

REPORT VIII OF THE STATE MINERALOGIST, MINING IN CALIFORNIA DURING 1888

PLACER COUNTY.

This county, so named from the Spanish word "placer," meaning a place where gold dust is found mixed with the sand, earth, or gravel, is bounded by Yuba and Nevada on the north, by the State of Nevada on the east, by El Dorado and Sacramento Counties on the south, and by Sutter on the west. Placer furnishes another example of the ill-shaped! ill-proportioned counties of the State of California, this, in proportion to its length, being the narrowest county in the State; its length being over ninety miles, while its average breadth is scarcely more than thirteen miles.

Extending beyond the summit of the Sierra Nevada, the eastern portion of this county reaches an altitude of over seven thousand feet, the surface of the entire eastern half being elevated and rugged. The other half, extending westward over the foothills, sinks into the great Sacramento Valley, its western border being hardly one hundred feet above the sea level. The middle and upper portions of Placer County are eroded by many deep ravines. The North Fork of the American River, coursing through a canon two thousand feet deep, flows west through the center of the county. The Middle Fork of the same river, flowing through a canon equally deep, separates this county from El Dorado. In the mountains are many streams, tributaries of the North and Middle Forks and of Bear River, which separates Placer from Nevada County. East of the Sierra Nevada a part of Lake Tahoe lies within the limits of this county. The water supply of Placer, naturally large, has been supplemented through the construction of numerous ditches, several of them costly and of large capacity. The upper half of this county is covered with splendid coniferous forests, the central portion with a scattered growth of oak and scrub pine, the western portion being nearly treeless. Extensive lumber operations are carried on in the higher foothill regions.

MINING INTERESTS.

Placer has from the first been noted for the varied character and the extent of her mining operations and her large bullion production, the latter having at one time amounted to several million dollars per annum. Of late years the output of gold has been greatly diminished, through the stopping of hydraulic mining, formerly prosecuted here on a large scale. Meanwhile, however, drift gravel mining has been somewhat increased. This branch of the business is now largely carried on in the county, the Forest Hill Divide being the site of its most extensive operations.

Besides gold in every form of deposit, Placer possesses other mineral resources, some of which are being largely utilized. Among these are chrome iron, granite, marble, iron, etc. Placer is also beginning to take high rank as a fruit and grape growing county. Her fine climate and rich soil, coupled with superior irrigation and transportation facilities, insuring for her special advantages for the prosecution of this industry, to which so much attention has been given of late.

QUARTZ MINES AND MILLS.

AUBURN DISTRICT.

This branch of mining has, for the past year, been rather inactive in and about Auburn, most of the work done being in the nature of prospecting and assessment work. The new five-stamp mill in Auburn ravine, near the Ohio Mine, has been running on ore from that mine. The Gold Blossom, ten stamps, the Shipley, ten stamps., the Pelster, five stamps, and the Thirty-one Mill, all in the same vicinity, have, for various reasons, been idle most of the time.

THE BELL MILL.

At Bald Hill, three miles northwest of Auburn, A. O. Bell has been running a Kendall National Rocker, No. 2, operated by an overshot wheel twenty-four feet in diameter, with ten inches of water, costing 10 cents per inch, \$1 per day. This quantity of water, however, supplies the mill. The ore worked is from various small rich veins in the vicinity. This rocker receives pieces the size of a hen's egg, and, with a No. 7 diagonal slot screen, treats from seven to ten tons of rock in twenty-four hours. Mr. Bell, who has had much experience in building and working stamp mills, is of the opinion that this rocker will work more ore and do it better than any stamp mill. He furthermore states that he works raw sulphurets (blanket washings from the mill) almost up to the fire assay.

In working quartz the mill is fed continuously with ore and water; but when working concentrates the screens are replaced by two-inch plank, in which are three half-inch plugholes at different levels. The mill is charged with five hundred pounds of sulphurets, and water enough added to make a rather thin pulp; quicksilver is also added. The rocking is then continued until the ore is finely ground, or rather crushed, for the action of this mill is similar to that of rolls. The upper plug is then removed and the pulp withdrawn. The plug being replaced, more water is admitted, and the working continued some time longer, when the next lower plug is taken out, and so finally the lowest, after which the mill is again charged as before. The roller weighs from one thousand five hundred to one thousand eight hundred pounds; but the next new set of shoes will make the weight one ton, which is equal to the weight of the mortar or cradle. This mill costs \$500, including iron in the rocker and the water wheel, also the toothed segment for the latter, and the gear wheel for connection with the rocker. There are no belts, though Mr. Bell thinks a belt would be better than the toothed gear.

As to the proportion of gold recovered in the rocker, this gentleman says he obtained \$320 to \$5 on the plates. This, however, must depend partly on the coarseness of the gold, although it seems likely that the rolling action of this style of mill will not cut the particles of gold as much as the revolving stamp mill. A plate of amalgamated copper is placed on the lip of the mortar, which forms an arc of a circle, the plate being bent to fit. There are also in use here copper-plated sluices, as in a stamp mill. simplest gold mill in use, and seems to be efficient. This is the simplest gold mill in use, and seems to be efficient. According to Mr. Bell, it will not cost more than \$65 per year to keep the machine in running order. A set of rings for the roller mill lasts twelve months. Two sets of dies are required to one of rings.

BUTTES MINE.

This mine, located three fourths of a mile southwest from the town of Ophir, in Ophir District, covers a surface area of one thousand five hundred by six hundred feet. Course of vein, east and west; dip, southerly, at an angle of 45 degrees; thickness, four feet. Length of pay shoot, one thousand two hundred feet, so far as developed. Hanging-wall, a talcose slate; foot-wall, porphyry. This mine makes but little water. The croppings have been extracted to a depth of eighty feet for a length of one thousand two hundred feet. A tunnel eight hundred feet long cuts the vein at one hundred and eighty feet from the surface, and a winze has been sunk to a further depth of forty feet. Ore to the amount of one thousand five hundred tons has been extracted. A contract has been let to drive the tunnel for \$6 per foot, the contractors furnishing powder and light, the company supplying tools.

The company has made three fourths of a mile of ditch, and a like length of road, besides branch roads about the mine. The ore is quartz, containing about \$8 per ton of free gold, but the chief value is in the sulphurets (pyrites and galena), which, beside gold, carry much silver. The method of treating the ore

is by wet stamping and amalgamation in a five-stamp mill, driven by an overshot water wheel. Seventeen men are employed at an average of \$2.50 per day each. Projected improvements are boarding and lodging houses for a large force of men, and a twenty-stamp mill to be run by a Pelton water wheel, water to be brought from Bear River, with about one hundred and seventy feet of fall.

Average width of vein ----- 4 feet
 Length of pay shoot ----- 1.200 feet
 Average value of ore per ton in free gold- - \$8
 Length of tunnel ----- 800 feet.
 Vertical depth reached ----- 210 feet
 Length of road built.. ----- ¾ mile
 Length of ditch built----- ½ mile
 Number of stamps----- 5
 Number of men employed ----- 17
 Wages ----- \$2.50perday.

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ST. LAWRENCE MINE.

This mine is one half mile northwest of the town of Ophir, at an elevation of six hundred and fifty feet, including an area of one thousand five hundred by six hundred feet. The vein here has an east and west course, dips to the south, and so far as explored has an average thickness of eighteen inches. The length of the ore shoot is one hundred and twenty-five feet. This consists of a stringer running nearly parallel with the main vein, on which are four ore shoots. This stringer is worked by a tunnel, which follows it a distance of two hundred and sixty feet. The walls are granitoid-more accurately protogenic gneiss, a stratified rock consisting principally of quartz and talc.

The vertical depth reached in the tunnel is one hundred and fifty feet. Cost of tunnel, \$6.75 per foot, with single hand drilling and Giant powder, No. 2, of which forty pounds are consumed monthly in driving and also in stoping. The tunnel is advanced one foot per day by the work of two men. Timber, used only for the shafts, costs \$18, per thousand for pine, brought from a distance of three miles. The ore is quartz, with iron and copper pyrites and galena. The ordinary class of rock is worked by wet stamping and amalgamation in the adjacent St. Patrick Mill, leased for the purpose. That which is heavily charged with sulphurets is selected and sent to the reduction works at Reno, at a cost of \$30 per carload for freight. The charge for smelting is \$14 per ton, the price paid less working charge is 95 per cent of the assay value in precious metal. The above mill has fifteen stamps of seven hundred and fifty pounds each, dropping from four and a half to five inches at the rate of eighty drops per minute. The shoes and dies are of steel, costing \$120 per set, from Pittsburg. One set crushed one thousand two hundred tons of ore, thus costing 10 cents per ton of ore crushed. The fifteen stamps crush one and two tenths tons each per day of twenty-four hours.

The mill is worked at intervals only, as ore is accumulated. The screens are wire gauze No. 40 and round punched No. 6, with a length of thirty-six inches by a height of five inches, and are fixed in a vertical position. The aprons are forty-two inches in width at the upper ends and eighteen inches at the lower, with a length of six feet. The plated sluices are five inches wide by fourteen feet long to each battery. The plates are silvered. Inside mortar plates are also used of the length of the mortars and four and a half inches high. The mill is furnished with two Hendy feeders, one Brodie rock breaker (sixteen inches), six Hendy concentrators, one Knox pan, one Wheeler pan, and two settlers. The pans are used in

working the concentrates, by amalgamation with the aid of nitre and salammoniac; but in general it pays better to ship the sulphurets to Reno. Nearly the whole of the amalgam recovered is found in the batteries. The sulphurets assay from \$70 to \$200 per ton; two thirds being gold and one third silver. The mine now employs three men at \$2.50 per day each. The mill when working employs two men, who are paid \$3 a day each. The mill is driven by a Knight wheel, with eighty inches of water at six-inch pressure and one hundred and sixty feet fall, costing 10 cents per inch per day.

Altitude -----600 feet
 Length of ore shoot ----- 125 feet.
 Vertical depth reached in mine. ----- 150 feet
 Length of tunnel ----- 260 feet:
 Cost of tunnel ----- \$6 75 per foot
 Number of stamps ----- 15
 Weight of stamps ----- 750 pounds
 Drop of stamps, inches ----- 4½ to 5
 Drops of stamp, per minute ----- 8 0
 Duty of stamp ----- 1.2 tons in 24 hours
 Kind of shoes and dies ----- -Steel
 Cost of shoes and dies ----- \$120 per set
 Cost of shoes and dies, per ton crushed -- 10 cents:
 Kind of screens ----- Wire, No. 40; round punched No. 6
 Dimensions of apron ----- 6 feet long and 18 to 42 inched wide.
 Plated sluices to each battery ----- 14 feet long and 5 inches wide.
 Kind of feeder ----- Hendy, No. 2
 Kind of rock breaker----- Brodie
 Kind of concentrator ----- Hendy.
 Number of men employed ----- 3
 Wages ----- \$2 50 per day.
 Water used for power ----- 80 miner's inches.
 Cost of water ----- 10 cents per miner's inch
 Fall of water for power ----- 160 feet.
 Kind of water wheel used ----- Knight.

RISING SUN MINE.

This mine is situated in Illinois District, about one mile northwest of the town of Colfax, being on the same quartz belt that extends north through Grass Valley. It is an early location, has been extensively and systematically worked, has been a large producer of bullion, and is well equipped with plant. Work on the property is stopped on account of litigation. The mine is opened by a vertical shaft to the depth of three hundred feet, when the vein dips to the southward and is followed six hundred feet by an incline shaft, all timbered. The walls are granite. The mine makes a great deal of water, which, when working, was raised by a Cornish pump. The ore is quartz, with free gold and pyrites, and is treated by wet crushing and amalgamation. On the mine is a mill with twenty stamps of nine hundred pounds weight each, with a drop of five inches eighty times per minute. 'The duty per stamp in twenty-four hours was one ton, through a wire screen of sixty meshes to the running inch. The shoes and dies are of cast-iron,

The feeders, the Hendy Challenge. The apron plates are silvered. There are four Frue concentrators in the mill. The concentrates were sent to Nevada City for treatment by the chlorination process. The mine, when worked, employed thirty men at \$3 per day. This mine has yielded \ \$2,000,000.

Altitude ----- 2,290 feet
Length of ore shoot ----- 500 feet.
Depth of ore shaft on incline ----- 960 feet.
Character of hanging-wall ----- Granite.
Character of foot-wall ----- Granite.
Shaft timbered ----- 900 feet.
Number of stamps ----- 5
Weight of stamps ----- 900 pounds.
Drop of stamps, inches ----- 5
Drops of stamp, per minute ----- 80
Duty of stamp ----- 1 ton in twenty-four hours.
Kind of screen ----- Wire, No. 60.
Kind and number of feeders ----- Hendy, 4
Kind and number of concentrators --- Frue. 4

BIG OAK TREE MINE.

This property was located in 1886 as the "Milford," and relocated in July, 1883, under the present name; is situated in the Illinois District, about one mile west of Colfax. Stopped working on May 7, 1888, on account of litigation, and has not yet (June 13, 1888) resumed; consequently the mine cannot be examined, being full of water.

The following information as to the mine was given by Joseph Werry: Course of vein, northeast and southwest, and dips to the northward 80 degrees; average width, sixteen feet. The length of the pay shoot is not known. The mine has one vertical and two incline shafts, the deepest (on the slope) being one hundred and eighty feet. The walls are crystalline rocks of granitoid character, highly siliceous. The cost of extracting ore was about \$6 per ton, and the sinking of the shaft cost \$20 per foot, including timbering, guides, etc. It was sunk at the rate of nine feet per week, six men working. The entire length is timbered with pine, at 10 cents per running foot, the timber having been cut on the ground. The company has built one half mile of road for the purpose of hauling the ore to the mill of the Rising Sun Mine adjoining. To transport the ore to the mill cost 25 cents per ton by wagon. The ore is quartz with free gold, which is often visible to the naked eye, and a little pyrites. It paid \$25 per ton in free gold. It was shown, in the evidence given in Court, that prior to the destruction of the old hoisting works by fire, in August, 1887, the mine had paid a profit of \$30,000 since its relocation in 1883. and good, and cost over \$5,000. The present hoisting works are new. The mine is at present under injunction, pending a decision as to whether the land is mineral or agricultural, it being on a railroad section (33).

THE GOLDEN EAGLE

Is another mine on this property, and is said to be the extension of the Rising Sun. There is a shaft on the vein seventy feet deep, showing a vein eighteen inches wide, but not of paying quality so far. The strike of this vein is northeast and southwest.

The Werry is the extension of the Golden Eagle. It has a crosscut tunnel in three hundred feet to the vein, and a drift on the vein. No ore milled yet. Yet another mine owned by the same parties, or some of them, is the Little Pine. It is an extension of the Big Oak Tree. annual work has been done. Nothing more than annual work has been done. All of these mines are on the same quarter section. The situation is very advantageous for a deep tunnel from Bear River, on the Golden Eagle, and thence to the Rising Sun, with crosscuts to the other mines. There is a good mill site on the river, owned by S. D. Valentine & Co. Water power can be obtained from the river to operate a large mill.

NEWCASTLE DISTRICT.

KIDD & JOHNSON MINE.

This mine is situated one and a half miles northwest from the town of Newcastle. Course of vein, nearly east and west; width, twenty-four inches; dip, south 35 degrees. Ore: quartz, galena, pyrites, free gold. Incline down eighty feet, for the purpose of cleaning out mine, the former workings of which have caved in. A good deal of water is met with, requiring the services of a four-inch pump. This pump, similar to the Cornish, is worked by a ten-foot overshot wheel, thirty inches of water being used to pump and hoist. The shaft is timbered. The claim is on a United States patent for agricultural land. There is another parallel vein on the land, from eight to ten inches wide, carrying free gold. The Pugh Mill is idle at present, but is to be started soon on custom work at \$2 50 per ton. This mill, which is driven by an overshot wheel thirty feet in diameter and thirty inches breast, using forty-five inches of water, has five stamps of six hundred and fifty pounds weight each.

DRIFT GRAVEL MINES.

DARDANELLES MINE.

The mine is situated one mile southwest from the town of Forest Hill, in Forest Hill District; embraces a tract of 312.77 acres. The ground is opened by a bedrock tunnel two thousand feet in length, driven at a cost of \$10 per foot through a slate formation. At about six hundred feet from the entrance the tunnel cuts a fissure in the slate, having a course north 1.5 degrees west, and south 15 degrees east, that of the tunnel being north 34 degrees west. The fissure, which is two feet wide, is filled with quartz, in bunches, and a soft, gray mass of volcanic ash. The vein is visible on the present surface, where formerly lay a bed of gravel, which has been washed off, for this was once an hydraulic mine. It is stated that the vein penetrated some distance into the gravel bed. The stratum of pay gravel in this mine, which is five feet thick, is a very hard cement, requiring to be crushed with a stamp. The channel contains a considerable number of boulders. Resting above the gravel is a bed of coarse gray sand, so firm that a post only here and there is required in the breast. The mine is ventilated by a No. 6 Sturtevant blower. The tunnel supplies the greater part of the water required in the battery for working the gravel.

This ground has been worked thirty-six years, mostly by the hydraulic process. The width of the pay channel now being drifted on is not known, but the breast is seventy-one feet in width, gold being visible on the cobbles. From forty to forty-three carloads of twenty cubic feet each are extracted in each day of twenty-four hours. The timbers used are round pine sticks, costing 1 cent per running foot. for the cutting, and 14 cents for the hauling from a distance of half a mile. The mine employs thirty men, at \$3 per day for miners, and \$2.50 per day for carmen. The mill contains five stamps of nine hundred and thirty pounds each, which drop seven and one half inches, from one hundred and one to one hundred and

four times per minute, crushing nine hundred cubic feet of cement per twenty-four hours, through a round-punched screen, holes three sixteenths of an inch in diameter; dimensions of screens, inside of the frame, fifty-four inches by twenty. The battery requires seven miner's inches of water, and is supplied with gravel by a Hendy feeder. The shoes and dies are of cast-iron, costing 7 cents per pound at the foundry. Steel is to be used in the future. The apron is twelve feet long by sixty inches wide, and is plated for three feet near the battery; inclination, three fourths of an inch to the foot; plate not silvered. Beyond the plate the apron has four transverse grooves, about an inch wide and half as deep, filled with quicksilver. Quicksilver is also used in the battery. The pulp passes from the apron to the Eureka rubber, and thence through ripple sluices. On panning some of the material passing from the rubber, no gold was seen. The gravel contains a considerable portion of pyrites, but whether they are auriferous or not is not known. The recovery from the different parts of the mill is divided as follows: In battery, eighty-seven; on plate, seventy-one; in rubber, five and one half, and in the sluices, one and one half per cent. The amalgam from the battery is worth much more per ounce than the other, being formed of coarse gold. The mill, which is new, and framed for ten stamps, went into operation May 18, 1888. The motive power required is obtained from a Pelton wheel, two feet diameter, with twenty inches of water under two hundred and ninety feet pressure, obtained from Volcano Creek: and owned by the mill. Three men are employed in the mill, at \$3 per day each. This property, formerly worked by hydraulic process, was paying well when further work upon it was enjoined by the Courts. The channel here is supposed to be identical with that of the Mayflower Mine.

Length of tunnel- - - - - 2,000 feet
 Cost of tunnel - - - - - \$10 per foot
 Nature of pay gravel - - - - - Cement:
 Nature of bedrock - - - - - Slate
 Depth of gravel drifted - - - - - 5 feet
 Length of time worked (in all) - - - - - 36 years
 Number of men worked in mine - - - - - 30
 Wages in mine - - - - - \$3 per day
 Number of men in mill - - - - - 3
 Wages paid in mill - - - - - \$ 3 per day.
 Number of stamps - - - - - 6
 Weight of stamp - - - - - 930 pounds.
 Duty of stamp - - - - - 180 cubic feet in twenty-four hours.
 Drop of stamp - - - - - 7.5 inches.
 Drops per minute- - - - - 102 to 104
 \Size of screens - - - - - 54 to 20 inches
 Size of holes in screens - - - - - 3/16 inch
 Quantity of water used in battery - - - - - 7 inches
 Quantity of water used for power - - - - - 20 inches.
 Fall of water used for power - - - - - 290 feet.

THE BAKER DIVIDE MINE.

This claim is located three miles from the town of Forest Hill, on the point between Shirt-tail Canon and Volcano Canon. From the face of the adjacent canon a tunnel seven by eight feet has been

carried in three thousand three hundred feet. From the inner extremity of this tunnel an uprise one hundred and twenty-five feet has been made, from which drifting has been extended three hundred and seventy-five feet. It is proposed to carry this tunnel forward another five hundred or one thousand feet till it intersects the channel which, coming down the divide from the Damascus and Waske Mines, passes through the Mayflower claim. This tunnel did not require timbering for the first one thousand five hundred and seventy-five feet; farther on, however, this became necessary. The ground has all to be blasted. Two of the National compressors, made at the Phoenix Iron Works in San Francisco, are employed for driving the drills. One of these is located near the office, four hundred feet above the tunnel mouth, and is driven by a fifty-horse power engine, the air being conveyed down the hillside to the receiver at the tunnel mouth by a two-inch pipe. This is used only when water is scarce. The other machine, located near the tunnel, is driven by a Knight wheel, placed two hundred and seventy-five feet further down the hill, which is so steep that a person can with difficulty stand on it. The power of the wheel is conveyed to the compressor by means of a wire rope. The water for the Knight wheel is taken from Shirt-tail Canon and flumed around the almost vertical hillside a distance of three thousand seven hundred feet. This flume is built for the most part on the grade of the old Union ditch, made in 1850 to 1851 to carry water to Georgia Hill. The planks for the old flume were hewn out of trees, and their remains are still to be seen.

The long tunnel is supplied with air by a No. 5 Anderson noiseless blower, operated by a Knight wheel of twelve inches diameter, impelled by a jet of water under two hundred and seventy-five feet fall, through a five-inch to a two-inch pipe. It requires about four miner's inches of water, under the above pressure, to drive the blower at the required speed, which, however, is not by any means the maximum.

Owing to the steepness of the country the installation of this plant must have been extremely laborious. The drill used is the National. The powder, Hercules, containing 40 per cent of nitroglycerine.

Work was begun on this property three years ago, but some delay was occasioned by the failure of the water during the dry season, for which reason the steam engine was added to the plant last fall.

WASHINGTON GRAVEL MINING COMPANY.

This claim lies between the Breece and Wheeler and the Mayflower. Work was begun in the fall of 1883, when a shaft was sunk three hundred and sixty feet to bedrock, exposing about two feet of gravel. They then drifted northward. about four hundred feet and found the bedrock to be level. They also drifted southeast three hundred feet, and north 60 degrees west nine hundred and fifty feet, when bedrock was lost. Fair prospects were got, but work was discontinued for a time.

The shaft is five and one half by twelve feet clear, has two compartments, and is well timbered. Of the drifts only that to the northwest is timbered, the other being in bedrock. The plant consists of two boilers fifty-four inches in diameter and sixteen feet long, a hoisting engine of fourteen-inch cylinder and a two-foot stroke, single-gear hoist, pumping engine, with fourteen-inch cylinder and three-foot stroke, also Wheelock's automatic cut-off, and two Cornish pumps of ten-inch bore and eight-foot stroke which have been taken up since the stoppage. This plant is well housed, and every precaution is taken to prevent deterioration by rusting etc., until it shall again be put to use. It cost \$25,000 and is first class in every respect.

THE MAYFLOWER GRAVEL MINING COMPANY

Own a claim adjoining the Pine Oak. It is stated that this mine is bonded. The mill has been taken down for the purpose of removal to a point below the new tunnel. The mine heretofore has been worked

by a shaft, which was expensive on account of the large quantity of water which had to be raised. At present nothing is being done, pending the duration of the bond.

BREECE AND WHEELER MINE.

This property, located near the town of Bath, in Bath District, at an altitude of two thousand eight hundred feet, comprises a number of claims, some of them taken up as early as 1856. The channel in this ground bears north 40 degrees west magnetic, and has lately averaged a width of fifty feet. The tunnel is seven thousand feet in length, and cost on an average \$8 per foot. The formation passed through is gravel, the bedrock being slate. The pay gravel is cemented and has to be crushed in a mill. The average depth extracted is seven feet. Average yield per carload of one and a half tons was \$31, for the years 1882-3; that for later years is not given. At the present time the yield is about \$9 per carload, and the extraction twenty-seven carloads daily. But little timber is required in the mine and cost only the cutting and hauling. About thirty inches of water issues from the tunnel. Boulders are not numerous except in spots. Hercules powder is used.

The mill has ten stamps of eight hundred and fifty pounds each, dropping ten inches, eighty-five times per minute, and crush twenty-seven carloads (forty and a half tons) in twelve hours, through a screen of iron wire mesh of one eighth of an inch clear opening. The screens are each four feet long and two feet high. The battery is fed by hand, the large cobbles being taken out and allowed to weather, before being washed in a flume four hundred feet long. There are no plates in this mill, but simply a wooden apron with eight transverse grooves about one and a half inches wide and one half inch deep containing quicksilver; the inclination is three quarters of an inch to two feet. From the apron the pulp passes to the Eureka rubber, and thence through two hundred of ripple sluices. Of the amalgam obtained 75 per cent is found in the battery while the dies are new, decreasing to 50 per cent as the dies wear down, leaving less room for the amalgam to accumulate and remain undisturbed by the action of the stamps. From twenty to twenty-five men are employed in the mine at \$3 per day. The mill employees three men at from \$3 to \$3.50 per day; four being engaged on outside work. The mill is worked by steam power, with a consumption of one and a half cords of wood in twelve hours.

Altitude	-----	2,800 feet
Length of tunnel	-----	7,500 feet
Cost of tunnel	-----	\$8 per foot
Nature of pay gravel	-----	Cement
Nature of bedrock	-----	Slate
Width of pay channel	-----	50 feet
Depth of channel drifted	-----	7 feet
Pay per car (2 tons)	-----	\$ 9
Number of carloads	-----	27 per day
Gross daily product	-----	\$243
Number of men in mine	-----	20 to 25
Wages	-----	\$3 per day
Number of men in mill	-----	3
Wages in mill	-----	\$3 to \$3.50
Number of men on outside work	-----	1
Number of stamps	-----	10

Weight of stamp ----- 1;50-,,d1,0
Drop of stamp ----- 10 inches
Drops of stamp. ----- 85 to 95 per minute.
Duty of stamp ----- s in twenty-four hours.
Kind of screen----- Iron wire, mesh ½ of an inch.
Size of screen ----- 48 by 24 inches.

PIONEER AND LYNN MINES

Are situated one and a half miles from Damascus, in Damascus District. The Pioneer is an old location, and has in time past turned out a good deal of bullion. The claim, which covers an area of six thousand by six hundred feet, includes four separate veins, on which considerable work has been done. The present owners, James G. Fair and A. E. Davis, are making a good road to the mine, and propose erecting on it a forty-stamp mill.

The Pioneer vein was worked from 1854 to 1862, then abandoned until 1880. Two ore shoots were opened and worked to water level, paying from \$8 to \$40 per ton. The tailings will assay \$10 per ton, and the concentrates \$200 per ton. The north shoot has been stoped five hundred feet in length, the south shoot one hundred and thirty-five feet.

THE DORER MINE AND MILL

Are located on the North Fork of the American River, three miles northeast from Damascus. Vein, five to eight feet wide. Tramway from mine 60 ten-stamp mill on the river; latter driven by a Pelton wheel. Has tunnel on vein three hundred feet. Cost of milling and mining, \$2 per ton.

THE SHERIDAN MINE

Is situated near the station of the same name, on the stage road half way between Auburn and Forest Hill. A vein of quartz, some of which is very rich, occurs here between slate and sandstone. There are rich stringers in the sandstone. The mine is worked in a small way by washing the soft, ledge matter and pounding up the richest of the quartz in hand mortars.

MOUNTAIN GATE GRAVEL MINE.

This mine is in the town of Damascus: in Damascus District. Some of the claims of which the property consists were located as early as 1852. The ground of the present company comprises one thousand and four acres, traversed by two different channels. It is opened by and worked through a tunnel seven thousand two hundred feet long, constructed at a cost of \$7 per linear foot, track, etc., included. The formation passed through is slate, which also constitutes the bed of the channel. course of the channel is here a little west of south. The gravel is of the loose or soft variety, admitting of its being washed in sluices. It is drifted out up to an average of five feet above bedrock, and has yielded an average of \$2 per carload for two years- a carload being one and three fourths tons, and thirty-two carloads being extracted daily. The mine has been worked thirty-six years, during which time two acres have been hydraulicked and twenty-five acres drifted.

The channels, for there is here a double channel, are capped with "chocolate cement." lower merely posts That in the upper channel requires lagging; in the and caps. The timbers used are fir and pine, obtained at 6 cents per running foot, merely the cost of cutting and delivery, the trees growing

on the property. The mine makes about sixty miner's inches of water per day. In the upper channel, containing "white gravel," consisting mainly of quartz, many large bowlders are met with, while in the lower channel the gravel is black, and but little quartz is found. The Superintendent believes the lower channel to be identical with that of the Red Point, or Golden River Mine. The upper tunnel was run in the white gravel six thousand feet, when a cross channel was encountered, occupying a level eighty-eight feet deeper. A new tunnel, one hundred feet lower, was then run in six thousand eight hundred feet, when a still lower part of the cross channel was found, making pumping necessary. A thirty-six foot overshot wheel of twenty-six inches breast was put in and driven by water from the upper tunnel. This answered for a time, but, as work progressed, was found inadequate to deal with the increasing influx of water. A branch drift was then made to tap the deep channel, and another wheel and pump were put in, a thick wall of gravel being left between the two in order to prevent the water from the first opening finding its way into the second. The pumps now suffice to keep the water down (June eighth), but a more effective arrangement will soon be required. The upper channel is three hundred feet wide, the lower four hundred and fifty feet, so far as yet known. The mine is ventilated by means of the combined tunnels aided, when necessary, by a fire in a furnace built for the purpose. The mine employs twenty men, at \$3 per day each for whites, and \$1.50 for Chinese. The gravel is washed in sluices in the ordinary way, by means of the water coming from the mine. The worn-out car wheels are utilized as riffles. There are also slat riffles, which are better. Quicksilver is used in the lower sluice boxes.

Altitude at tunnel ----- 3 800 feet.
 Course of lead ----- A little west of south
 Length of tunnel ----- 7,200 feet:
 Cost of tunnel (with tracks) -- \$7 per foot.
 Nature of gravel ----- Free
 Depth of gravel (drifted) ----- 5 feet
 Pay ----- \$2 per carload.
 Number of men employed ----- 20
 Wages ----- Whites, \$3 per day; Chinese, \$1.50
 Gross production per month, calculated on stated average yield per carload and
 daily extraction ----- \$1,920

HIDDEN TREASURE MINE.

This mine is situated four miles westerly from the town of Damascus at an altitude of three thousand six hundred and ten feet. The claim covers about four hundred and eighty acres, and includes two miles of the channel, which, so far as developed, holds a north and south direction. And up to the present time (June eighth) has shown an average width of between four hundred and five hundred feet. This mine has been worked for about ten years, and is now operated through some eight thousand feet of tunnel traversing a slate formation. For fifty feet this tunnel has a double tramway. The mine is timbered all through with spruce, and pine, an ample supply being near at hand. The tunnel yields sufficient water for washing the gravel. Very little blasting is required. Ventilation is secured by means of a special air drift, extending to the end of the working tunnel. The cars, of which there are four trains of sixteen cars each, are drawn into the mine by horses, and come out by gravity, the grade being such as to make a brake necessary to prevent too high speed. The bed of the channel is slate. The gravel, which is of a loose character, is drifted to the depth of six feet, from three hundred to four hundred carloads, averaging one

ton each, being extracted daily by the labor of one hundred and thirty-five men, at \$3 per day each for whites, and \$1.75 per day for Chinese, and yielding about \$1.50 per carload. Quartz bowlders are abundant. The gravel is dumped into a chute and falls to the washing floor, whence it is washed into the sluices by a stream of water from a hose and nozzle, under a pressure of twenty feet. There are two sets of sluices, with an intervening drop of fifteen feet, the first set being three hundred feet long, the second much longer. These sluices are lined with blocks of spruce and worn-out car wheels, the latter being good riffles for coarse gold ore are used in the upper sluices. A little quicksilver is used near the lower end to retain fine gold. According to report this mine has paid dividends regularly for ten years.

Altitude - - - - -	3,610 feet.	Length of time worked - - - - -	10 years:
Length of tunnel - - - - -	8,000 feet.	Number of men employed - - - - -	135
Nature of pay gravel - - - - -	Free	Wages, whites. - - - - -	\$3 per day.
Nature of bedrock - - - - -	Slate	Wages, Chinese - - - - -	\$1.75 per day.
Depth of gravel drifted - - - - -	6 feet		

GOLDEN RIVER MINE.

This mine is situated a short distance below Damascus, at an altitude of four thousand one hundred and twelve feet, and comprises four claims, aggregating about two thousand two hundred acres. Course of channel at this point east and west; width, four hundred and sixty feet. Gravel was struck in November, 1887; the bedrock tunnel, two thousand feet long, having been commenced in July, 1886. The total length of tunnel to date (June, 1888) is three thousand three hundred and forty-nine feet. It is seven feet high and eight feet wide; cost \$12.40 per foot, and was driven at the rate of nine feet per day, by the aid of a No. 44 Straight-line Ingersoll air compressor, and three Ingersoll Eclipse drills, driven by a seventy-five-horse power steam engine, fuel costing \$3 per cord. The powder used is Giant, No. 2. The grade of this tunnel is three inches to one hundred feet. The tracks are of sixteen-pound "T" rails; cars drawn in and out of the mine by horses. Ventilation is secured by means of a No. 4 Baker blower, four thousand feet of eleven-inch main pipe and six hundred feet of seven-inch distributing pipe. A very neat device in this connection is a system of stand pipes two or three feet high from the main air pipe in the tunnel; the upper end of each is curved toward the tunnel mouth by means of an elbow and nipple, and furnished with a stopcock. When the tunnel is full of smoke from blasting first one and then the other of the pipes is opened and thus the smoke is blown out of the mine in a simple and expeditious manner. The position of the channel was determined before starting the tunnel by careful surveys! examination of the channel in the Damascus Mine, and by tracing the vein rock so far as practicable.

The mine shows a bedrock tunnel straight for over two thousand three hundred and forty feet; a depth of six to seven feet of gravel-in places twelve or fifteen feet, the channel being crosscut at every one hundred feet, from rim to rim. A pan of gravel, taken from the face of the advance drift to the eastward at four feet from bedrock, yielded about 12 cents worth of gold, equal to \$6 to the carload. The gravel has been breasted out to the extent of four hundred feet square. The roof is lava, of the kind known locally as "chocolate cement," a term which sufficiently describes its appearance. It is so firm that but little timbering is required—simply single posts and caps; no lagging, except in a few spots in the tunnel, the posts being at least fourteen inches square. The timber used is spruce and pine, costing 63 cents per running foot, found growing on the property in abundance. Of water not enough flows from the mine

to serve for washing the gravel, and a larger supply from this source is a desideratum. Boulders are plentiful, not of quartz, but of diorite and A peculiar dark and light-striped boulder is porphyry. A peculiar dark and light-striped boulder is characteristic of this channel.

It is intended to open this mine by another tunnel, two miles further up stream. The gravel here is of the kind known to miners as “free“ that is, not cemented. It is now being taken out at the rate of three thousand carloads per month. The portion that has been washed has yielded \$2 per carload of twenty-two cubic feet. This, however, has included much bedrock, cut out in leveling the tracks, also roof lava, which it was necessary to remove. This waste stuff, having been passed through the sluices., helps to swell the number of carloads, without adding much to the total yield. The gravel is washed through two hundred and fifty feet of sluices, which will soon be added to. The “riffles” are alternately slat (iron) and Hungarian. A partial clean-up is made every two days. A little quicksilver is used in the lower sluice boxes. The gold is scale or river gold, the largest nugget found being about \$1. The fineness is from 929 to 931. There is a considerable quantity of black sand, part of it magnetic, and iron pyrites, some crystals of the latter being as large as an inch cube. This material is rich, and means are to be taken to save it more completely’ than is now being done. It has not yet been fully determined whether the gold in this material is really free, being merely mixed in a more or less finely divided state, with the black sand and pyrites or whether a considerable portion of it is inclosed in the grains of sand or crystals of pyrites.

The Superintendent thinks the pyrite comes mainly from the slate, and contains no gold of consequence. Certain it is, the country rock abounds in sulphurets, yet it is known that sulphurets occur in the gravel in some mines, being apparently produced by reduction of iron sulphate in percolating water, by organic matter, as wood, etc., existing in the gravel, sulphurets so formed being often auriferous, both in this country and in Australia. Nor must it be hastily assumed that any organic matter which may have been originally buried in this gravel must necessarily have disappeared long ago. There is now a cedar trunk to be seen imbedded in the “chocolate cement” roof of this mine in a perfect state of preservation; not petrified, but only blackened.

Altitude ----- 4,112 feet.
 Length of tunnel ----- 3,349 feet.
 Cost of tunnel ----- \$12 40 per foot.
 Nature of gravel----- Free
 Nature of bedrock ----- Slate
 Depth of gravel drifted ----- 6 feet
 Pay per carload ----- 40 cents to \$6.
 Length of time worked ----- 7 months
 Number of men employed ----- 50
 Wages (whites) ----- \$ 2.50 to \$3.50 per day.
 Wages (Chinese) ----- \$ 1.75 per day.

HOGS BACK MINE.

This mine, located near the Golden River property, is owned by the owners of the preceding mine, but under the corporate name of “ Societe Anonyme des mines d’or de E’orest Hill Divide.” Recently a tunnel has been constructed on this ground, designed to tap the channel in a distance of about one thousand two hundred feet. The intended plant is a duplicate of that at the other mine.

THE HERMAN MINE.

The Herman Mine, which lies one and one half miles southeast of the town of Iowa Hill, in Prospect Hill District, covers one hundred and sixty-two and one half acres, and was worked twenty years ago by the hydraulic method. The course of the channel here is northeast and southwest. This ground has been opened by a tunnel five hundred feet long, driven at a cost of \$15 per foot through metamorphic slate.

The pay gravel is six feet deep, and of the kind called blue cement, similar to that of the Morning Star Mine, which is supposed to be on the same channel. No timbering has been needed here. The gravel is washed in sluices, but requires to be crushed in a mill, in the absence of which a considerable percentage of the gold is lost. Boulders of diorite and quartz are found in abundance, and about three inches of water flow from the tunnel. The mine employs three men, at \$3 per day. The tunnel is a crosscut in a westerly direction to the channel, the further developments consisting of four drifts of the following lengths, namely, seventy, one hundred, fifty-five, and forty feet.,

Altitude - - - - -	2,500 feet	Depth of gravel (drifted) - - - -	6 feet.
Length of tunnel - - - - -	500 feet	Length of time worked - - - - -	34 years
Cost of tunnel - - - - -	\$15 per foot.	Number of men worked - - - - -	3
Nature of pay gravel - - - - -	Cement.	Wages - - - - -	\$3 per day.
Nature of bedrock - - - - -	Slate		

The patent to the above property includes the Iowa claim, exploited by a tunnel three hundred feet in length, and in which two men are employed. This mine has to be timbered throughout. The gold is of coarser grain and finer quality than that found in the Herman claim. It is but little rounded by washing, much of it being still attached to quartz; neither is the gravel cemented. This is a different channel from that of the Herman Mine, being two hundred and fifty feet higher, and having a general east and west course. It is supposed to be identical with that of the Mayflower Mine.

THE MORNING STAR MINE.

This mine, situated a quarter of a mile from Iowa Hill, at an altitude of two thousand six hundred and fifty feet, embraces a tract of one hundred and sixty acres, through which an ancient gravel channel, having an average width of two hundred feet, strikes in a northwest direction. The bedrock is slate, the gravel cemented, and but few boulders are found. The depth drifted is seven feet, the roof is hard cement, requiring only a few posts and caps to support it; though, in other mines of the class, the worked-out spaces are filled, as far as may be, with the large cobbles from the gravel. The mine is opened by two thousand six hundred feet of tunnel, which cost \$16 per foot (the high cost of the tunnel is due to the extreme hardness of the rock and to the use, until recently of black powder). The mine has been worked more or less for thirty-four years, though only about one and a half years by the present company. It is ventilated by an air drift and shaft. The work done by this company since 1886 has been confined to development, an area of three thousand one hundred and forty-four square yards having been blocked in readiness for extraction.

This mine contains seventy-three thousand six hundred and twenty-nine cubic yards of gravel, from which one third may be deducted for boulders and waste, leaving forty-nine thousand and sixty-six cubic yards for crushing. To this may be added one thousand five hundred and seventy-two cubic yards of bedrock, which pays to the depth of eighteen inches. The spruce and pine timber used costs 50 cents per

set of two posts and one cap. The powder used is Safety Nitro, of which seventy-three pounds are consumed weekly. This mine is at present yielding seventeen carloads, one ton to a load, daily, with eight miners working at \$2 50 per day, and eight mechanics, who receive \$3.50 per day.

Between June, 1887, and May, 1888, the mine yielded two thousand three hundred and eighty-four loads, from which were extracted nine hundred and twenty-three and a half ounces of gold, worth \$18 per ounce, giving \$6.97 per load. Between November, 1886, and August, 1887, were taken out one thousand eight hundred and fifty-nine carloads, which yielded a profit of \$8 per carload, about \$11 gross per load. This richer gravel was taken from a deep part of the channel. The gravel being cemented to a hard pudding stone, cannot be washed in sluices, as is done with free gravel, but must be crushed in a mill.

At the mouth of the tunnel is located a steam mill with ten stamps of eight hundred and fifty pounds weight each, dropping from six to eight inches, from sixty-five to seventy times per minute, and crushing four and one half tons of cement per stamp per day of twenty-four hours, through round-punched screens with quarter-inch holes. The shoes and dies are of cast-iron. The feeding is done by hand. The apron is not plated, being simply a broad wooden sluice with transverse grooves about an inch wide and deep, which are nearly filled with quicksilver. About 90 per cent of the recovery is found in the mortar, the other 10 per cent in the grooves. The tailings contain about one half of one per cent of sulphurets, worth about \$128 in gold and \$8 in silver per ton. This material is not saved at present.

Altitude- - - - -	2,650 feet.
Length of tunnel - - - - -	2,600 feet.
Cost of tunnel- - - - -	\$16 per foot.
Nature of gravel - - - - -	Cement.
Nature of bedrock - - - - -	Slate.
Depth of gravel drifted - - - - -	7 feet.
Pay - - - - -	\$6 97per ton
Length of time worked - - - - -	34 years.
Number of men employed - - - - -	16
Wages paid miners - - - - -	\$ 2 50 per day.
The gross monthly product, computed on average yield of gravel per carload - -	\$3,000
Number of stamps - - - - -	10
Weight of stamp - - - - -	850 pounds.
.Drop of stamps - - - - -	7 to inches.
Drops - - - - -	- 65 to 70 per minute.
Screens - - - - -	Round holes, ¼ inch in diameter.
Duty of stamp - - - - -	4 to 5 tons in twenty-four hours
Percentage of recovery saved in mortar - - - - -	90

LIVE OAK DRIFT CLAIM.

This claim is located in Brushy Canon District, two miles northwest from the town of Forest Hill, at an altitude of two thousand six hundred and eighty-six feet. The mine was first opened, to a slight extent, some time in the fifties, when a tunnel was run in, but on too high a level to strike the channel. A shaft was then sunk in the tunnel fifty-five feet to bedrock, and good gravel found; but water came in to a troublesome extent, and another tunnel was driven on a lower level; an uprising having been made, good

gravel was struck; from this some thousands of dollars were extracted, when it gave out. After drifting to a trifling extent without finding any more rich gravel, the claim was abandoned till two years ago, when the present company took hold of it, and soon developed good pay. So far as opened, the course of the channel is north and south. here are three bedrock tunnels, respectively, nine hundred and eighty, one thousand, and six hundred feet long. The cost of driving is, at the present time, about \$6 per foot, using blasting gelatine, No. 1, and Hercules, No. 1, powder, with hand drilling. The formation cut by the tunnel is slate, seamed with quartz. The gravel is cemented, and has all to be blasted. The stratum removed has an average thickness of about eight feet. The channel is from sixty to eighty feet wide, being over one hundred feet in places, From fifty-five to sixty-five carloads of gravel, one ton each, go from mine to mill daily. About twenty inches of water flows from the mine. The entire works underground are timbered with cedar, spruce, and pine, costing 1 cent per running foot. Large quartz bowlders, weighing from fifteen to twenty tons, are frequently met with. The mine employs forty-five men, at \$2.50 and \$3 per day for whites, \$1.75 for Chinese.

The mill, which is located on the mine, has ten stamps, only five of which are running at present, owing to the insufficient supply of gravel. The stamps weigh eleven hundred pounds each; drop nine inches at the rate of one hundred drops per minute, crushing sixty tons of cement in twenty-four hours through a screen with round holes three sixteenths of an inch in diameter, and a surface of fifty-six inches by seventeen inches, using about eight inches of water. The shoes and dies. are of steel from the East; cost per pound and consumption not given. The battery is fed by hand, the larger cobbles being picked out and thrown in a pile, where they are left to weather, after which they are washed. The apron is fifty-six inches wide and twelve feet long, with an inclination of six inches in the length; it is plated on two and a half feet next to the battery. There are four transverse grooves cut in the apron, which contain quicksilver. Following the apron is the Eureka rubber, from which the tailings flow through riffle sluices. Of the value saved 50 per cent is found in the battery, 10 per cent on the plate, and the remainder in the grooves, rubber, etc. The mill employs two men when running five stamps, at \$3 per day. It is propelled by a Pelton wheel, with about sixty inches of water and seventy-four feet fall. The water comes from the Mayflower tunnel and is constant. The mine is ventilated by a No. 3 Noiseless blower.

Altitude ----- 2,686 feet.
 Length of tunnels ----- 980,1,000, and 600 feet.
 Cost of tunneling ----- \$6 per foot
 Nature of pay gravel ----- Cement.
 Nature of bedrock ----- Slate.
 Width of pay channel ----- 80 feet.
 Depth of gravel drifted ----- 8 feet.
 Length of time worked. ----- 2 years.
 Number of men worked in mine -- 45
 Number of men worked in mill --- 2_
 Wages paid whites ----- \$2 50 to \$3 per day.
 Wages paid Chinese ----- \$1 75 per day.
 Wages paid in mill ----- \$3 per day.
 Number of stamps in operation --- 5
 Weight of stamp ----- 1,100 pounds
 Drop of stamp ----- 9 inches
 Drops of stamp ----- 100 per minute.

Duty of stamp ----- 12 tons in twenty-four hours.
Kind of screen used ----- Round punched, & of an inch.
Quantity of water used in battery -- 8, inches.
Quantity of water used for power -- 60 inches

IOWA HILL AND VICINITY.

While there are some promising quartz prospects about this place, none have been developed to any great extent. At Wisconsin Hill a few Chinese miners are cleaning bedrock in an old hydraulic mine. At Elizabethtown a small force of men are drifting in the Sumpter Mine. At Georgia Hill three men are working in a drift. At Grizzly Flat the Cameron Company has driven a tunnel in about three fourths of a mile, at the end of which a shaft was put down fifty feet without finding bottom. At Monona Flat, Watts Brothers are working eight men in a drift mine. They have a tunnel in over a half mile and are washing gravel with remunerative results.

BLUE WING GRAVEL MINE.

Situated on Road Hill {Roach Hill??}, one half mile east of Iowa, formerly worked by J. B. Hobson as an hydraulic mine, is now being worked by him as a drift claim. The channel has a rich streak of gravel at the bottom about two hundred feet wide. The results of six hundred feet of prospecting drifts and gangways gave a yield of nearly \$4,000, some pieces of gold obtained in drifting here weighing fourteen ounces. The gold, which is rough, and mixed with quartz, is of low grade, being only 750 fine. The gold from the top gravel was much purer, averaging 930 fine. This seems to be the general experience in the gravel.

RIVER BAR AND BED MINING.

At Horseshoe Bar, on the Middle Fork of the American River, half way between Forest Hill and Michigan Bluff, an operation is in progress similar to that at the Big Bend on Feather River, in Butte County. At the above bar the Middle Fork makes a loop, almost returning upon itself, and requiring only two hundred feet of tunnel to cut the dividing ridge.

The tunnel is thirty and one half feet wide, and twelve and one half feet high, with thirty-three feet fall; having capacity to take all the water of the river, even at its highest stage. No dam is required beyond a natural rock barrier, which crosses the river bed immediately above the tunnel mouth. The river bed is dried for a distance of one and three quarters miles. Nothing has yet been done towards working the ground, beyond prospecting some of the bars, in which encouraging results were obtained. Although the work was begun in May, 1887, but little was accomplished prior to September, when more active measures were taken, and the job was practically done in three months, only hand drills being used, with Hercules, No. 1, powder. A company is now engaged working Mammoth Bar, on the same river, with an hydraulic elevator. About thirty men, mostly Chinese, are here employed. The machine is operated with about three hundred inches of water, having four hundred feet fall.

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