa Barbara County.* Point Sal.

*Santa Clara County.* Near Gilroy.

*Stanislaus County.* Near Modesto.

*Ventura County.* Lockwood Creek.

SATIN SPAR—

*San Bernardino County*, and Tulare County, near White River.

70. HALITE. Common salt.

The manufacture of salt was described in a special paper in the second annual report of the State Mineralogist. Since that report was published, several new salt springs have been discovered, and in sinking wells for petroleum salt water frequently rises.

Salt is known to exist in a mineral state in the following counties of the State: Alameda, Inyo, Kern, Los Angeles, Marin, Placer, San Bernardino, San Diego, Santa Clara, and others. In Inyo, Kern, San Bernardino, and San Diego Counties, it occurs in the great deserts and in the sinks of rivers which have no outlet to the sea. In Inyo County it is abundant in Owens', Saline, and Death Valleys, associated with borax, gay-lussite, hanksite, thenardite, iron, and ulexite. In Saline Valley, rock salt was discovered in

1864, in extensive beds. Large beds of salt have recently been discovered in the Alkaline Lake or sink in the Colorado Desert, in San Diego County, which are now being successfully worked by an incorporated company under the name of the New Liverpool Salt Company.

In *Alameda County* solar salt was found by the early settlers on the shores of the bay of San Francisco.

In *Kern County* it occurs fourteen miles from Cañada de los Uvas, where the ground is impregnated with salt; also in the Tehachapi Valley.

Salt springs occur in *Inyo County*, in numerous localities.

*Los Angeles County.* Fourteen miles from Los Angeles.

*Placer County.* Near Clipper Gap, and elsewhere in the State.

71. HANKSITE. This new mineral has been fully described in the fifth annual report of this office, folio 62 to 66. It has lately been discovered that it occurs in very large quantities and in a different form at the same locality, where the hexagonal crystals were found, and that a confused mass of dogtooth crystals in the State Museum are another form of hanksite. When this became known a doubt arose whether thenardite existed at all in California, but it was found that a massive variety, called *ice* by the borax miners, gave no reaction for carbonic acid and *all* the reaction for thenardite. It will be interesting when the Winter overflow of water at the locality in San Bernardino County subsides to obtain all the varieties, and to make a careful study of them. It is my opinion that instead of being a scarce mineral, hanksite will be found in great abundance, and that it will be proved that it plays an active and important part in the metamorphosis that produces gay-lussite, thinolite, and perhaps borax. Hanksite is known to occur in California in the borax fields in Death Valley, Inyo County, and in San Bernardino County, at the original locality. There are several known localities in the State of Nevada.

72. HEMATITE. Specular iron, micaceous iron, red hematite, sesquioxide of iron.

The reader is referred to a special paper on iron ores in fourth annual report, folio 232. Hematite is found in the following counties and localities in the State:

*Alameda County.* Near Alameda.

*Alpine County.* At Monitor.

*Amador County.* Ione Valley, near the Amador Gold Gravel Mine, two and a half miles northeast of Jackson.

*Butte County* (Micaceous). Feather River, near Oroville.

*Calaveras County.* Near Campo Seco, opposite section three, township four north, range ten east; near San Andreas—near the big tree grove.

*Del Norte County.* Kelsey tunnel, fourteen miles southeast of Crescent City.

*El Dorado County.* Diamond Springs township.

*Inyo County.* Owens Valley.

*Napa County.* Near St. Helena.

*Nevada County.* Holden ledge, township fifteen north, range seven east; large quantity; 1,000 tons shipped to San Francisco.

*Placer County.* Clipper Gap Iron Mine, on section twenty-four, township thirteen north, and range eight east; Red Hill, on section fifteen, same township and range.

*Plumas County.* With magnetite, near Crescent Mills; Mumford's Hill, and Light's Cañon.

*San Luis Obispo County.* Harrington Iron Mine, township thirty-one south, ranges eleven and twelve east.
*Shasta County.* Near Shasta.
*Sonoma County.* Specular iron, equal to that from Elba.

73. HESSITE. Telluride of silver. A single specimen was obtained in 1854, near Georgetown, El Dorado County. It had been washed out from the gold drift, and the parent vein has never been found (Blake).
HORNBLENDE—see Amphibole.
HORNSILVER—see Cerargyrite.
HORSEFLESH COPPER ORE—see Bornite.
HYALITE—see Opal.

74. HYDROMAGNESITE. A mineral, supposed to be hydromagnesite (no analysis), is found in the serpentines on the peninsula of San Francisco, and elsewhere in the State. It is represented by specimen No. 1320, in the State Museum.
ICELAND SPAR—see Calcite.
IDOCRASE—see Vesuvianite.
IDRIALITE—see Petroleum.
ILMENITE—see Menaccanite.
IODIDE OF MERCURY—see Coccinite.
IONITE—see Lignite.

75. IODINE. Dr. Trask found free iodine and bromine in the serpentine rocks at Point Lobos, San Francisco. ("Report on the Geology of the Coast Mountains, etc., J. B. Trask, State Geologist, 1854," fols. 26 and 92.) About seventeen years ago I made an analysis of mineral water containing a large quantity of iodine. The sample was furnished by Mr. Fargo, of San Francisco, who has since informed me that the spring from which it was taken was at the entrance of Grizzly Cañon, Lake County, five or six miles from Wilbur Springs. In a letter by Dr. John A. Veatch, quoted in the third annual report of the State Mineralogist, 1883, fol. 17, he writes: "Nothing of much importance presented itself until reaching the saline district, about eighty miles south of Red Bluff. It is on one of the branches of Stony Creek. Valuable salt springs exist here. The waters contain the borates in minute quantities, and one spring was remarkable for the enormous proportion of iodine salts held in solution."

76. IRIDIUM. Iridium has been found with gold and platinum in all the stream washings or placer mines of California; also in the auriferous beach sands. As not much effort has ever been made by the miners to save it, the quantity collected in this State has not been large. During the earlier stages of gold washing, when operations were prosecuted on a more extended scale, the miners finding this troublesome stuff in their sluices, where its great weight had retained it with the gold, were at much pains to separate it from the latter, after which, being ignorant of its value, the most of it was thrown away. Afterwards, when the miners found out what it was, they began to save this metal, and small lots, finding their way to San Francisco, were sold at such prices as happened to be offered for it, there being no regular purchasers in this market.
In melting gold in the United States Mint in San Francisco, and in the bullion refineries of the State, much iridium was collected which rose to the surface of the melted gold, and was skimmed off with the flux or dross. At the San Francisco Assaying and Refining Works, under the

management of Kellogg & Hewston, large quantities were so collected. The principal localities in the State where it has been found will be given under the head of platinum.

IRIDOSMINE—see Iridium and Platinum.

IRON GARNET—see Garnet.

IRON AND IRON ORES—see Hematite, Limonite, Magnetite, and Siderite. This subject has been somewhat fully treated in the fourth annual report of this office, folio 232.

ISINGLASS—see Mica, Brolite, and Muscovite.

77. JAMESONITE. Sulphide of antimony, lead, iron, copper, and zinc. This mineral is represented in the State Mnseum by a single specimen, No. 2262, from Mokelumne Hill, Calaveras County.

JASPER—see Quartz.

78. JEFFERISITE. A mineral resembling mica, which is a hydrous silicate of numerous bases, principally alumina, iron, and magnesia. Specimens in the State Museum are (2126), from Susanville, Lassen County, and (4911), from Tulare County.

79. KAOLINITE. Including all varieties of clay resulting from the decomposition of feldspar. The numerous deposits of clay in the State and the condition of the pottery manufactures have been described at some length in the fourth annual report of the State Mineralogist, folio 139, to which the reader is referred for details. Clays are very abundant in the State, while some are admirably adapted for the manufacture of the finer quality of porcelain, others are useful only for the making of bricks. The following are the most important localities in the State, of the better quality; the inferior kinds are too numerous to mention:

*Alameda County.*

*Amador County.* Ione Valley, near Jackson.

*Calaveras County.*

*Contra Costa County.* Mount Diablo.

*El Dorado County.* Dutch Creek, twenty miles northeast of Placerville.

*Humboldt County.*

*Inyo County.* One deposit said to have an area of forty acres, ten feet thick; another opposite Independence.

*Los Angeles County.*

*Marin County.* Duncan's Mills.

*Mendocino County.* Near Point Arena.

*Monterey County.*

*Napa County.*

*Nevada County.* Seven miles southeast of Grass Valley, on section three, township fifteen north, range nine east, a large and very important deposit. Another is found on Rush Creek, three miles from Nevada City.

*Placer County.* Spinks' coal mine at Lincoln, one of the most important localities in the State; found also near Clipper Gap.

*Sacramento County.* Michigan Bar and Cook's Bar are important deposits.

*San Bernardino County.* In 1883 a deposit of very pure white kaolin of great value if in sufficient quantity was discovered at Calico.

*San Diego County.* Several large deposits have been found within six miles of Elsinore. Potteries have been established which are working the clay successfully.

*Santa Clara County.* Near San José.

*Shasta County.*

*Sonoma County.* Two miles from Santa Rosa.
*Tehama County.*

80. LABRADORITE. Feldspar.
This mineral has been observed in small quantities in street pavement blocks in San Francisco; the exact locality is not known.

81. LEAD AND LEAD ORES. See also galena, anglesite, and cerusite.
In the fourth annual report of this office, folio 244, the reader will find published a special paper on this subject. Metallic lead was said to have been found in a placer mine at Magalia, Butte County, in 1867. This was probably flattened bullets, which are very frequently if not invariably found in the clean up of hydraulic mines.

82. LENZINITE. Hydrous silicate of alumina.
MOUNTAIN BUTTER. Found in cavities in rocks at the mouth of Pine Creek Cañon, Alabama Range, Owens Valley, Inyo County. (Aaron.) This mineral is probably lenzinite.

83. LEPIDOLITE. Lithium mica.
This beautiful mineral has recently been found in California, at several localities, with erythrite and rubellite. It is a pink colored, scaly mineral, containing from two to six per cent of lithium. The California mineral has not yet been analyzed. It might, at some future time, be found profitable to extract lithium from it. The salts of lithium are principally used in fireworks and in medicine. The California localities are represented in the State Museum by Nos. 1229, San Diego County; 2773, twenty miles southwest of Colton, San Bernardino County; and 4262, with azurite, from the Half Dollar Mine, Inyo County.

84. LEUCOPYRITE. Arsenical iron.
Said to occur in Los Angeles County; exact locality not given.

85. LIGNITE. Brown coal, mineral coal, ionite, peat, etc.
One of the most pressing wants of California at the present time is extensive and accessible beds of good coal. It will be difficult, if not impossible, to compete otherwise with eastern manufacturers, who can purchase an unlimited supply of greatly superior fuel for less than one third the price paid by the same class of manufacturers on the Pacific Coast. The question of fuel becomes a very serious one when extensive manufactures on the Pacific Coast are contemplated.
While our mineral fuels of this class are neither cheap, abundant, nor of good quality, they serve a useful purpose, and are somewhat largely utilized. Even the brea, or crude asphaltum, is burned under steam boilers in some parts of the State.
As carboniferous rocks are known to exist in several parts of the State, there is reason to hope that true coal may be eventually found. The reader is referred to a special paper on the mineral coals of the Pacific Coast, on folio 265, fourth annual report of this office. The following California localities are known:
*Alameda County.* Corral Hollow.
*Amador County.* Ione Valley, in a vein of inferior quality, five to fifteen feet in thickness; several thousand tons have been burned in locomotives.
*Butte County.*
*Calaveras County.* Near Lancha Plana.

*Contra Costa County.* Mount Diablo, extending ten to twelve miles along the northern slope of the mountain; the most prolific locality in the State.

*Fresno County.* Six miles westwardly from the New Idria Quicksilver Mine.

*Humboldt County.* Near Eureka, on Eel River, thirty miles from Eureka, one hundred and fifty feet above the bed of the river; said to be a well defined and extensive bed of coal.

*Kern County.* Tejon Pass.

*Lassen County.* Near Bieber.

*Los Angeles County.* Four miles from Fulton—Santa Clara Coal Mine.

*Mendocino County.* Middle fork of Eel River, eight miles south of Round Valley—Willits.

*Mono County.* A vein six inches thick, twenty-five miles from Bodie.

*Monterey County.* South of Carmello Bay.

*Placer County.* At Lincoln, a very poor quality; it has been used, to a limited extent, for making steam.

*San Benito County.* Cienega del Gabilan Rancho, in the mountains east of Soledad.

*San Bernardino County.* Temescal Mountains, twenty-five miles west of Colton, Cajon Pass, said to be a fifteen-foot vein; if an analysis published in the San Diego *News* is correct, the coal is of superior quality.

*San Diego.* Croppings of coal or lignite were known in this county many years ago. R. C. Taylor, in his statistics of coal, published in 1855, but written before 1851, mentions the occurrence of coal on the seacoast, twelve miles north of San Diego, and the fact that the tooth of a saurian and amber were found with it. According to the statements of Dr. Le Conte, the vein is four feet thick. The writer also asserts that brown coal is found between San Diego and San Luis Rey (folio 497). According to the *Mining and Scientific Press*, coal occurs near the harbor of San Diego, on Point Loma (vol. 16, folio 81). A vein of lignite has been found four miles from Elsinore. It has been named the Cheney Coal Mine. It is developed to the extent of fifty feet, and is used as a cheap fuel. I have made an analysis which has not before been published.

ANALYSIS.

| | | | |
|---|---|---|---|
| Fixed carbon | 39.94 | Inflammable | 85.00 |
| Volatile combustible matter | 45.06 | | |
| Water | 5.80 | Non-inflammable | 15.00 |
| Ash | 9.20 | | |
| | 100.00 | | 100.00 |

Streak, brown; does not cake or coke.

*San Francisco County.* Ore specimen found on Telegraph Hill had the following composition:

| | |
|---|---|
| Combustible matter and water | 75.7 |
| Ash | 24.3 |
| | 100.00 |

Another from the cemetery grounds, Presidio:

| | |
|---|---|
| Fixed carbon | 47.55 |
| Volatile combustible matter | 7.30 |
| Water | 4.40 |
| Ash | 40.75 |
| | 100.00 |
| Inflammable | 54.85 |
| Non-inflammable | 45.15 |

Small croppings of lignite are known to occur on the ocean beach.

*San Luis Obispo County.* Near the town, lat. 35° north; discovered 1847 (Statistics of Coal, R. C. Taylor, folio 497).

*Santa Clara Countg.* Near Lexington.

*Santa Cruz County.*

*Shasta County.*

*Siskiyou County.* Eight miles north of Yreka, on the road to Linkville.

*Solano County.* Southwestern part.

*Sonoma County.* Santa Rosa Valley.

IONITE—Described in fourth annual report, occurs in at least four localities, in Ione Valley, the original locality, and in San Benito County at the Coal Mine Mountains, east of Soledad. Among the asphaltum beds at Sargent's ranch, Santa Clara County, and in Los Angeles County near Petrolia, it seems to be some obscure pseudomorth after petroleum and to have a common origin.

LIME—see Calcite.

LIME GARNET—see Grossularite.

LIMESTONE—see Calcite, and special paper on Rocks and Building Stones.

86. LIMONITE. Limonite is rather an abundant mineral in California, being found in numerous localities with other iron ores in the State. The following are the principal and most important ones:

*Alameda County.* Five miles from the town of Alameda.

*Calaveras County.* Between Jenny Lind and Campo Seco, San Andreas, near the Big Trees, Sheep Ranch District, near Murphy's.

*El Dorado County.* Near Latrobe. For description, see Catalogue No. 4148.

*Placer County.* Forest Hill. In nodules resembling coprolites.

*San Luis Obispo County.* Harrington Iron Mine, on subdivision of Rancho Cañada de los Osos.

*Santa Clara County.* With psilomelane.

*Shasta County.* Iron Mountain Mine, seven miles from Shasta.

*Sierra County.* At or near Gold Lake.

*Solano County.* Shores of the bay, in nodules.

*Tulare County.* Twenty-five miles from Visalia.

YELLOW OCHRE—

*Calaveras County.* Near Campo Seco.

*El Dorado County.* Twelve miles northeast of Shingle Springs, section thirty-two, township twelve north, range eleven east, four miles east of Georgetown.

*San Diego County.* Two miles from Elsinore.

*Santa Clara County.* Near the Mission of San José.

87. LINARITE. Cupreous sulphate of lead, cupreous anglesite.

This mineral, at first mistaken for azurite, is found in considerable abundance in the silver lead mines of Cerro Gordo, Inyo County, and at the Modoc Mine, in the same county. Some of the specimens obtained are very beautiful.

88. LITHARGE. This substance has been found in San Bernardino County. It is probably a furnace product, made in prehistoric times. It has been found also in Arizona, in localities remote from the Missions, and under circumstances leading to the opinion that the furnaces, now obliterated, were erected and worked by the people who dug the irrigating canals,

and built the Casa Grande, in the valley of the Gila River, and lived in the ancient cliff dwellings.

LITHOGRAPHIC STONE—see Calcite.

89. LITHOMARGE. A fine grained hydrous silicate of alumina, probably sedimentary. It contains generally magnesia and lime. Specimen No. 423, in the State Museum, is from the Alpha Mine, Table Mountain, Tuolumne County; called "pipe clay;" No. 2515 is from near the Big Trees, Calaveras County; and No. 4498 from Lassen County.

LOADSTONE. Natural magnet—see Magnetite.

MACLE—see Andalusite.

MAGNESIAN LIMESTONE—see Dolomite.

90. MAGNESITE. Carbonate of magnesia. Magnesite is a valuable mineral, found in numerous localities in our State. None has, as yet, been put to practical use. The market has been generally supplied from Greece. It is exported to England to the extent of from one thousand to two thousand tons annually. It is sold for thirty-two drachms (about $5 44) per ton. It is used in England for the manufacture of sulphate of magnesia. A small quantity goes to Austria, and is used in the manufacture of hydraulic lime, and a smaller quantity to France, where it is used in the manufacture of firebrick and tiles. The California mineral will be turned to account at some future time, when it will be interesting and important to know where it may be found. The known localities in the State are as follows:

*Alameda County.* Mount Diable Range, thirty miles south of the mountain.

*Mariposa County.* A heavy bed of magnesian rock, chiefly magnesite, charged with crystals of iron pyrites, accompanies the chief gold-bearing quartz vein of this county. The rock is charged also with nickel and chrome talc in green films, like the magnesite of Canada.

*Monterey County.* On Arroyo Seco, in a vein two feet wide. The mineral contains also silica.

*Napa County.* Township nine north, range five west, M. D. M.

*Placer County.* At Gold Run and Damascus, said to exist in large quantities.

*San Luis Obispo County.* At Port Harford.

*Santa Clara County.* On Coyote Creek, about two miles from Madrone Station, Southern Pacific Railroad, a large deposit of excellent quality.

*Tulare County.* Near Visalia, below Four Creeks and Moore's Creek, in solid beds of pure white massive mineral. Hard, fine-grained like unglazed porcelain. The beds are from one to six feet thick, interstratified with serpentine and talcose slates. South side of Tule River, ten miles from Portersville.

*Tuolumne County.* Associated with gold-bearing quartz veins and serpentine.

An artificial carbonate of magnesia is obtained as a by-product in the tanks in working the mother liquors, from the manufacture of salt by the Union Pacific Salt Company, Alameda County, and largely used in the manufacture of explosives.

MAGNETIC PYRITES—see Pyrrhotite.

MAGNETIC SANDS—see Magnetite.

91. MAGNETITE. Magnetic iron ore.

Magnetite is a valuable ore of iron, and exists with other ores in numerous localities in California. The following are known localities:

*Amador County.* Two miles northeast of Jackson, magnetic sand, with pyrite; Sutter Creek.

*Butte County.* With native copper, in the Lincoln Tunnel; Ball Creek, near Oroville.

*El Dorado County.* Volcanoville (Blake); crystals in slate, near Boston Copper Mine, and with quartz and pyrite, Excelsior Copper Mine (Blake); two miles northwest of Shingle Springs; near Big Red Ravine, two miles from Coloma; Clarksville.

*Fresno County.*

*Inyo County.* Magnetite is found in a number of localities in the Inyo Mountains. Fine specimens of loadstone have lately been sent to the State Mining Bureau from the Slate Range, where it exists in quantity.

*Los Angeles County.* In the Cañada de las Uvas there is a vein, three feet thick, in limestone (Blake); also, thirty miles north of Los Angeles.

*Mariposa County.* East of the Mariposa estate (Blake); near Coulterville; base of Mount Hoffman.

*Mendocino County.* Six miles from Calpella.

*Mono County.* In a vein, five miles south of Benton, with steatite and gold (Aaron); Indian District. Analysis by Falkenau & Reese: Peroxide of iron, 93.00; silica, 7.00; total, 100.00; graphite and sulphide of copper, traces. Near Benton. Analysis by Falkenau & Reese: Peroxide of iron, 93.00; silica, 7.00; traces of sulphide of copper. This ore is said to be in very large quantities. Loadstone. Spur of White Mountains, half a mile south of Montgomery (Aaron).

*Napa County.* Near St. Helena.

*Nevada County.* Magnetic sands with gold and pyrite, concentration from hydraulic mines, Grass Valley.

*Placer County.* Utt's Ranch (Blake); near New England Mills; six miles from Auburn, large deposit; section fifteen, township thirteen north, range eight east.

*Plumas County* (after pyrite). Armentine Mine, with epidote and garnet (Blake); Mumford's Hill (Edman); near Gold Lake, line of Plumas and Sierra Counties; with hematite, near Crescent Mills.

*San Benito County.* Tres Pinos; Coast Range Mountains; fourteen miles from Hollister, in large quantities with limestone.

*San Diego County.* Eight or nine miles north of Mesquit Station.

*Santa Barbara County* (Trask).

*Santa Cruz County.* Near the town is an extensive bed; the needle deflected 31° on approaching it (Trask).

*Shasta County.* At Iron Mountain, five miles from the Sacramento River. Altitude above river, thirteen hundred feet. An abundance of wood at $2 50 per cord and plenty of water at the mine. Analysis by Kellogg, Hewston & Co.: Protoxide of iron, 11.58; sesquioxide of iron, 80.15; alumina, 1.69; silica, 4.95; water, 1.63. McCloud River; Potter's Iron Mine, seven miles from Shasta; in octahedral crystals, exact locality not known.

*Sierra County.* In large beds (Blake); Mohawk Valley, Sierra Iron Company.

*Sonoma County.* Mouth of Russian River; magnetic sands.

*Trinity County.* Near Weaverville (Trask).

*Yuba County.*

92. MALACHITE. Green carbonate of copper, mountain green. This mineral occurs with other ores of copper at numerous localities in the State.

*Calaveras County.* In remarkably fine specimens, with crystals of azurite, at Hughes' Mine (Blake); at Copperopolis.

*Del Norte County.* Low Divide.

*Inyo County.* At numerous localities in the Inyo and Coso Mountains.

*Kern County.* San Emidio Ranch, with melaconite.

*Mono County.* With azurite, cuprite, and partzite; Kerrick Mine, Blind Springs.

*Plumas County.* With azurite, gold, and quartz.

*San Diego County.* With azurite, cuprite, and chrysocolla; Lost Mine, thirty miles west of Colorado River.

*San Luis Obispo County.* Santa Rosa Creek.

*Shasta County.* Peck Mine, Copper Hill.

*Tuolumne County.* Whitman's Pass.

MALTHA—see Petroleum.

MANGANESE OXIDE—see Pyrolusite.

93. MARIPOSITE. This is a mineral of an apple green color, found with quartz, on the Mariposa estate, Mariposa County, and elsewhere on the great mother lode of the State. It has not yet been fully determined. It is referred by Dana to fuchsite. It was first described by Professor Silliman, December 2, 1867: see proceedings of the California Academy of Sciences, vol. 3, folio 380. It is represented in the State Museum by a single specimen, No. 1295, from the Josephine Mine, Mariposa County.

Quartz containing mariposite has been shipped to China from Mariposa County in considerable quantity, which mineral was the valued one is not known; as mariposite has a pleasing green color it has been thought that the Chinese either mistook it for jade or used it as a substitute.

MARBLE—see Calcite and special paper on Building Stones.

94. MARCASITE. Sulphide of iron, white pyrites. This mineral has the same composition as pyrites, but is of a white color. It is put to the same uses, such as making sulphur, sulphuric acid, etc. It is quite common as an associate of gold in California with pyrite. (yellow colored), chalcopyrite, galena, sphalerite, mispickel, etc.

95. MELACONITE. Black oxide of copper. This is a rare mineral in California. It is said to occur with malachite at the San Emidio Ranch, Kern County, and in the Afterthought Mine, Shasta County. Melaconite occurs in the Satellite Copper Mine, formerly the Lancha Plana, near Campo Seco, Calaveras County, in masses of considerable size, with bornite, and containing granules of metallic copper the size of bird-shot. In the R. F., with chloride of ammonia it imparts an intense blue color to the flame. It is partly soluble in hydrochoric acid. The mineral occurs in nodules, black and earthy inside, but covered with a white incrustation.

96. MENACCANITE. Ilmenite, titaniferous iron. A single but fine crystal was found in the gold washings near Georgetown, El Dorado County. It was about an inch in diameter, with brilliant planes (Blake). Fine specimens are brought from Bill Taylor's Ranch, near Buchanan, Fresno County, twenty miles southeast of Mariposa.

97. MERCURY. Native mercury is found in many of the quicksilver mines in the State, but never in large quantities. It always occurs near

the surface of the earth, above active mines in which cinnabar has formed and is still forming. Sometimes a soft rock overlying the mines, the nature of which has not been properly studied, on being broken open is found to be permeated by native mercury in minute globules. Under the head of cinnabar the production of quicksilver in the State is given.

98. METACINNABARITE. This rare mineral is a black sulphide of mercury, described by G. E. Moore in 1870. It resembles cinnabar in composition, being like that species (Hg S), but differs from it in color, streak, specific gravity, and luster. It corresponds to the black sulphide of mercury, produced artificially by mixing the elements; while cinnabar conforms to the artificial sulphide obtained by sublimation. It occurs with cinnabar and native mercury in several quicksilver mines in California, and has lately been found in Oregon. It has never been obtained in large quantities like cinnabar, and is still considered a rare mineral. When first found it was generally thought to be amorphous, but it has since been found beautifully crystallized in the Redington Mine, Napa County, the locality where it was first discovered. Fine specimens have been obtained in the Great Western Mine, Lake County; in the California Mine, Yolo County, amorphous and in crystals.

99. METEORIC IRON. In 1866 Dr. Trask found a small fragment of iron in Honcut Creek, Butte County. It had the appearance of cast-iron, and was pronounced by Professor Brush not to be meteoric. Still it was considered remarkable at the time, that a fragment of cast-iron should have been found under the circumstances, and it is a little singular that a similar fragment has been recently sent to the State Mining Bureau, which was found on the bedrock, near Columbia, Tuolumne County. At a meeting of the California Academy of Sciences, February 19, 1866, Professor J. D. Whitney stated that Dr. J. G. Coffin had found fragments of iron in the bed of the Mohave River. At that time no meteorite had been found in California that was known to be such.

There was a rumor, a number of years ago, that there was a large mass of meteoric iron on the line of travel up the coast, a few miles north of Crescent City, Del Norte County, but it could never be traced to any reliable source. The El Dorado meteorite was found at Shingle Springs, by a blacksmith whose name is not given. It was noticed by J. H. Crossman in 1871, and placed in the cabinet of W. V. H. Cronise, where it was seen and described by Professor B. Silliman, in the *American Journal of Science and Arts* for July 18, 1873, with a figure from a photograph by Watkins of San Francisco. A short notice of it by Professor C. U. Shepard of Amherst College, appeared in the same journal of June, 1872. The weight of this meteorite was about eighty-five pounds avoirdupois. Its largest dimensions were twenty-four and twenty-nine centimeters; density, 7.875. No Widmannstattian figures were developed by etching.

The following analysis of it by J. A. Cairns, of the School of Mines, Columbia College, New York, is published:

| | |
|---|---|
| Iron | 81.480 |
| Nickel | 17.173 |
| Cobalt | .604 |
| | 99.257 |

With the following elements in small proportions: aluminum, calcium, carbon, chromium, magnesium, phosphorus, potassium, sulphur.

Professor Shepard arrived at quite different results, viz.:

| | |
|---|---|
| Iron | 88.02 |
| Nickel | 8.88 |
| Insoluble | 3.50 |
| | 100.40 |

This meteorite still remains in San Francisco.

The *San Bernardino Meteorite*, No. 2339, State Museum, was found in 1880 in the Ivanpah Mining District, San Bernardino County, by Stephen Goddard. The weight, before cutting, was 1,870 troy ounces. Dimensions: length, 13.5 inches; width, 9.7 inches; thickness, 8 inches. Specific gravity of the mass, 7.693. It is an irregular body or mass of malleable iron. The surface is covered with concave cup-like depressions, some of which have considerable depth. The fine Widmannstattian figures on the cut face were developed by the action of nitric acid, and the smooth rim or border was protected from the action of the acid by wax, and should not be mistaken for a crust or outer shell. On one end of the aerolite may be seen distinct crystals corresponding to those developed by acid. Photographs, on a scale of one third the actual size, were taken of this specimen, both before and after cutting. Lithographs from these photographs were published in the fourth annual report. The following analysis was made in the University of California by Mr. Gustav Gehring:

UNIVERSITY OF CALIFORNIA, BERKELEY, May 17, 1884.

Analysis of the San Bernardino Meteorite, by Gustav Gehring, Assistant in Chemistry in the University of California:

| | |
|---|---|
| Iron | 94.856 |
| Nickel | 4.469 |
| Cobalt | .261 |
| Silica | .041 |
| Sulphur | .004 |
| Phosphorus | .002 |
| Carbon in combination | .115 |
| Graphite | .067 |
| | 99.815 |

Hardness, 3.75; specific gravity, 8.076.

100. MICA. Isinglass, muscovy glass, etc. See also biotite. Muscovite is abundant in the granite rocks of the State.

The following include the principal localities at which this mineral has been found in California: At Gold Lake, Plumas County; in El Dorado County; Ivanpah District, San Bernardino County; near Susanville, Lassen County; and at Tehachapi Pass, Kern County; it having been observed at many other places in the State. As little or no work has been done on any of these deposits, not much can be said in regard to their probable value, one way or the other. We have reports of mica being found in nearly all the Pacific States and Territories; also in those contiguous to the Rocky Mountains; its occurrence in some of these being abundant, and extending to many different localities.

MICACEOUS IRON—see Hematite.

101. MILLERITE. Sulphide of nickel. This mineral is brass-yellow, resembling chalcopyrite. It is not a common or abundant mineral, and in California has been observed only at one locality, half a mile from Cisco, Placer County.

MINERAL COAL—see Lignite.

MINERAL WATERS—see special paper on this subject elsewhere.
MISPICKEL—see Arsenopyrite.

102. MOLYBDENITE. Sulphide of molybdenum.
This is a soft, black, lustrous, foliated mineral, resembling graphite, for which it is frequently mistaken. It has no special value. It is rather common in California, in the granites of the Sierra Nevada, and associated with gold in the quartz veins, and frequently with copper and silver ores.
The following are the most important localities in the State. Most of them are represented in the State Museum:
*El Dorado County.* Cosumnes Copper Mine, with ores of copper.
*Fresno County.* Speckerman's Mine, Fresno Flat.
*Inyo County.* Beveridge Mine; foliated; mistaken for graphite; near Independence.
*Nevada County.* Excelsior Mine (Dana).
*San Diego County.* At Campo.
*Tulare County.* South Fork of King's River, forty-five miles northeast of Visalia.

103. MOLYBDITE. Molybdic acid, molybdic ochre, molybdine.
According to Dana, this mineral is found in the Excelsior Mine, Nevada County, with molybdenite and gold.
MOUNTAIN BLUE—see Azurite.
MOUNTAIN BUTTER—see Lenzinite.
MOUNTAIN CORK—see Amphibole.
MOUNTAIN LEATHER—see Amphibole.
MUNDIC—see Pyrite.
MUSCOVITE—see Mica.
NATRON—see Trona.

104. NICKEL ORES. See also Millerite and Zaratite.
Dr. Trask, in his first "Report on the Geology of the Coast Mountains, and part of the Sierra Nevada, 1854," refers to nickel ores, "in the Coast Mountains from Contra Costa to the utmost limit reached in that range, associated with chromic iron in primitive rocks. The mineral is more abundant in the serpentine rocks south of Tularcitos, and near San Antonio, Monterey County." This mineral, zaratite, or "emerald nickel," will be described under the proper head.
NITRATE OF SODA—see Soda Niter.
OBSIDIAN—see Orthoclase.
OCHRE—see Limonite.
ONYX MARBLE—see Aragonite.

105. OPAL. Hyalite, wood opal.
Only the inferior varieties of opal are known in California, and these only at a few localities, as follows:
*Alameda County.* With semi-opal in Mount Diablo Range, thirty miles south of the mountain (Blake).
*Amador County.* At Volcano (Hyalite).
*Calaveras County.* A white milky variety of opal is found in Calaveras County, at Mokelumne Hill, or on the hill near that place known as Stockton Hill, on the west side of Chile Gulch. A shaft has been sunk there three hundred and forty-five feet, and the opals are found in a thin stratum of red gravel. They vary in size from a kernel of corn to the size of walnuts. Many of them contain dendritic infiltrations of manganese

oxide, looking like moss. About a bushel of these stones are raised in one day, and are said to have a market value. A white, milky variety similar to the above, and without "fire," is found with magnesite in the Mount Diablo Range, thirty miles south of the mountain. Also in the foothills of the Sierra Nevada, at the Four Creeks (Blake).

This locality is represented in the State Museum by No. 4395. They are also found near Murphy's, Calaveras County (Dana).

*El Dorado County.* Nine miles northeast of Georgetown.

*Lake County.* Kelseyville—hyalites found plentifully in cavities in basaltic lava, township ten north, and ranges five and six east.

*San Bernardino County.* (Hyalite). Hyalite resembles glass, and is generally found in irregular fragments. Opalized wood is wood petrified and changed to opal. It is not uncommon in the hydraulic gold mines, in magnificent specimens.

OSMIUM—see Iridium, with which it is invariably alloyed or associated.

OPALIZED WOOD—see Opal.

106. ORTHOCLASE. Feldspar, common feldspar, potash feldspar, obsidian.

Orthoclase, and obsidian, a variety of the same mineral, are found in numerous localities in California.

*Fresno County.* (*Orthoclase*), near Millerton, in coarse granite.

*Inyo County.* (*Obsidian*), with basaltic lava.

*Kern County.* (*Orthoclase*), in veins several feet thick, Tehachapi Pass.

*Lake County.* (*Obsidian*). When first discovered, years ago, at Clear Lake, in Lake County, a company was formed to make bottles and other glassware from it, but the enterprise was of course a failure.

Near Lower Lake, in fine specimens—black, gray, red, and variegated.

*Lassen County.* (*Obsidian*), found in great abundance on the east side of Eagle Lake, a mile, more or less, from Clark's Ranch. It is found scattered over the surface and in the soil with a porous, redish colored lava.

*Mariposa County.* (*Orthoclase*), in veins in granite, with molybdenite, in Yosemite Valley.

*Modoc County.* (*Obsidian*), south end of Goose Lake.

*Mono County.* (*Obsidian*), McBride's Ranch, near Mono Lake, in and at the base of volcanic cones.

*Napa County.* (*Obsidian*), three miles west of Napa.

*Plumas County.* (*Orthoclase*), at Meadow Valley.

*San Diego County.* (*Orthoclase*), Hunsacker Grade, stage road from San Diego to Julian, in considerable quantities and suitable quality for the manufacture of fine pottery. It is associated with pegmatite, also useful for the same purpose; near the Owens Mine, Julian, in coarse granite. Some varieties of obsidian cut beautifully, and might be used for ornamental purposes, for paper weights, vases, bases of clocks, and similar purposes.

OSMIUM—see Iridium, with which it is invariably alloyed or associated.

PANDERMITE—see Priceite.

PARTZITE—see Stibiconite.

PEARL SPAR—see Dolomite.

107. PECTOLITE. A single specimen was found in a bowlder or fragment at the foot of the White Mountains, near Montgomery, Mono County. Doubtful (Aaron).

108. PETROLEUM.

Under this heading also *asphaltum*, *maltha*, *brea*, *idrialite*, *bitumen*, *aragotite*.

For special paper on this subject see fourth annual report, folio 278.

Petroleum has been found in the following counties in this State, viz.: Alameda, Colusa, Contra Costa, Humboldt, Kern, Lake, Los Angeles, Mendocino, Napa, San Bernardino, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Sonoma, Tulare, and Ventura.

The most important localities are given below; for details of the occurrence see fourth annual report.

PETROLEUM—

*Alameda County.* Near Midway.

*Los Angeles County.* In Pico Cañon, near Newhall, where there are numerous wells which yield very large quantities; at Puenta; at Petrolia, near the latter, on section five, township three south, range nine west, since my visit in May, 1884, flowing wells have been struck. In October, 1885, in sinking a well in Cahuenga Valley, a flow of petroleum was struck, which according to the Los Angeles *Evening Express*, it was impossible to check.

*San Mateo County.* At Tunitas Creek, several wells which have produced excellent light oil.

*Santa Barbara County.* Oil springs under the ocean; oil seen floating on the surface of the sea; these oil springs have been described elsewhere in this report.

*Santa Clara County.* At Moody Gulch—extensive works—considerable high grade oil produced.

*Ventura County.* At Santa Paula, where large receiving tanks have been provided.

ASPHALTUM AND MALTHA—

*Kern County.* Near Buena Vista Lake and elsewhere, in large quantities.

*Los Angeles County.* La Bréa Ranch, near Los Angeles.

*San Luis Obispo County.* Coral de Piedra.

*Santa Barbara County.* Goleta Landing, seven miles west of the town of Santa Barbara, on Laguna Santos and Los Alamos Ranchos, near Carpenteria.

*Santa Clara County.* Sargent's Ranch, in large quantities.

*Ventura County.* Oil wells near Sulphur Mountain, Santa Ynez, and Kayamos Valleys, near Mission of San Buenaventura.

ARAGOTITE—

This mineral, a hydro-carbon, was found by F. E. Durand, in the New Almaden Quicksilver Mine, and, so far as known, is peculiar to the quicksilver mines of this State.

109. PETZITE. This mineral is a telluride of silver and gold. It is of too rare occurrence in California to have any practical value aside from the gold it contains, and interesting only as being an associate of gold.

An analysis of a specimen from the Stanislaus Mine, Calaveras County, afforded Kustel:

| | |
|---|---|
| Tellurium | 35.40 |
| Silver | 40.60 |
| Gold | 24.80 |
| | 100.80 |

While this analysis shows the mineral to be rich in gold, it is so rare that only very small specimens can be obtained, and these but seldom. It

occurs with the other tellurium minerals which constitute but a very small portion of the vein matter.

The following localities are known: Stanislaus and Melones Mines, in Calaveras County; Morgan Mine, Tuolumne County.

110. PHOSGENITE. Chloro-Carbonate of Lead.

A single specimen has been found in quartz from the Silver Sprout Mine, western slope of the Sierra Nevada, Inyo County. Straw-colored, acicular interlaced crystals in cavities (Aaron). Determination by C. Ide.

PHOSPHATE OF LIME—see Apatite.

111. PICOTITE. Chrome spinel.

Has been found by Dr. M. E. Wadsworth in the basalts of Mount Shasta; "Summary of the Progress of Mineralogy in 1882," H. C. Lewis.

PICROLITE—See Serpentine.

PLATINIRIDIUM—See Platinum and Iridium.

112. PLATINUM—See, also, Iridium.

Platinum is rather abundant in California with other metals of the group. The miners call it "white gold," and generally believe it to be more valuable than that metal, generally declining to save it when informed that it can only be sold for two or three dollars per ounce.

The following are the most important localities:

*Butte County.* Platinum minerals are rather abundant in this county. Considerable quantities are recovered in the clean-ups at the Spring Valley hydraulic mine. At St. Clare Flat near Pence, large quantities were found in the early days of placer mining.

*Mendocino County.* With iridium, cinnabar, zircons, and gold, Anderson Valley, on the Navarro River.

*Plumas County.* Mr. A. Hewett found several large pieces of platinum in 1851 on Nelson Creek. The largest was the size of a large bean. It is found also at Gopher and Badger Hills.

*Trinity County.* Found with iridium and associated metals and minerals, and in considerable quantities, at Hay Fork, a large stream. All the gold found is more or less mixed with the platinum metals; so much so that dealers deduct two dollars per ounce from the price paid elsewhere for gold dust. At North Fork of Trinity River, platinum is found in less quantities, but in larger pieces. One was once offered for sale in Marysville which weighed over two and a half ounces troy.

Although platinum occurs in the river beds, and on the banks of the streams, yet in the so called "hill claims," about half a mile only from the river, no trace of that metal has been found. In lower Trinity, near its junction with the Klamath, platinum abounds in very fine particles; and it is with this finely divided platinum that Professor Wöhler discovered diamonds.

The metal is so abundant that the miners have the utmost difficulty in separating it from the gold. The particles are so extremely fine that they can hardly be distinguished from the black sand which accompanies the gold. Heretofore no effort has been made to place the platinum in the market, except the sending to San Francisco of one hundred ounces or more, a few years ago. It could, probably, be sent to Europe to advantage. In Salmon River it is also found. In fact, it is common in the beds of the streams in Sierra, Trinity, Klamath, and Del Norte Counties.

Mr. Block of San Francisco, said that large pieces have been found on North Fork of Trinity River; one piece weighed two ounces. The miners

in washing gold in long sluices got the gold by the aid of quicksilver, and the platinum minerals remained in the riffles; with platin-iridium, in a claim three miles from Trinity Center; and with gold zircons, diamonds, and other minerals on the ocean beach, from Cape Blanco to Cape Mendocino.

Dr. S. R. Hayden, now of Chicago, was at Rich Bar, North Feather River, in 1851. He found in a placer mine he was working a piece of white metal, very heavy, about three inches long, two inches wide, and about half an inch thick, which he thinks must have been platinum.

113. POLYBASITE. A sulphide of many bases, viz.: antimony, arsenic, copper, iron, silver, and zinc.

It is a rare mineral in California, being found only in small microscopical crystals in the Morning Star and Monitor Mines, Alpine County.

114. PRICEITE. Borate of lime, pandermite, colemanite, etc.

The variety pandermite has recently been found in apparent abundance in Death Valley, Inyo County, and at Calico, San Bernardino County, and the cryptomorphic variety also at the latter locality.

COLEMANITE—

Is also a variety of priceite found recently in Death Valley in a crystalline state. As this mineral possesses certain physical properties differing from priceite, a name has been given to it to distinguish it from the soft chalky mineral found both in southern Oregon and San Bernardino County, California.

The name *colemanite* was given by the discoverer of the mineral in honor of William T. Coleman of San Francisco, who has been identified with the borax interests of the Pacific Coast from the commencement. Colemanite is now found in magnificent crystals, but good crystallized specimens are very scarce.

115. PROUSTITE. Light ruby silver ore.

Arsenical sulphide of silver, found sparingly in the Chicago Mine, Shasta County, with galena, pyrite, and quartz, between walls of granite (Aaron). No. 4951, in the State Museum, from the Oro Mine, Bodie, Mono County, shows it in crystals, with pyrargyrite in quartz.

116. PSILOMELANE. A hard black mineral, supposed to be psilomelane, is found in several localities in the State, with pyrolusite and rhodonite, but no analysis has been made to prove it. This mineral differs from pyrolusite in containing baryta and oxide of manganese, and more water. It has been found at Spanish Ranch, Plumas County, on Red Rock, Bay of San Francisco, and in quartz, Santa Ana River, Los Angeles County.

PUMICE STONE—see Orthoclase.

117. PYRARGYRITE. Dark ruby silver, antimonial sulphide of silver.

This mineral, like proustite, is rare in California. It has been found in the Exchequer Mine, Alpine County, and with proustite, in the Oro Mine, Bodie, Mono County.

118. PYRRHOTITE. Magnetic pyrites.

Found in Mariposa County, at the Iona Copper Company's tunnel, north side of the Merced River, on the trail from Bear Valley to Coulterville (Blake).

119. PYROLUSITE. Binoxide of manganese.
The known California localities are:
*Alameda County.*
*Calaveras County.* Near Angels'; Railroad Flat.
*Colusa County.* About two miles south of Font's Springs, township seventeen north, range seven west.
*Contra Costa County.* Corral Hollow—abundant.
*Marin County.* Near Saucelito and Tomales.
*Napa County.* St. Helena Mountain.
*Nevada County.* Sweetland.
*Plumas County.* Argentine, and Mumford's Hill (Edman).
*San Bernardino County.* With rhodonite, near Colton.
*San Francisco Bay.* Red Rock, San Francisco County; Bernal Heights, San Francisco; just south of St. Mary's College, Peninsula of San Francisco.
*Santa Clara County.* Hahn's ranch, twelve miles south of the Guadalupe Quicksilver Mine.
*Sonoma County.* Near Cloverdale; Santa Rosa.
*Tuolumne County.* Knight's Ranch, near Columbia, in botryoidal and mammillary masses, from the size of a grape to one hundred pounds in weight, on the surface of the ground; with rhodonite, two miles south of Summerville.

120. PYRITES. Pyrite, sulphuret of iron, the "sulphurets" of the gold miner, mundic, martial pyrites. See, also, Marcasite.
Of the numerous localities of pyrite in the State, the following are worthy of special mention, or are represented in the State Museum:
*Alpine County.* Morning Star Mine, with enargite.
*Amador County.* Jackson.
*Calaveras County.* E Pluribus Unum Mine, three miles from Murphy's (Blake).
*El Dorado County.* Brilliant cubes, Mameluke Mine, near Georgetown (Blake); Pilot Hill, in large cubes, with garnet-brown spar and specular iron (Blake); in crystals with gold, with quartz, both crystallized.
*Inyo County.* Modoc Mine.
*Mariposa County.* In slates, in large and perfect crystals, near Princeton Hill (Blake).
*Mono County.*
*Napa County.* With cinnabar, Redington Quicksilver Mine, very fine; in cavities in quartz, cubical crystals, Knox & Osborn Quicksilver Mine.
*Nevada County.* Grass Valley, massive, with chalcopyrite, San Francisco copper mine, Spenceville; massive, with gold, Meadow Lake District; taking the form of wood, with hematite, Occidental Mine, Scott's Flat; with calcite, Malakoff Mine, North Bloomfield; in lignite, Malakoff Mine, North Bloomfield.
*Placer County.* Globular, in calcite, near Auburn; Clipper Coal Mine, near Grizzly Bear House, Forest Hill, in large crystals (Blake); True Fissure Mine, Devil's Peak Mountain; with lignite, Spinks' Coal Mine, Lincoln.
*Plumas County.* Granite Basin, Mumford's Hill, in crystals, with dolomite (Edman).
*San Luis Obispo County.* In cavities in the Sunderland Quicksilver Mine.
*Shasta County.* With pyrolusite and gold, Banghart Mine; with erube-

scite and chalcopyrite, Copper City; in nodules, with sulphide of silver, very rich.

*Tuolumne County.* In fine crystals, Patterson Mine, Tuttletown.

121. PYROPHYLLITE. This mineral, a hydrous silicate having no economic value, but which is interesting from a scientific standpoint, is found in beautiful radiating tufts of a golden yellow color, at Greaser Gulch, or Indian Gulch, Mariposa County. It occurs in large bowlders on the surface of the ground near two prominent buttes. This locality is represented by No. 3723 in the State Museum.

122. PYROXENE. A silicate of different bases, the varieties of which are known under different names, as augite, diopside, sahlite, omphazite, hypersthene, diallage, smaragdite, etc.

This mineral enters largely into the composition of igneous rocks. In this form it is probably largely distributed in California. It is found in fine dark green crystals near Mud Springs, El Dorado County (Blake), and also in fine crystals at the Cosumnes Copper Mine, in the same county.

123. QUARTZ. The varieties are known by many names, among which are agate, amethyst, aventurine, blood stone, Brazilian pebble, buhr stone, carnelian, cat's-eye, chalcedony, chrysoprase, cairngorm, false topaz, heliotrope, jasper, mocha stone, onyx, prase, quartz and quartzite, rock crystal, siderite, silicified wood, sardonyx, etc.

Quartz is very abundant in California. It forms the principal vein matter in the gold mines, associated with blende, galena, chalcopyrite, freibergite, bornite, mispickel, pyrite azurite, and malachite, scheelite calcite, caproscheelite, dolomite, enargite, and other minerals. It would be impossible and unnecessary to enumerate all the known localities in the State. The following are the most important and interesting. The massive quartz found almost universally where the rocks are not covered with soil, is not included:

*Alameda County.* Hills back of Berkeley, *chalcedony.*

*Alpine County.* Monitor, *red jasper.* Sonora Trail, *chalcedony.* Morning Star Mine, *quartz.* Hope Valley, *rose quartz*, massive, very fine; *drusy crystals.*

*Amador County.* Near Volcano, *chalcedony, silicified wood.* Ione Valley, *diatomaceous earth.*

*Butte County.* North Fork of Feather River, *smoky.* Near Doon's Mill, *crystals*, fine, and *chalcedonic pebbles.* Three miles south of Cherokee Flat, Gold King Mine, with quartz, *sacchroidal quartz*, like that in the gold mines of Georgia and Brazil.

*Calaveras County.* Mokelumne Hill, *silicified wood.* In the gold mines, croppings, or "iron hat," *red jasper.* Murphy's, *brown jasper*, which polishes beautifully; *cat's eye.* Vallecito, *chalcedony.* Chili Gulch, Duryea's Hydraulic Mine, *silicified wood.* Near Comanche, *diatomaceous earth.* Murphy's, *chalcedony.* Near Angel's Camp, *silicified wood.* Dutch Flat, in hydraulic mines, *silicified wood*, very fine. Roseville, *silicified wood.*

*Contra Costa County.* Mount Diablo Coal Mine, with lignite, *silicified wood.*

*Del Norte County.* Crescent City beach; *chalcedony, jasper, carnelian, agate.*

*El Dorado County.* Summerfield, Mosquito Cañon, near Placerville; *cairngorm, rock crystal, smoky quartz* in crystals six inches in diameter (Blake).

*Fresno County.* Fresno Flat, *yellow granular quartz* containing gold, resembling that found in the gold mines of Georgia. The gold is remarkably fine.

*Inyo County.* Eclipse Mine, *chalcedony;* very fine. Beveridge District, *double terminated crystals, smoky quartz.* Modoc Mine, in beautiful forms. Panamint, colored with malachite. Wyoming Mine, in fine large clusters of crystals; very fine. Small Butte, in Owens Valley, *buhrstone;* good quality.

*Lake County.* Eclipse Mine, seven miles west of Lower Lake, *silicified wood.* Lost Spring Ranch, *diatomaceous earth.*

*Los Angeles County.* Between Williamson's Pass and Johnson's River, *chalcedony* in pear-shaped nodules in eruptive rocks (Blake). Santa Monica, *diatomaceous earth.* Fourteen miles south of San Pedro, *diatomaceous earth.*

*Marin County.* Saucelito, *jasper;* red and green.

*Mariposa County.* Merced River, between Horse Bend and Don Pedro Bar, *oil stone,* or novaculite, discovered in 1866, and said to be of good quality. Pine Tree Mine, *hacked quartz;* a peculiar variety of quartz which has a resinous luster and containing mariposite, has been shipped to China, said to be used in the manufacture of porcelain. There were four shipments of three to four tons each.

*Modoc County.* Jess Valley, *bloodstone.* Pit River, near Goose Lake, *buhrstone* in great abundance (Trask).

*Mono County.* Mono Lake, *silicified wood.* Bodie Mines, on silver ore in fine crystals, *chalcedony,* pink and straw colored, very fine; *hornstone.*

*Monterey County.* Monterey, on the beach; quartz sand, much employed for glass-making and other purposes; near Panoche's, large masses of *chalcedony;* white and delicately veined; in mammillary sheets; *diatomaceous earth* in numerous localities.

*Napa County.* Manhattan Mine, with cinnabar and stibnite, *chalcedony;* Mount St. Helena, *silicified wood;* near Calistoga, *silicified wood;* near St. Helena, *jasper, chalcedony.*

*Nevada County.* In the gold mines; often supporting native gold between the crystals (Blake); Hinchman's hydraulic mine, *quartz breccia;* Malakoff Mine, *quartzite;* Omega, *silicified wood;* Chalk Bluffs, *silicified wood* in many varieties in the hydraulic mines.

*Placer County.* At Lincoln, in beds several feet in thickness, *quartz sand,* very pure and white. *Silicified wood* at a number of localities. Dutch Flat, *diatomaceous earth.* Forest Hill, *silicified wood.* Gold Run, *silicified wood.* Shores of Lake Tahoe, *carnelian, agate.*

*Plumas County. Rose quartz,* fine. Claremont's Hill and Mumford's Hill, *jasper.* Long Valley and Spanish Creek, *agate.* Granite Basin, *quartz crystals,* very fine.

*San Bernardino County.* Soledad Cañon, *chalcedony.*

*San Diego County.* Seacoast, forty miles north of San Diego, *diatomaceous earth.* Big Tank, Colorado Desert, *silicified wood, chalcedony.*

*San Francisco County. Jasper,* red and green. On the seabeach, *quartz sand* with magnetite.

*San Joaquin County.* Staples' ranch and San Carlos ranch, *diatomaceous earth.*

*San Luis Obispo County. Agate, silicified wood.* Port Harford, *diatomaceous earth.*

*San Mateo County. Chalcedony, jasper;* Pescadero beach, *carnelian, agate, chalcedony;* San Gregorio, *diatomaceous earth.*

*Santa Barbara County. Diatomaceous earth.*

*Santa Cruz County.* Ranch of Harry Love, near San Lorenzo, there is said to be a mountain of *white quartz sand.*

*Shasta County.* *Hacked quartz* with gold.

*Sierra County.* Near Downieville, *silicified wood.*

*Sonoma County.* Ten miles north of Petaluma, *diatomaceous earth;* Santa Rosa, *silicified wood*; before petrefaction the wood had been pierced by worms; near Windsor, *bloodstone;* eighteen miles southeast of Santa Rosa, *diatomaceous earth.*

*Tulare County.* Portersville, *silicified wood;* Yokhe Valley, *rose quartz.*

*Tuolumne County.* Columbia, *silicified wood;* Douglasville, *chalcedony.*

QUARTZITE—see Quartz.

QUICKSILVER—see Mercury.

124. REALGAR. Sulphide of arsenic. This mineral is rare in California, being known only with arsenolite in Alpine County.

RED OXIDE OF COPPER—see Cuprite.

RED OXIDE OF IRON—see Hematite.

125. RESIN. Fossil.

In the hydraulic gold mines of California a fossil resin is frequently met with, which is probably from the coniferous trees of former growth, found in such profusion in a silicified state. It is brittle and resinous, and still retains an odor. It somewhat resembles gum dammar, but is more yellow. It has never been studied.

RETINALITE—see Serpentine.

126. RHODONITE. Silicate of manganese.

It occurs in several localities in the State, always with pyrolusite; with native copper, Mumford's Hill; Plumas County (Edman); one mile from the Southern Pacific Railroad, between Colton and San Diego; near San José, Santa Clara County; two miles south of Summersville, Tuolumne County, in considerable quantity; a large deposit of rhodonite and pyrolusite occurs two miles north of Sonora, Tuolumne County. Rhodonite has little or no economic value.

127. ROCK SOAP. This is a mineral resembling halloysite and mordenite, but believed to be a mechanical mixture of two or more minerals. It has the remarkable property of removing impurity from the skin, like soap, whence the name. There have been numerous analyses made which do not agree among themselves. A paper was published by Professor George H. Koenig, in *The Naturalists' Leisure Hours*, Philadelphia, which is very full and explicit, giving the result of considerable laboratory work. A series of analyses were made in the laboratory of the State University, which have not been published. In Professor Koenig's examination the soapy portion was separated mechanically from a sandy portion and analyzed, with the following results:

| | |
|---|---|
| Sesquioxides of alumina and iron | 14.10 |
| Silica | 73.10 |
| Water | 6.70 |
| Not determined | 6.10 |
| | 100.00 |

Nearly all the silica was found to be in the soluble or opaline state, and the alumina either as a hydrate, or a very basic hydrated silicate. At one time this material was manufactured into a variety of useful articles, as

salt water soap (it having been found that the presence of salt and lime did not impair its detergent properties), scrubbing, and toilet soap, and even tooth powder. Having had occasion to examine into the merits of these preparations, I am prepared to say that they served every purpose claimed for them. At the Paris Exposition of 1878, samples were shown which attracted considerable attention, and there were those who expressed an inclination to enter into their manufacture in France. At present "rock soap" is largely used in the manufacture of certain kinds of soap in California. No. 4024, in the State Museum, is a specimen from Ventura County, and No. 4794 is from San Benito County.

128. ROSCOELITE. Vanadium mica. This very rare mineral was described in the second annual report, folio 262, and a history given of its discovery.

California known localities:

The "Stuckslager," "Plum Tree," or "Sam Simms" Mine lies in section twenty-four, township eleven north, and range nine east, Mount Diablo base and meridian, somewhat more than a mile from the town of Coloma, in a southwest direction, where it was first found.

Another locality of roscoelite in the State, is section thirty-one, township eleven north, and range ten east, two miles from the Sam Simms Mine. Big Red Ravine is on this section, lying only two miles from the site of Sutter's Mill, where gold was first discovered. It was one of the earliest placer mines known in the State, and so rich did it prove, that it has paid to rework as many as seven times. It is in the bedrock of these old workings that roscoelite is found.

Recently a fine specimen of roscoelite has been presented to the State Museum, which is mixed with gold to the extent of seemingly half the bulk of the specimen. It was presented by Richard Sparling and is numbered (5768). It is from the Tip Top vein, section seven, township eleven north, range ten east, El Dorado County. There is about a foot of quartz disseminated through the vein, in small bunches, connected with which are seams of roscoelite, generally very thin, from the thickness of paper to half an inch. Occasionally a bunch of roscoelite appears, from which specimens like No. 5768 may be obtained, but these are extremely rare. Mr. Sparling says that at the Sam Simms Mine, the owners once took out of a pocket $11,000. A great deal of free gold has been washed from the sides of the hill, below the vein, which came, without much doubt, from decomposed roscoelite, and it is more than probable that the gold discovered at Sutter's Mill, in 1848, and that taken from Big Red Ravine, were from the same source. In the Tip Top there is a sheet of what seems to be sandstone; when this and the brown slate come in contact, gold and roscoelite are found.

RUBELLITE—see Tourmaline.

RUBY SILVER—see Pyargyrite and Proustite.

129. RUTILE. Titanic acid. Is found at Long Valley, Plumas County (Edman); and frequently in acicular or capillary crystals in quartz. No. 3747 is a specimen of this character from Humboldt County, Nevada, and there are other specimens in the museum from other localities. Titanic acid has few applications in the arts; it is used in porcelain painting, and to give color to artificial teeth.

SALT—see Halite.

130. SASSOLITE. Native boracic acid.

Boracic acid, free or combined, is a common occurrence on the Pacific Coast. It has been detected in the waters of the ocean along the shores of California and Oregon. Common salt, made by evaporating the sea-water, contains more than traces of boracic acid. According to Professor W. P. Blake, it occurs in a free state in the water of Clear Lake. The discovery of this acid in mineral water in Tehama County led to the examination of other springs then known, which resulted in the finding of boracic acid in nearly all of them. It was found later in the mud volcanoes in San Diego County by Dr. Veatch, which was verified by my own observation.

SATIN SPAR—see Gypsum.

131. SCHEELITE. See also Cuproscheelite, tungstate of lime.

Only one locality is known in the State, the footwall of a gold mine on Howard Hill, Grass Valley, Nevada County, where it is said to occur in considerable quantity.

SCHORL—see Tourmaline.

SELENITE—see Gypsum.

SEMI-OPAL—see Quartz and Opal.

132. SEPIOLITE. Meerschaum, hydrous silicate of magnesia.

A specimen in the State Museum from the Half Dollar Mine, Inyo County, resembles sepiolite, but as yet no analysis has been made to determine it.

133. SERPENTINE. Chrysotile, picrolite, retinalite. This mineral is very abundant in California. Quicksilver and chromium ores are found in it almost universally. The following localities are represented in the State Museum:

*Butte County.* Near Red Hill. The bedrocks are serpentine; fine specimens of picrolite are found.

*Lake County.* Kelseyville.

*Marin County.* Very abundant.

*Mariposa County.* Three hundred yards northeast of the Pine Tree Mine, and elsewhere in the county.

*Mendocino County.* Township ten north, range ten west, foliated serpentine and picrolite found in considerable quantity.

*Monterey County.* Coral de Tierra.

*Napa County.*

*Nevada Coanty.* Grass Valley, in the Maryland Mine, picrolite.

*Placer County.* Bald Prairie; Verde antique or ophite, serpentine with carbonate of lime, has recently been found near Yankee Jim's. It is of a sea-green shade, with blotches of a darker color. It is a beautiful ornamental stone, if it can be found in sufficient quantity. The specimen sent to San Francisco was small.

*Plumas County.* Claremont Hill, Meadow Valley, retinalite, green and translucent.

*San Francisco County.* Peninsula of San Francisco, Fort Point, with aragonite; in the streets of San Francisco, Market Street Cut, and the cemeteries.

*Santa Barbara County.* Goleta.

*Santa Clara County.* New Almaden Mine, schistose, and in many other quicksilver mines in the State; Gilroy.

*Shasta County.* McCloud River, with *chrysotile.*

*Sonoma County.*

*Tehama County.* Township twenty-five north, range seven west, with chromic iron in large quantities.

*Yuba County.*

134. SIDERITE. Spathic iron, carbonate of iron.

This mineral has recently been found by J. W. Redway in quartz ledges in Tejunga Cañon, Los Angeles County, and is represented in the State Museum by No. 3712.

SILICIFIED WOOD—See Quartz.

SILICATE OF COPPER—See Chrysocolla.

135. SILVER. While silver minerals are abundant in California, native or free silver is of rare occurrence; it is even then found only in specks or very thin sheets, covering but small surface. This is the case in Mono County in the Diana, Kerrick, and Comanche Silver Mines, where it is sometimes seen on partzite, and in the Tower Mine, near Benton. It occurs, also, in the silver ores in Inyo County, notably in the Kearsarge District, in the form of electrum (gold alloyed with silver or the reverse). It is found, also, in Bodie, in Mono County, and in Fresno County, near Millerton.

SILVER GLANCE—see Argentite.

SLATE—see Building Stones.

136. SMITHSONITE. Carbonate of zinc. Said to occur with cerusite in the Modoc Mine, Inyo County.

137. SODA NITER. This important mineral is nitrate of soda. Found only in small quantities in caves and cavities in the rocks near Calico, San Bernardino County. It is reasonable to expect from the nature of the climate that it will be found in greater quantity.

SPECULAR IRON—see Hematite.

138. SPHALERITE. Blende, zinc blende, black jack, sulphuret of zinc.

Zinc blende is very abundant in California, disseminated through the vein matter in gold and silver mines, but has not been found in distinct veins. When concentration becomes more general in treating low grade ores, zinc will be considered worthy of attention, and will be saved and utilized. It occurs at Meadow Lake, Nevada County, in considerable masses, with galena, pyrite, and chalcopyrite; and associated with yellow copper in the Lancha Plana and Napoleon Copper Mines in Calaveras County (Blake).

It is represented in the State Museum by the following specimens: White Chief Mine, Mineral King District, Tulare County; Dennis Martin's ranch, four miles west of Menlo Park, San Mateo County; with calcite, Small Hill Mine, Santa Catalina Island.

SPHENE—see Titanite.

STALACITE—see Calcite.

STALAGMITE—see Calcite.

STEATITE—see Talc.

139. STEPHANITE. Brittle silver ore, brittle sulphuret of silver. Found in the Morning Star Mine, Alpine County (Dana).

140. STIBICONITE. Partzite, antimony ochre, hydrous oxide of antimony. Partzite is found in abundance in Mono County. It seems to be

a mechanical mixture of stibiconite with other oxides, and is always rich in copper and silver.

Magnificent specimens with free silver are found in the Diana, Kerrick, and Comanche Mines, Blind Springs District, Mono County. Specimens may be seen in the State Museum from the Kerrick Mine, Benton, Mono County; from the Comanche Mine, Blind Springs, Mono County; and with native silver and galena, from the Tower Mine, near Benton, Mono County.

141. STIBNITE. Sulphide of antimony, antimony glance.

Stibnite is not a common mineral in California as far as known, but there are several important localities, some of which are likely to be productive. It is found in small quantities, with cinnabar, in most of the quicksilver mines of the State.

*Inyo County.* Panamint, in large veins.

*Kern County.* San Emidio Cañon, township ten north, range twenty-one west, sections nine and ten, S. B. M. This is probably the largest deposit of antimony ore in the State. It is likely to be worked to a considerable extent in the near future; preparations are being made with that end in view. Stibnite has also been found near Kernville in the same county.

*Lake County.* With cinnabar and chalcedony in quicksilver mines.

*Mono County.* Head of Bloody Cañon.

*San Bernardino County.* Centennial Mine, in washed bowlders.

*San Benito County.* At the Alta Antimony Mine, where it occurs in considerable quantity. This mine has been somewhat worked, but at the present time it has been suspended.

*Santa Barbara County.* (Dana.)

*Tulare County.* Mineral King District.

142. STROMEYRITE. Silver copper glance.

It occurs with other silver and copper ores in the White Mountains, Inyo County (Aaron), and is not uncommon in the Inyo Mountains, from White Mountains to Coso.

SULPHATE OF COPPER—see Chalcanthite.

SULPHATE OF IRON—see Coquimbite.

SULPHATE OF SODA—see Thenardite.

143. SULPHUR.

While indications of sulphur are very common in the State, there are but few localities where the mineral occurs in any considerable quantity. The following is the most important:

*Colusa County.* At Sulphur Creek, where it occurs with cinnabar, petroleum, gold, and other minerals.

*Inyo County.* Near Little Owens Lake, said to be in considerable quantity.

*Kern County.*

*Lake County.* Near Clear Lake and Borax Lake. At this locality, known as the sulphur bank, 1,881,697 pounds of commercial sulphur were produced before it was discovered to be the croppings of a quicksilver mine.

*Los Angeles County.* Quantity unknown.

*Napa County.*

*San Bernardino County.*

*San Diego County.* At the mud volcanoes described in the second annual report of the State Mineralogist.

*San Luis Obispo County.*

*Santa Barbara County.* In the Azufre Mountains.

*Tehama County.*
SULPHURETS AND SULPHURET OF IRON—see Pyrite.
SULPHURETS OF SILVER—see Argentite.

144. SYLVANITE. Telluride of gold. This rare mineral is said to exist in the Melones and Stanislaus Mines, with other tellurium minerals.

145. TALC. Steatite, soapstone, French chalk. This in various forms is a very abundant mineral in this State, as may be seen by the following localities, mostly represented in the State Museum:
*Amador County.* Two miles northeast of Jackson; *soapstone* in large deposits and of excellent quality.
*Calaveras County.* Near Murphy's; also at Rocky Hill and Jenny Lind Hill (Trask).
*Catalina Island.* The *soapstone* of which the California Indians made cooking dishes, came from this island. This is stated by Abel Stearns, a well known pioneer.
*Fresno County.*
*Inyo County.* Alabama Range, a greenish, translucent variety (Aaron).
*Kern County.* Soapstone Mountain.
*Los Angeles County.* Fourteen miles below San Pedro, on the coast.
*Marin County.* Taylorville, Paper Mill Creek.
*Mariposa County.* Coulterville, *soapstone* of excellent quality, and said to be in large quantities. At Lewis (soapstone). In quartz with gold, Yosemite Mine.
*Mendocino County.* Township nineteen north, range ten west, said to be in quantity.
*Nevada County.* Grass Valley, wall rock of Maryland Mine.
*Placer County.* *Foliated talc* near Auburn. *Soapstone*—Stockbridge Soapstone Quarry and Works, township fifteen north, range nine east. The deposit was formerly worked for gold, which it contains in small quantity. This mineral (soapstone) which exists in large deposits, has been used extensively in lining the furnaces in the Alabaster Lime Works, near Auburn, and found very refractory.
*Plumas County.* Rock Island Hill.
*San Diego County.* *Foliated talc* with chalcopyrite.
*Santa Clara County.* Seven miles from Mount Hamilton.
*Sonoma County.* Pine Flat, *talc resembling French chalk.*
*Tulare County.* Tule River *soapstone* of excellent quality, suitable for use as a fine resisting material.
*Tuolumne County.* *Soapstone* in beds eight feet thick(?)
*Yuba County.*
TCHERMIGNITE—see Alum.
TELLURIC GOLD—see Sylvanite.
TELLURIDE OF SILVER—see Hessite.
TELLURIUM—see Altaite, Calaverite, Hessite, Petzite, and Tetradymite.

146. TETRADYMITE. Bismuth, with tellurium.
Professor Blake discovered a tellurium mineral in the Melones Mine, Calaveras County, which he thought might be tetradymite, associated with gold. According to Willard, it occurs with massive gold in the Morgan Mine, Carson Hill, and in the Melones Mine, Calaveras County. It is said, also, to be found in the Murchie Mine, Nevada County.

147. TETRAHEDRITE. Gray copper, fahlerz, freibergite.

This mineral is a double sulphide of copper and antimony, of which there are numerous varieties. When it contains silver it is named freibergite. The following are the few known localities in the State:

*Calaveras County.* At Coulterville and at Carson Hill, associated with gold. Freibergite rich in silver has recently been found disseminated through milk-white quartz in the Live Oak Mine. It is sometimes found in considerable masses associated with chalcopyrite and azurite. A specimen examined by me was found to be to the quartz in the proportion of five per cent, and to contain gold and silver as follows:

| | |
|---|---|
| Gold | 7.5 ounces per ton of 2,000 pounds. |
| Silver | 256.1 ounces per ton of 2,000 pounds. |

It is therefore a valuable silver ore, and can be easily concentrated. The quantity is not known.

*Inyo County.* In the White Mountains, on Jacob's Wonder Mine, Panament, and elsewhere in the county.

*Mariposa County.* With gold in the Pine Tree Mine.

*Plumas County.* Irby Holt Mine, Indian Valley.

*Tuolumne County.* Golden Rule Mine.

148. THENARDITE. Anhydrous sulphate of soda.

Thenardite is found in large quantities with hanksite, tincal, trona, gaylussite, and other minerals, at the works of the San Bernardino Borax Company. For further particulars, see third annual report of the State Mineralogist, 1883.

THINOLITE—see Calcite.

TIN ORES—see Cassiterite.

TINCAL—see Borax.

149. TITANITE. Sphene, titaniferous iron.

Titaniferous iron is found in iron sand in Spanish Creek, Plumas County (Edman). Sphene is in small hair-form crystals in the granite of the Sierra Nevada (Blake), and in albite, Fine Gold Gulch, Fresno County.

150. TOURMALINE. Rubellite, schorl.

Is a mineral almost invariably found crystallized, of all colors, from opaque black to nearly or quite transparent colorless. The usual colors are: *black* (schorl), *red* (rubellite), *blue* (indicolite), *green* (crysolite), *honey-yellow* (peridot), *colorless* (achroite).

All the tourmalines contain boracic acid, from three to ten per cent. This mineral has never been worked for boracic acid, but is probably a source of that acid in nature, resulting from the decomposition of rocks containing it.

The localities of tourmaline are not many in the State. The following are known:

*Calaveras County.* In white quartz, schorl.

*Contra Costa County.* Near Bay of San Francisco.

*Fresno County.* Fine Gold Gulch; schorl, with quartz and feldspar.

*San Bernardino County.*

RUBELLITE (rose colored tourmaline). This very interesting mineral is now observed for the first time in California in the form of long slender crystals from one sixteenth to one eighth of an inch in transverse diameter, with the usual triangular section. Color, a beautiful rose pink, contrasting

well with the matrix of white lepidolite. When ignited, the color disappears and the mineral becomes perfectly white; infusible (Blake).

*San Diego County.* Schorl, on the north side of San Felipe Valley in feldspathic veins. For description see Report Geological Reconnaissance of California (Blake, folio 304).

*Tulare County. Schorl* in granite on the summit of the Sierra Nevada.

*Tuolumne County.* Large crystals of *schorl* are found in granite on the summit of the Sierra.

TRAVERTINE—see Calcite.

TREMOLITE—see Amphibole.

151. TRONA. Sesquicarbonate of soda. This mineral is found with salt, thenardite, tincal, hanksite, and gay-lussite, at the works of the San Bernardino Borax Company, and is utilized to some extent in the manufacture of borax. It is also found in Death Valley, Inyo County, and at other localities in the Mojave and Colorado Deserts.

TUFA—see Calcite and Aragonite.

152. TURBITH MINERAL. Yellow sulphate of mercury. Is not found in nature. Specimens taken from the interior of the furnaces at the Sulphur Bank Quicksilver Mine, Lake County, were exhibited by T. Parrott at the Paris Exposition of 1878, and at his request were delivered to the School of Mines, Paris, at the close of the Exposition.

153. ULEXITE. Borate of lime, tiza, boronatrocalcite, natroborocalcite, tinkalzit, cotton balls, sheet cotton, etc. Ulexite is a hydrated borate of lime and soda. The history of the discovery of ulexite in Nevada is given in detail in the third annual report. The following localities are represented in the State Museum: The variety technically known as "sheet cotton," containing free boracic acid, from Death Valley, Inyo County, and borax made from it by decomposing with carbonate of soda; "sheet cotton," from Desert Springs Lake, Kern County, with boracic acid made from it by the Boracic Acid Manufacturing Company of San Francisco.

VARIEGATED COPPER ORE—see Bornite.

154. VESUVIANITE. Idocrase. Is a silicate of alumina, lime, iron, etc., first found in the ancient lavas of Vesuvius, whence the name. It has been found in the Siegel Lode, El Dorado County (Blake). Some years ago, Mr. S. S. Taylor sent a fine specimen to San Francisco from Spanish Ranch.

VITREOUS COPPER—see Chalcosite.

VITREOUS SILVER—see Argentite.

155. VIVIANITE. Among a set of samples from Brea Ranch, Los Angeles County, sent to the State Mining Bureau by Mr. J. W. Redway, of Los Angeles, was one of dark color and earthy texture, containing small nodular masses of a beautiful pale blue color, which were examined and found to be vivianite, or hydrous phosphate of iron. This mineral, which is rare in California, is interesting as leading to the hope that other phosphates, so important as fertilizers, may be found at or near the new locality. There is a specimen of vivianite in the Museum of the State University, which is said to be from a California locality, but, if my memory serves me, this is attended with some doubt. It is reported also at Young's Hill, Yuba County, and near Oroville, Butte County, but no certain information has been obtained. The Los Angeles mineral occurs with asphaltum, at

the well known Brea Ranch deposit. The specimen is marked "Gangue and Country Rock." The mass is a dark colored earthy mineral, with streaks and veins of asphaltic substance, the whole being evidently the sandy desert soil blown over liquid asphaltum and cemented by it. The vivianite is in small inclosed nodules, never larger than a pea, and generally smaller. The mineral is that variety known as blue iron earth or native Prussian blue. It is soft, pulverulent; under the microscope, crypto-crystalline; before the blowpipe, whitens for an instant, then blackens and fuses to a black magnetic globule. It is wholly and easily decomposed, by boiling hydrochloric acid; the solution reacts for iron, which, being separated, the solution gives precipitates with sulphate of magnesia and with molybdate of ammonia. In a closed tube it gives much water. The specimen has been numbered 3538, and placed in the State Museum.

WOOD OPAL—see Opal and Quartz.

WOOD TIN—see Cassiterite.

156. WOLFRAMITE. A mineral numbered 3731 in the museum, was entered as *ilmenite*, which it was supposed to be. Quite lately a specimen was sent to Washington and was there named *samarskite*. Doubt being thus thrown on the mineral, I was induced to make a careful examination of it, and found it to be as above. The reactions obtained were as follows: Color, brown to black; luster, metallic; streak, brown red. Hardness, 4.5. Specific gravity, 7.14. Fuses with difficulty to a bead which is slightly magnetic. In closed tube shows traces of water; partly decomposed by boiling nitro-hydrochloric acid, yields a yellow solution and a voluminous yellow residue; decomposed by fusion with bisulphate of potash, hydrochlorine acid added, gives yellow solution and residue of tungstic acid. From this solution ammonia throws down a heavy precipitate of iron.

Scheelite and cuproscheelite are known in the State, but there is the first instance of the occurrence of wolframite that has come to my notice; the locality is Mariposa County, twenty miles south of Mariposa, near Buchanan.

157. WULFENITE. Molybdate of lead. This mineral is found as yet but sparingly in California, although it is abundant in Nevada and Arizona. It is represented in the State Museum by No. 5351, as small, perfect, tabular crystals, in ore from a mineral vein containing other lead minerals, six miles northeast of Cave Springs, Kern County. In Owens River Valley, Inyo County, the miners are often vexed by finding a heavy yellow mineral in the pan or horn spoon, mixed with the gold prospect, which so much resembles the noble metal that they are frequently deceived by it. It is probably molybdate of lead, the specific gravity of which is from 6 to 7.

YELLOW COPPER ORE—see Chalcopyrite.

YELLOW OCHRE—see Limonite.

158. ZARATITE. Emerald nickel, hydrate of nickel, hydrated carbonate of nickel. A rare mineral and one that is never found in large quantities; generally as a thin coating on serpentine and chromic iron. It was observed by Blake on chromic iron in Monterey County. Dr. Trask reported it also with chromic iron at Panoches, Gabilan Mountains, Cañada of San Benito, and in Alameda County. It has lately been found in Mendocino County, in township twenty north, and range fourteen west, on chrome iron. It is said to occur on bowlders of chromic iron.

159. ZEOLITE. The name zeolite applies to a group of minerals which includes at least twenty species; the name is, therefore, indefinite. They are all hydrous silicates of alumina, and generally are found in lavas and amygdaloids. There are several minerals in the State Museum from California which have been provisionally referred to the zeolites, pending future analysis and determination. In lava, North Fork Mining District, Fresno County. In lava, Eureka, Humboldt County. In cellular lava, Soledad Cañon, Los Angeles County.

ZINC ORES—see Blende, Sphalerite, and Smithsonite.

160. ZIRCON. Jargon, silicate of zirconia. Zircon has not as yet been found in place in California, but is abundant in beautiful but small crystals in alluvial sands. In cleaning up hydraulic mines it might be collected by the ton if it had any value, but zirconia is not much used in the arts. The sands and final concentrations from the hydraulic mines are very interesting, consisting as they do of gold, platinum, quartz, barite, magnetite, cinnabar, as well as zircons, and sometimes diamonds. Zircon sands are more abundant in some localities than in others; the following localities are the most important:

Arroyo Seco and Irish Hill. *Amador County;* Spring Valley Hydraulic Mine, Cherokee, *Butte County;* in splendid crystals, Picayune Flat, *Fresno County;* in the sands of the Novarro River, Anderson Valley, *Mendocino County;* and Eagle Gulch and Rock Island Hill, *Plumas County.*

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