THE MINERAL PRODUCT OF CALIFORNIA.

An Exhaustive Review of the Mining Industry on the Pacific Coast From Its Inception to the Present Time, Including Tables of Statistics Showing the Mineral Output of the Various Counties and the Value of the Gold Product During Half a Century.

(BY CHARLES G. YALE.)

The following review of the mining industry of California was prepared by Charles G. Yale, Statistician of the United States Mint, for publication in the series of papers by specialists and experts for circulation through the Bureau of Information of the Southern Pacific Railroad Company's Exhibit at the Paris Exposition:

The character of mining carried on in California in these days is entirely different from that done by the miners who came to the State in the "days of '49," when very simple appliances were all they required to obtain the gold which the concentrating forces of Nature had gathered in the gulches, ravines, canyons, creeks, river bars and river beds. The pick, pan, shovel and rocker, long-tom, or sluice, were all the implements necessary, for this was the era of placer mining, when fortunes were gained in a day, and labor, not capital, was the prime requisite for successful mining.

At that time all the mining done was placer or surface work, and only the richer diggings were touched. Very little skill or experience was necessary, and the early day miner collected the gold in quantities which now seem wonderful. In the year 1852 the sum of $81,294,000 was taken out. Gradually the area of this surface mining began to be narrowed down, and attention had to be turned to other sources of the gold for which all were in search. To-day, however, many of these old claims are still being worked over and over by Chinese miners, and as they are satisfied with small wages there are plenty of places for them to mine. White men own most of the ground, which they lease to Chinamen, and poor mining ground is now called "Chinese diggings."

After a time it was discovered that the great, red hills in the foothill and mountain counties in the central and northern part of California contained plenty of gold, though the material was much poorer than the concentrated shallow placers, necessitating the handling of more dirt. Then hydraulic mining was invented. Then, too, men began to inquire into the sources of the rich placers and commenced to hunt for, open and work the quartz ledges.

The collection of gold from these sources is a much more expensive operation than taking it from shallow surface placers, and very different systems have to be adopted. The method is practically the same as that pursued by nature—concentrating the heavier valuable material and washing away the lighter—but man's efforts are slow, and it takes time and money to handle the material.

With the necessary change in the character and system of mining came an entire change in the social conditions and methods of the miners themselves. People who only know about gold mining in California from the old stories of the mining camps in the "days of '49" would recognize none of the features should they visit the mining regions of the State in 1900. The nomadic habits of the miner have entirely disappeared, and with them the recklessness, drunkenness and extravagance which were supposed to universally prevail. It is proper to note, however, that such habits were not universal by any means, though among the thousands who came were numbers of men who made necessary lynch law and vigilance committees. Around all the larger mines of the present day are permanent settlements, where the miners live with their families, content to work for wages and a sure income. The larger mining towns of the State, where there are a number of mines in operation, have lost entirely the old features of mining camp life. The people have settled down to mining as a permanent business, and conduct it like any other industry.

The principal producing mines of the State now belong to private companies or individuals. Many small claims and prospects are owned by individual working miners, but capital is required to open and work quartz and gravel claims to conduct the business on an economical and profitable basis. Many of the wage-working miners, of course, do more or less prospecting for themselves, and many own small claims, which they work in a desultory manner until they can be disposed of to people in a position financially able to bring them to a producing condition. California is the pioneer of the gold-producing States of the Pacific Coast, and the one which has made the greatest aggregate yield, has very naturally long since passed its "boom" period, and its mining affairs are conducted on the same principles as any other industrial business.

The auriferous gravels are worked by both the hydraulic and the drifting process. If the bed or channel of gravel is only covered by soil or earth which may be washed away by water thrown against the bank under pressure, then the whole mass, soil, gravel and all is washed down to obtain the gold. If the channel of gravel is covered with hard lava which the water will not break up, then the deposit is "drifted"; that is, long tunnels are run under the lava capping, and the bottom stratum of rich gravel is removed and then washed on floors or crushed in "cement mills." The upper portion is in this case not disturbed, only the richer gravel being taken out.

These deposits of gold bearing gravel were laid down by a system of prehistoric or "dead" rivers, whose channels were wider and slopes steeper than the present rivers. Through many centuries rain and frost disintegrated the rocks, and the rushing rivers carried the detritus down toward the valleys. The numerous quartz veins in the mountains were thus broken up, and the freed gold, being heavy, collected in the beds of these rivers, while the lighter detritus was transported farther down. The beds of these old rivers constitute what are to-day called the auriferous gravel channels. They owe their richness to the enormous amount of erosion which had taken place, an amount considered by geologists to have been equal to a layer of rock several thousand feet in thickness. After these auriferous channels were thus filled and the gold collected in the gravels, volcanic eruptions occurred, and immense streams of molten lava hundreds of feet deep flowed directly down their beds. In this way the auriferous gravel channels were covered or buried by what is called the lava cap. When these masses of lava cooled and hardened, the rivers of the present day began to carve their courses downward from the mountains, and naturally sought the softer and lower portions, and owing to the hardness of the lava often formed channels by the side of the ancient beds. We see the result of their cutting in the canyons of the present streams, which are often one or two thousands feet deep. The old buried rivers under the lava are therefore high above the present ones. A great mountain ridge, or "divide," extends for many miles from the main range. Hundreds of feet below the top of this divide, and buried deep under lava is the graveled channel of a Pliocene river. On each side of this great ridge, and one or two thousand feet below the bed of the old buried river, flow the rivers of to-day. The new streams, in cutting their channels, often cross and recross the old ones, and thus washing out the gold the Californian pioneers found so abundant in the streams.

Miners run long tunnels into the sides of these "divides," or ridges, until they reach the old gravel channel carrying the gold. The lowest or richest portion of this gravel is then mined, and by drifting removed. If it is hard and "cemented," it is crushed in stamp mills and the gold saved; or if it is not cemented, the gravel is placed on washing floors, and a stream of water under pressure turned upon it by which it is disintegrated and the gold freed and saved, the rock, sand, earth, etc., passing away down the flumes. This bottom cement gravel pays from $3 to $10 per mine carload, and when they breast out from 50 to 150 feet wide on the channel and six to eight feet high, the channel will yield from $100 to $200 per running foot, and often very much higher. These lava capped divides covering the buried rivers are found in many counties in the upper part of California.

As stated, when these old river channels are under the lava they are "drifted." When there is no lava capping and only a bank or deposit from 50 to 150 feet high covered with trees, shrubs, etc., the hydraulic process is used, and the mass is washed away. The hard lava capping of the old rivers has resisted the elements better than the softer rocks, so that what were formerly the lowest point, or rivers, are now the higher mountain ridges. In some places the bones and teeth of elephants and other large animals are found, and pine cones and leaves are taken out as fresh looking as those of to-day, but they soon crumble on exposure to the air.

In hydraulicking a very much larger amount of dirt has to be handled than in drifting but the process is cheaper. Ditches, reservoirs and pipe lines are built, and water brought to the mine under heavy pressure. This is thrown against the bank through a nozzle, or "giant," as it is called, and tears down the gravel at a wonderful rate. Tunnels are run, in which blasts of powder are placed and the bank is thus shaken up. Sometimes 20,000 or 30,000 pounds of powder are exploded at one time, disintegrating many thousand cubic yards of earth which the water then attacks. The material thus washed down passes through flumes or sluices, where the gold is caught in riffles with quicksilver, the rock and earth passing on to a dumping place. In this way all labor of shoveling or handling is avoided, and immense amounts of material may be moved in a short space of time. It can be imagined how much material is moved by hydraulic mining when it is stated that the bulk of this auriferous earth is only worth 3 or 4 cents a cubic yard; yet these mines in the hight of their prosperity yielded $8,000,000 or $10,000,000 a year. Mines of this character are quite expensive to open and equip, since so large a water supply has to be provided, and ditches, reservoirs, flumes, etc., have to be built and maintained. Therefore the larger and more productive ones are only worked by large companies.

There was a serious controversy in California about this class of mining, which lasted some years. In washing away the high banks or hills, the debris, or tailings, as the waste material is called, filled in and injured the navigable streams and the farming lands along their banks. Long and costly and bitter controversy between the farmers of the valley and the miners of the mountains finally resulted in closing the hydraulic mines down by injunctions of the United States courts, and these mines, large and small, were compelled to stop work wherever their debris went into the main streams or their tributaries. Thus great productive hydraulic mining properties, with their extensive ditch systems, reservoirs and mining plants, in which about $100,000,000 were invested, became unproductive and valueless. This condition of affairs continued for some years, and the annual gold product of the State fell off materially.

The towns and camps in the hydraulic mining regions of the State became depopulated, and large numbers of people were thrown out of employment. This condition of affairs continued for ten or twelve years, until the matter was agitated before Congress, which resulted in a law being passed which permits these auriferous gravel mines to be operated by the hydraulic process under certain conditions and restrictions. The essential features of the law are that all such mines operated under the hydraulic system shall impound, or restrain, their debris, or tailings, and prevent them entering the navigable streams, or injuring the land of other parties. The California Debris Commission, consisting of three United States engineer officers, is empowered to issue licenses for mining by the hydraulic process under this law, when it is satisfied that the debris dams or impounding works are sufficient to restrain the debris resulting from the mining operations of the claim. The hydraulic miner must make application to the commission for permission to mine and submit plans for the proposed restraining works, which are subject to the approval of the commission. Each separate application is advertised for a specified time, and a hearing is held before the commission, at which those opposed to the issuance of the license may state their reasons. After a thorough investigation, if satisfied that the debris can be restrained, a license to operate by the hydraulic process is granted, and the mine may begin operations. If the engineers see any reason to believe, however, that damage will be done to rivers or to individuals by the operation of the mine, no license is granted, and the mine may not be legally worked. Moreover, even after a license is granted, if debris is, for any reason permitted, to enter a stream, or if it is not properly impounded, the license may be recalled. This Government commission has jurisdiction over all hydraulic mines in the drainage basin of the Sacramento and San Joaquin Rivers and their tributaries. In the northwestern part of California, in Siskiyou and Trinity Counties, where there are extensive gravel deposits and many hydraulic mines, there is no restriction on hydraulic mining. The hydraulic mines in that section dump their tailings, or debris, into the tributaries of the Klamath River, which has been officially declared a non-navigable stream.

In those parts of the State where licenses must be obtained, the miners themselves must bear the expense of the impounding works for their respective mines, and for this reason many hundreds of the smaller ones, especially in Sierra and Plumas Counties, where they are numerous, are still closed down. Their owners, having become impoverished by enforced cessation of operations during a series of years, have not generally the money to construct the necessary impounding works. Still, since the law was passed, some hundreds of the hydraulic mines have been granted licenses to mine, and are now being operated, but not on the former scale, as by having to impound and settle their debris, they are restricted in the amount of gravel they may wash in a given time.

There are still very large areas of this auriferous gravel which have not been touched by the miners. These undeveloped gravel channels need the aid of capital to be brought to a productive stage.

The drift gravel miners are not restricted in their operations. These are also mines of auriferous gravel, but the ground being covered by a lava capping, it is impossible to wash the gravel by the hydraulic system.

In the hydraulic and drift, as well as in the quartz mines, experience shows that those enterprises into which capital has been put pay the best profit, and that gold mining on a small scale is not proportionately so remunerative as that carried on in a systematic manner, backed by abundant means. The long tunnels, through barren material, to reach the channel in the drift mines; the money required for the reservoir, ditch and pipe systems of the hydraulic mines, and the expensive machinery for the quartz mines, account for this feature of gold mining. It doubtless may seem strange to many that investment of capital is necessary in this particular kind of industry, and that a man having a gold mine should be in need of financial help. Still, as in almost every other kind of business, much more can be done with capital than without it. If the prospector in the mining regions finds a ledge of gold-bearing rock which is rich near the surface, he may take out considerable gold at once, but generally they have to sink deep shafts to properly open the mine. He may sink a short shaft and find good indications of permanency in his ledge, but to sink deeper he must have a pump to take out the water and a machine hoist to take out waste and ore. He needs timbers, supplies and labor. Then he must have some sort of mill to crush his ore, and if there are sulphurets he needs concentrators to save them. All these things cost money, and money few prospectors have. Even if he succeeds in getting down a couple of hundred feet, his requirements become greater, for heavier machinery is needed, and also some kind of power, steam, electricity or water. This involves engines, boilers, etc. The result of this is, that there are in all the mining counties of California hundreds of half-opened mines where men have had to quit work, simply because they did not have the money to go on further with development or to furnish machinery to work the claims. Naturally, most of such claims are for sale. Again, some small company may start to work such a claim and try to bring it to a producing stage and then have to quit because they have not funds enough. Nearly everywhere there is apt to be barren ground through which it is expensive to sink, and floods of water sometimes drown out a mine not properly equipped with pumping machinery.

The rich companies often have to spend one, two or three hundred thousand dollars, and do not expect any returns until this money is spent in development and equipment of the mine. Some mines are unprofitable when worked in a small way, which pay handsomely when properly developed and equipped.

Most of the gold now being produced in California comes from the quartz mines which are found in the mountainous portions of nearly the whole State. They occur in association with all the different kinds of metamorphic and eruptive rocks, but are particularly abundant in what is termed the auriferous slate. Some of the quartz mines of the State which have been worked for twenty or thirty years are still producing, and several are now worked to a depth of over 2,000 feet.

A quartz ledge or vein is a fissure in the earth which is filled with quartz containing more or less gold; that is, the one you own generally has less and that of some other fellow near by has more. The country rock enclosing the ledge on both sides is barren, and the ledge matter is what the miners have to get out as best they may. Shafts are sunk, and drifts and crosscuts run to extract this ore, and all the openings thus made have to be timbered up strongly to prevent caves. Often a great amount of valueless material or waste has to be moved to properly work the mine, so that it is not only the gold-bearing rock which is hoisted to the surface. Where the lay of the mountain permits, the mines are opened by tunnels instead of shafts, but in some cases both tunnels and shafts are made on the same mine. Where a tunnel is possible, the water drains off itself, but in shafts the water must be pumped or hoisted out in bailing tanks. At the bottom of the shaft is a sump, or continuation of the shaft, where the water collects, and from which it is pumped. In breaking down the rock in running the drifts, etc., holes have to be drilled and powder used for blasting. These ledges are of an average width of two to three feet, and extend downward to an indefinite depth. Sometimes they are thirty, forty or fifty feet wide and sometimes only a few inches. Generally speaking, the wide ones are poorer in gold, on the average, than the small ones; still the very wide ones of low grade are preferred to the small but richer ones by companies which invest in these properties.

The large veins of medium or low grade ore are supposed to be more lasting than the small ones, and pay very handsomely when extensive crushing mills are provided. In all these mines some portions are poor and others rich, but there is no way of telling anything about this in advance, unless one happens to be like the man who was sure that there was money in a certain mine because he had put in $50,000 and never got it out. When men tell about quartz from these mines running from $500 to $1,000 per ton, it can be put down as "bosh," or in that case there is very little of the rock. "Pockets," or small bunches of ore, as rich as that are sometimes found in a ledge, but they are very scarce and are often succeeded by barren rock, which may continue a long time before another pocket is found.

When the ore is raised to the surface from the mine, it is dumped in bins or hoppers above the mill, from which it falls by gravity into large, steam-driven rock-breakers, which crush it into small pieces, and thence it slides, again by gravity, into what are called ore-feeders. One of these is placed in behind each battery of five stamps of the mill, and is so arranged that at each drop of a stamp a small quantity of ore is fed under the stamps. The amount to be fed may be regulated according to the character of the ore.

The stamps, which weigh from 900 to 1,000 pounds each and drop ninety to 100 times each per minute, are arranged in groups of five, each five having a mortar of their own. In this are five steel dies on which the shoes of the stamps drop, the ore being crushed between the shoe and die. In the mortar in which the stamps drop on the ore, quicksilver is placed so as to catch the gold as it is freed from the rock. Water passes through the mortar continually and washes the ore, as it is crushed, through fine screens on to inclined aprons or small sluices placed in front of each battery. These aprons are covered with sheets of silver-plated copper on which amalgam or quicksilver is placed, so as to catch any gold which escapes from the mortars with the finely crushed ore. These aprons are scraped periodically to remove the amalgam and gold. The amalgam—which is gold and quicksilver mixed—from the mortars and from these plates is placed in a buckskin bag, and the free quicksilver squeezed out, the hard amalgam remaining being then retorted. The heat in the retort evaporates the quicksilver, which is saved by being again condensed, and the gold is left in the retort. This is then melted into bars, sent to the Mint and turned into coin, and we all fight in our various ways to get hold of as much of it as we can.

In addition to the "free" gold—that is, in a pure native state—most of the ore in these ledges carries sulphurets or pyrites of iron, also containing gold, but in such a condition that it will not amalgamate with the quicksilver. The crushed ore, therefore, after going through the batteries and over the aprons as described, passes on to concentrators on the floor below. These consist of inclined endless rubber belts, which are revolved and have also a shaking motion. They are so arranged and operated that the light tailings or worthless material pass away, while they collect and concentrate the heavy sulphurets and any stray gold or amalgam which may have passed through the mortars. A concentrator is used for each five-stamp battery. The sulphurets thus collected are roasted in a furnace to drive off the sulphur, and are then so treated by the chlorination process that the gold is first dissolved and then precipitated from the solution. Only a few mills have a chlorination plant of their own, most of the miners selling their sulphurets to the smelting works. A ton of rock may contain only from 1 to 3 per cent. of sulphurets, and these are often worth from a hundred to a thousand dollars a ton, but it takes time and work to get a ton of them. The usual average is from 1 to 1½ per cent. of sulphurets, worth from $75 to $150 per ton.

In some mines there is little or no free gold, but the rock has to be crushed and concentrated to obtain the sulphurets which carry the gold values. After passing all these appliances the pulp, as the crushed ore is called, still has some value, and is led through sluices to a canvas plant. Broad sheets of ordinary canvas are spread smoothly on slightly inclined surfaces, and over these the tailings pass, carried by the water, and clear water is added. The little fibers of the canvas catch very fine gold and rich "slimes" which may have escaped the other appliances. At some mines the cyanide process is made use of to save gold from ores which it is difficult to treat by the ordinary milling process, and cyaniding is also done with tailings which still contain some gold. By this process the finely crushed ore is placed in vats and treated with a weak solution of cyanide of potassium, by which the gold is dissolved, and from this solution the gold is afterward precipitated by passing it through zinc sponge, and is thus recovered.

In some small mines where they cannot afford a stamp or roller mill, the old-fashioned Mexican arastra is used for crushing and amalgamating the ore. This is a circular bed of stone or rocks inclosed by a rim, and having a vertical central shaft on which are horizontal arms. To these arms are fastened by chains great stones with a flat under surface, which are dragged by the arms over the stone paved surface of the central circular bed. Horses or mules are used to give the circular motion necessary to drag the stones around the circle. Water and quicksilver are mixed with the pulp or ore. The stones move slowly around the circle, grinding the ore and polishing the tiny specs of gold which the quicksilver then catches. Every now and then they "clean up" by adding water and thinning down the pulp until it is washed away, leaving the quicksilver and gold in the crevices of the bed of the arastra. A great many miners use these machines for working their own ore when it is rich enough to pay by this process, which is quite slow. The miners can build this sort of mill themselves. Sometimes they are run by steam or water power and used for working the tailings from a mill. There are several other forms of mills for crushing ore from mines, and some with rollers are used where the rock is not very hard.

There are various forms of placer, or surface, gold mining carried on in different parts of California. The beach mining is rather a peculiar feature. In many places along the coast the magnetic iron sands, or "black sands," as they are called, carry an appreciable quantity of gold, and many of the ocean beaches have black sand mines in operation. The upper, or lighter, stratum of white beach sand is removed, and the lower, heavier stratum of black sand is washed in sluices. It is difficult to save the gold, because there is so little difference in the specific gravity of the particles of black iron sand and the fine, light, flaky gold. Quicksilver is used in the sluices. The black sands are also washed in a machine called a "tom," the sand being elevated by a Chinese pump and passed through this appliance. The large toms handle about 200 tons of sand in twenty-four hours.

These sands often carry a small percentage of platinum which is also saved. The beaches are richer at some periods than at others. When the winds throw the ocean waves at a cutting angle along the beach, the sands are concentrated by the wave action, the lighter being carried away, and the auriferous black sand being in a more concentrated condition. These sands usually do not contain more than from 75 cents to $1.50 per ton, but sometimes rich patches are found.

River bed mining is carried on at many of the mountain streams. In some places extensive flumes are built to carry the water of the whole river during certain months when the river is low, and the river bed is thus laid bare so the gravel may be handled and the gold obtained. Along the Klamath and some other rivers the miners build wing dams, so as to divert a portion of the water and leave a small section bare. Then they put in current wheels, which operate pumps to take the water out of the ground they are working, and thus obtain the auriferous gravel, etc., and wash it in sluices, getting the gold. At high stages of the water this kind of mining cannot be carried on.

From all classes of gold mines the average annual product of the State for the past forty-eight years has been about $26,500,000, the total output of gold since 1849 having aggregated $1,314,176,658. The annual yield is now between $16,000,000 and $17,000,000. In view of the many developments and investment of capital, the annual yield is expected to reach $20,000,000 before long.

The conditions under which mining is carried on have changed materially for the better. The mining country has been more densely settled, means of transportation have vastly improved, machinery has been perfected and cheapened, all supplies have become cheaper, and radical changes have taken place in the systems of mining and of handling and treating ores. High-priced officials and supernumeraries have been done away with; there is a closer system in conducting operations; and all the appliances necessary are not only more perfect but cheaper. As a result of all these factors, ore is now mined and milled at a much less cost than formerly, and mines that twenty years ago would run a company in debt can now be made to pay a handsome profit. Each year has shown a gradual reduction in cost, and improvement in the method of treating ores, and with every dollar off this cost hundreds of mines have been added to the list of producers. The successful treatment at low cost of the rich auriferous sulphurets found in the ores of nearly all our quartz mines, has been an important factor, as at one time little attention was paid to them, whereas now all mills are equipped with appliances for saving them for ultimate treatment, in addition to the ordinary methods for saving the free gold.

There is plenty of opportunity for investment in the gold mines of the State, but this should not be undertaken by those unfamiliar with the business, except upon the advice of persons of experience. Even those long in the business, and who have invested large sums, do not purchase properties or interests in them on their own judgment alone, but employ skilled experts to make examinations and reports. There are so many conditions to be taken into consideration that it is foolish to invest money in this kind of property without very careful examination in advance.

While the principal product of the mineral world in California is gold, there are many other substances mined, which swell the total valuation of the mineral output of the State to upwards of $27,000,000 a year. Several of these products are not mined in other States. Quicksilver, for instance, is nowhere else mined on this continent, and since we began working it California has produced upwards of $78,000,000 worth, and continues to produce it at the rate of over a million dollars a year.

During the last seventeen years the total silver product has been over $20,000,000.

All the borax in this country comes from California and Nevada, and eleven-twelfths of this product is from California. The annual output of this substance is valued at upwards of $1,000,000.

The State produces more rock asphalt than any other, and is the only one yielding natural liquid asphalt. Magnesite, used in paper manufacture and for furnace linings, is mined here only. The only product of chrome in the United States is from California, and all the antimony is from this State and Nevada. The only platinum found in the United States is taken with the gold from the beach black sands of the auriferous gravel mines.

The mineral oils are very valuable and the petroleum produced is largely increasing as new fields are opened. The State has a somewhat scant supply of coal and much petroleum is used for fuel purposes. Most of the mineral oil has heretofore come from Los Angeles, Ventura and Santa Barbara Counties, but the industry is now being prosecuted vigorously in Fresno and Kern Counties where large areas of oil-producing territory are located.

Gold continues to be the most important substance mined in California, for out of a total valuation of mineral products for the year 1898 of $27,289,079, the value of the gold alone was $15,906,478. Gold was mined in thirty-one counties of the State in that year, and seven of these produced over a million dollars each, while one exceeded two millions. Of the gold and silver product the quartz mines yielded $12,488,321; placer mines, $1,841,473; drift mines, $1,028,547, and hydraulic mines, $962,192.

Approximately there are 19,823 miners employed in the gold, silver, lead and copper mines of the State. The counties in which over a thousand miners are employed are Amador, Calaveras, El Dorado, Kern, Nevada, Placer, Shasta, Siskiyou, Trinity and Tuolumne. The highest number is employed in Nevada County (1,949), and this county is also the largest gold producer.

The following table shows the gold and silver product of the State for the year 1898, as indicated by returns received at the United States mint at San Francisco:

County.	Gold.	Silver.	Total.
Amador	$1,806,363	$1,742	$1,808,105
Butte	514,508	9,317	523,825
Calaveras	1,019,023	3,432	1,022,455
Del Norte	9,057	....	9,057
El Dorado	501,966	4,174	506,140
Fresno	27,557	....	27,557
Humboldt	57,512	....	57,512
Inyo	137,107	73,503	210,610
Kern	1,017,930	6,543	1,024,473
Lassen	37,460	300	37,760
Los Angeles	21,300	....	21,300
Madera	94,884	50	94,934
Mariposa	336,418	993	337,411
Mono	446,017	66,667	512,684
Nevada	2,017,628	19,476	2,037,104
Placer	1,488,022	5,670	1,493,692
Plumas	369,609	....	369,609
Riverside	189,188	1,384	190,572
Sacramento	57,301	....	57,301
San Bernardino	261,512	32,000	293,512
San Diego	673,196	300	673,496
San Luis Obispo	1,000	....	1,000
Santa Barbara	1,000	....	1,000
Shasta	860,180	171,768	1,031,948
Sierra	399,063	519	399,582
Siskiyou	768,804	321	769,125
Stanislaus	19,400	....	19,400
Trinity	859,255	314	859,569
Tulare	12,400	....	12,400
Tuolumne	1,734,953	15,582	1,750,535
Yuba	166,865	....	166,865
	$15,906,478	$414,055	$16,320,533

In 1898 there were 52 of the 57 counties of California which produced mineral of some kind. In some of the counties four or five substances are produced. There are upward of 70 different mineral substances of commercial value found in California, of which about 42 are at present being utilized. In nearly all of these branches of mineral industry there is room for increase of product as more capital is invested. There are numerous known deposits which are not worked or utilized, either owing to lack of transportation facilities or because of cost of shipping to distant markets.

The following official statement of the State Mineralogist shows the value and the amount of the different substances mined in California in 1898:

Asbestos, 10 tons	$200
Antimony, 40 tons	1,200
Asphalt, 25,690 tons	482,175
Bituminous rock, 46,836 tons	137,575
Borax, 8,300 tons	1,153,000
Cement, 50,000 bbls	150,000
Clay, brick, 100,102 M	571,362
Clay, pottery, 28,547 tons	33,747
Coal, 143,045 tons	337,475
Copper, 21,543,229 lbs	2,475,168
Gold	15,906,478
Granite, 98,369 cu. ft	147,732
Gypsum, 3,100 tons	23,600
Lead, 655,000 lbs	23,907
Lime, 297,860 bbls	254,010
Limestone, 27,686 tons	24,548
Macadam, 452,691 tons	369,082
Magnesite, 1,263 tons	19,075
Manganese, 440 tons	2,102
Marble, 8,050 cu. ft	23,594
Mineral paint, 653 tons	9,698
Mineral waters, 1,429,809 gallons	213,817
Natural gas	74,424
Paving blocks, 1,144 M	21,725
Platinum, 300 oz	1,800
Petroleum, 2,249,088 bbls	2,376,420
Pyrites, 6,000 tons	30,000
Quicksilver, 31,092 flasks	1,188,626
Rubble, 724,674 tons	445,395
Salt, 93,421 tons	170,855
Sandstone, 37,264 cu. ft	46,384
Serpentine, 750 cu. ft	3,000
Silver	414,055
Slate, 400 squares	2,800
Soda, 7,000 tons	154,000
Sulphur, 2 tons	50
Total	$27,289,079

The relative rank of the counties of the State, in point of mineral production, is given in the following table. In each case the value given includes that of all mineral substances combined produced in the respective counties for the year. Some counties produce in addition to gold and silver, five, six or seven other substances, while other counties which yield little or no gold or silver, produce in large quantities quicksilver, mineral oils, copper, lead, asphalt, structural materials, etc. The figures after the names of the counties indicate aggregate value of all mineral products for the year, including the precious metals. The term "undistributed" includes total values of such substances as are grouped to avoid disclosing private business, as in the case of single operations in a county. In the large and complete tables published by the State Mining Bureau, from which these figures are taken, the amount of value of each substance in said county is set forth. It is, therefore, necessary in some cases to place the figures in the "undistributed" column:

1—Shasta	$3,510,728
2—Nevada	2,072,604
3—Amador	1,849,846
4—Tuolumne	1,757,735
5—Los Angeles	1,732,357
6—San Bernardino	1,644,152
7—Placer	1,535,525
8—Kern	1,129,573
9—Calaveras	1,024,507
10—Trinity	1,010,769
11—Siskiyou	769,125
12—San Diego	694,418
13—Ventura	654,063
14—Napa	555,966
15—Butte	529,225
16—Mono	519,421
17—El Dorado	512,300
18—Santa Barbara	472,784
19—Alameda	443,759
20—Inyo	434,766
21—Sierra	399,582
22—Plumas	369,609
23—Humboldt	357,288
24—Mariposa	337,411
25—Santa Clara	334,848
26—Santa Cruz	270,636
27—Riverside	247,022
28—San Benito	212,585
29—Fresno	201,057
30—Yuba	166,865
31—Madera	147,907
32—Contra Costa	141,440
33—Sonoma	132,709
34—Sacramento	131,438
35—San Francisco	129,595
36—Lake	102,096
37—San Joaquin	91,289
38—San Luis Obispo	84,267
39—San Mateo	77,000
40—Marin	67,800
41—Orange	65,600
42—Lassen	37,760
43—Stanislaus	22,298
44—Solano	20,635
45—Monterey	19,115
46—Tulare	15,900
47—Tehama	9,400
48—Del Norte	9,064
49—Kings	8,450
50—Mendocino	3,330
51—Colusa	1,093
52—Yolo	384
Undistributed	219,990
Total	$27,289,079

All the asbestos produced in California in 1898 was from Riverside County, and the antimony came from Kern. Asphalt was produced in Kern, Santa Barbara and Ventura Counties. Bituminous rock came from Mendocino, San Benito, San Luis Obispo and Santa Cruz.

The borax yield was from San Bernardino and Inyo. Brick clays were utilized in Alameda, Butte, Contra Costa, Fresno, Humboldt, Kern, Kings, Los Angeles, Madera, Marin, Mendocino, Monterey, Orange, Riverside, Sacramento, San Bernardino, San Diego, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Sonoma, Tehama, Tulare, Tuolumne, Shasta, and Ventura Counties.

Pottery clay came from Amador, Los Angeles, Placer, Riverside and Santa Clara. All the hydraulic cement came from San Bernardino County. Coal was produced in Alameda, Amador, Contra Costa, Orange, Riverside and San Benito Counties. The copper was mined in Amador, Calaveras, Inyo, Nevada and Shasta Counties. The pyrites all came from Nevada County.

Gold was produced in the counties of Amador, Butte, Calaveras, Del Norte, El Dorado, Fresno, Humboldt, Inyo, Kern, Lassen, Los Angeles, Madera, Mariposa, Mono, Nevada, Placer, Plumas, Riverside, Sacramento, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, Shasta, Sierra, Siskiyou, Stanislaus, Trinity, Tulare, Tuolumne and Yuba.

Granite was quarried in the counties of Madera, Nevada, Placer, Riverside, Sacramento, San Bernardino, San Diego, Solano, Sonoma and Tulare.

Gypsum came from Fresno, Los Angeles, San Benito, and lead from Inyo and Mono Counties. Lime and limestone was quarried in El Dorado, Kern, Mono, Riverside, San Bernardino, Santa Cruz, Solano and Shasta Counties.

The principal macadam quarries are in Alameda, Los Angeles, Marin, Sacramento, San Benito, San Francisco, Santa Clara, Solano and Sonoma Counties. The magnesite all came from Napa County; and manganese all from Alameda. Marble was quarried in Amador, Inyo and San Bernardino Counties.

Mineral paint was mined in Butte, Nevada and Stanislaus Counties. The mineral springs which utilize the waters commercially are in Butte, Colusa, Contra Costa, Fresno, Lake, Monterey, Napa, San Benito, San Diego, San Luis Obispo, Santa Barbara, Santa Clara, Shasta, Siskiyou, Sonoma and Tehama Counties. Natural gas was utilized in Sacramento, San Joaquin and Santa Barbara Counties. Paving blocks, or basalt, were quarried in San Bernardino, Solano and Sonoma Counties. The platinum came mainly from Trinity and Siskiyou Counties. Petroleum was produced in Fresno, Kern, Los Angeles, Orange, Santa Barbara, Santa Clara and Ventura Counties. Quicksilver came from Lake, Napa, San Benito, San Luis Obispo, Santa Clara, Sonoma and Trinity. Rubble was quarried in the counties of Alameda, Humboldt, Madera, Marin, Monterey, Sacramento, San Diego, San Luis Obispo and San Mateo. Silver was produced in the counties of Amador, Butte, Calaveras, El Dorado, Inyo, Kern, Lassen, Madera, Mariposa, Mono, Nevada, Placer, Riverside, San Bernardino, San Diego, Shasta, Sierra, Siskiyou, Trinity, Tuolumne.

The salt came from Alameda, Colusa, Riverside and San Diego Counties. Sandstone was from Alameda, Los Angeles and Yolo Counties. The serpentine was from Los Angeles; slate from El Dorado; soda from Inyo, and sulphur from Los Angeles Counties.

As far as the "banner" counties are concerned, in the different mineral products, the following is the record for 1898, with the values of the material from the county named. Alameda leads in the production of salt ($155,812), manganese ($2,102) and coal ($176,250). Butte leads in mineral paints ($3,000). El Dorado in slate ($2,800). Humboldt in rubble ($297,276). Inyo in soda ($154,000), lead ($21,170), and marble ($12,000), Kern in antimony ($1,200), Los Angeles in petroleum ($1,462,871), brick clays ($188,386), gypsum ($18,500), serpentine ($3,000) and sulphur ($50). Madera leads in granite ($49,673), Napa in mineral waters ($63,919), quicksilver ($472,972) and magnesite ($19,075). Nevada leads in gold ($2,017,628), and pyrites ($30,000). Placer has the most pottery clay ($12,000). Riverside leads in asbestos ($200). San Bernardino has the most borax ($1,120,000), cement ($150,000), and limestone ($6,600). San Francisco quarries the most macadam ($129,595). San Joaquin utilizes the most natural gas ($57,289). Santa Barbara has the most extensive asphaltum output ($351,400). Santa Cruz produces the most lime ($151,000), and bituminous rock ($113,898). The bulk of the copper comes from Shasta County ($2,465,830), and this county also leads in silver product ($171,768). The most paving blocks are from Sonoma County ($13,310).

It is to be noted that only one county has the lead on five things—Los Angeles. Four lead on three substances—Alameda, Inyo, Napa and San Bernardino, and the counties of Nevada, Shasta and Santa Cruz lead in two products. The other counties named only have the lead in one substance each.

In the year 1895 the total value of the mineral products of the State was $22,844,664; in 1896 it was $24,291,398; in 1897 it was $25,142,441; and in 1898 the total value was $27,289,079 so that the increase for the past year alone is $2,146,638. The figures given show that in the past year the total value of metallic substances including precious metals was $20,023,034; of non-metallic substances $2,102,072; of hydrocarbons and gases $3,070,594, and of structural materials $2,093,379; total $27,289,079.

Generally speaking the gold mines are in the Sierra Nevada Range of mountains and in the foothills. In the Coast Range are found the mines of quicksilver, chrome, manganese, coal, bituminous rock, etc. The main oil fields are in the southern and central valley part of the State. The auriferous gravel mines are in the upper part of California, but the gold quartz mines are found in the extreme north, extreme south, and all along the intervening distance inside the Coast Range.

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