Mines in the 'Mother Lode' Formations.

In the counties south of Placer, as far as Mariposa, the larger quartz mines are found along a distinct fault zone which runs about parallel to the main axis of the Sierra Nevada, north of northwest usually, and traverses, superficially at least, a series of weak rocks or contacts. These rocks, notably the Mariposa (Jurassic) slates and the greenstones which lie on both sides of them, enter Placer County at its narrowest part opposite Spanish Dry Diggings and extend to the north county-line near Colfax. The structural conditions which made the Mother Lode mines farther south have been dissipated in a great number of small fractures in northern El Dorado County, and in these rocks in Placer County as well, mineralization has been sporadic. The eastward slope of the granitic batholith which produced the mines of the Ophir district is no doubt buried at a great depth under the Mariposa slate in this county. There is another unfavorable condition—the absence of structurally strong but chemically permeable dikes or sills in the Mariposa rocks to form firm walls for the open fissures in which ore deposits might form. It is not surprising that most of the mines there are of the seam type, so common in northern El Dorado County. The only important producer in this belt has been the Rising Sun Mine, but it is interesting to note that its vein outcrops in a contact zone of diabase, serpentine and slate almost at the edge of a small batholith of gabbro.

The Serpentine Belt.

The principal outcrops of peridotite or similar rocks and the serpentine derived from them which, in the counties to the south follow the course of the Mother Lode, lie farther east in Placer County, running north from Volcano Canyon (just east of Forest Hill), to Towle and thence through Nevada and Sierra counties. These rocks are prominent at Alleghany, a district of rich 'specimen' ores in Sierra County. Numerous good-sized specimens of crystallized gold have been found along the contacts of this intrusive rock. It is likely that much of the gold which fed the lower courses of the rich ancient channels under the lava capping of the Forest Hill ridge was derived from such deposits. In these areas, the serpentine and the adjoining schists or gabbro have in places been subjected to intense alteration by alkaline solutions, giving rise to the formation of large bodies of ankerite or similar carbonate rocks, often stained green by mariposite. While the most of such rock may carry a little gold, it seldom makes ore. Gold is at times found in the seams or 'floors' in coarse crystallized pieces as at the Garbe and de Maria Mine in Lady's Canyon or it may occur in a vein along or near the wall, as at the Three Queens Mine, in Volcano Canyon.

East Belt.

East of the serpentine and covering most of the remainder of the gold-bearing area, except where mantled by volcanic flows, are the Carboniferous rocks called the Blue Canyon formation. These are black clay-slates and quartzite principally, with many layers of interbedded igneous rocks which accompany the quartz veins. Quite a large number of scattered mines have been worked in this region. The only pronounced groupings of veins are four miles southeast of Towle and in the Canada Hill section. These veins generally strike north to northwest. The Pioneer, Herman and American Bar have been the most important mines of this type.

Alabama Mine. Alabama California Gold Mines Company, 834 Central Building. Seattle. Washington. William Anderson, president and superintendent. Box 155. Auburn, California. This mine is about a mile east of Penryn on the Williamson property and the surface is covered by a bearing orchard.

The quartz veins of this district, known in early days as Stewart's Flat, were first worked in the 1850's. Two quartz mills were in operation in 1857 and 1858 and a third was built in 1862. No details remain of the results of this early work. The Alabama Consolidated Mining Company was active in the 1880's. The quartz claim which is now the nucleus of operations was patented about 1894 as the American Mine. The mine had lain idle over 40 years when George Phillips and associates began work unwatering it in 1932. The shaft was found to be 200 ft. deep, but comparatively little ore had been mined. The first trial millruns were so encouraging that a 10-stamp mill was erected and sloping was started. The operation was creditable and almost unique in that the working partners reopened, equipped and began production from the mine with their own funds and labor, without recourse to a stock issue.

In February, 1934, after doing further work, Wm. Anderson took charge for the present company. Ten stamps were put in operation in May, 1934. Early in 1935, flotation cells were installed and July 15 ten more stamps were put in operation. About 65 tons of ore was being milled daily at the end of July with a total crew of 26 men.

The vein stands nearly vertical and strikes nearly north. All work late in July was being done upon and in stopes above the 200-ft. level, which follows the vein 565 ft. south and 480 ft. north of the shaft. In the north face, vein was then 55 inches wide, of quartz banded in layers an inch wide with thin seams and some larger irregular bunches of oxidized sulphide. A pronounced layer of quartz 10 inches wide, carrying considerable oxidized sulphide, lies on the hanging wall. On this end the vein is only slightly flexed and offset in two or three places. At the south face the vein is split into footwall and hanging-wall seams and near here the dip flattens to 46° W., with 4 to 5 ft. of quartz. The horse of rock on the west is a darker phase of the granitic rock, probably a gabbrodiorite or gabbro, that on the east being lighter and more decomposed. Not enough work has been done at this face to show whether this is a contact of two igneous rocks or one of those cases of segregation of basic constituents from a parent magma. For the entire distance of 1045 ft. the vein is of good width, 2 to 7 ft. of quartz with 2 to 4 inches of gouge on each wall. Down to this depth the ore is oxidized. The best pay is reported in the layers of quartz varying from 2 inches to 1 ft. wide, found on each wall. Average assays are reported over $9 a ton. Considerable ore is already broken and blocked out above the 200-ft. level. From 50,000 to 60,000 gallons of water is pumped daily. Ore is hoisted in buckets.

After being broken, ore goes by belt conveyor to the mill bin and to 20 stamps, which crush through 30-mesh screen. From the plates, pulp passes to five Fagergren flotation cells, size 28 by 7, run by 1 ½ h.p. vertical motors, 1200 r.p.m. From the last cell tailings go over two concentrating tables. Pine oil and Zanthate 25 are used in flotation. Concentrate forms about one-half of 1% of the ore, and contains pyrite, and a little galena, argentite and telluride. There are small amounts of bismuth, antimony and arsenic reported. Concentrate is said to contain about 9 oz. gold and 120 oz. silver per ton.

For 1935 to October, the company reported milling 11,000 tons of ore which yielded a reported profit of $1 a ton.

Alameda Mine contains one claim and adjoins the Annie Laurie on the southeast. Geologically, it is similar to and an extension of, that mine. Most of the work upon it was done by placer mining, which was facilitated by the steep slope toward American River and decomposed condition near the surface. The last production was between 1902 and 1908, when irregular work on a small scale yielded a few

hundred dollars a year, part of it evidently from quartz ore. The formation was soft and decomposed to a depth of 25 to 40 ft. In 1909, Begole Mines Syndicate of Boston had an option on this and the adjoining Annie Laurie and prospected both of them, but are not known to have made any production.

American Bar Quartz Mine in Sec. 33, T. 14 N., R. 11 E., 3½ miles by road and trail from Michigan Bluff has had several periods of activity since 1895, when the first mill was built, and has been mentioned in earlier reports, the last of these being that for 1922. The mine occupies the slope on the north side of American River and has been worked through a series of adits, the lowest of which is near the river level. The country rock is Carboniferous slate with many interbedded layers of igneous material probably deposited as dikes or sills, with strike similar to the slate but dipping at a small angle to it, at least locally. This igneous rock carries much pyrite and weathers a rusty red. A good exposure of the rock series a few hundred feet northwest of the mill shows a system of alternating layers of slate quartz veins and rusty dikes, striking N. 20° W. and dipping northeast. Some of the veins are 1 to 3 ft. thick here.

The principal production in late years was from 1923 to 1925 inclusive, when American Bar Quartz Mining Company milled over 10,000 tons of ore which averaged over one-half an ounce of gold per ton. The sulphide was surprisingly low grade for such ore. In 1934, Industrial Engineering and Equipment Corporation reopened the mine and milled with 10 stamps at the rate of 30 tons a day for a short time, on lower grade quartz. In 1935, the uncovering of better grade ore was announced, and milling is reported as having been resumed. The best ore in 1924 was reported from 2 to 5 ft. thick and 170 ft. in stope length, probably the largest part of the orebody. In 1934, Level D, the deepest adit in ore, was reported 820 ft. long and 280 ft. deep on the dip of vein.

A 20-stamp mill has a capacity of 65 tons a day.

Annie Laurie Mine comprises six unpatented quartz claims 4 ½ miles south of Colfax on the Forest Hill road. R. H. Young, Colfax et al., owners. G. Nissen worked the decomposed upper part of deposit before 1900 by placer mining. A Huntington mill was installed in 1901. The operation of the mine by Young and by different lessees has been intermittent, but there has been a small production reported nearly every year for the past ten years.

The deposit is a dike lying between schist walls. To a depth of about 25 ft. the dike is oxidized, soft and iron-stained. Below that, it shows as a dense, fine-grained black rock, filled with narrow seams of quartz and carrying considerable disseminated pyrite. Several short adits have been run, and also an open cut which was 550 ft. long, 25 ft. deep and 8 to 15 ft. wide at the bottom in 1931. From here, after dropping through a raise, the ore was hand trammed for about 670 ft. and dropped down a chute on the east side of the hill to the mill. The dike strikes north and dips steeply east, and where the greatest width had been mined north of the raise, the hanging wall had apparently not been reached.

Formerly 10 medium-weight stamps were used for milling. Recently some other equipment, of sufficient capacity only for testing purposes, has been added. Riley Self and associates have had a lease and option during 1935 and have done a little work.

Australian Mine. East of the Copper Bottom drift mine, in Iowa Hill district. No work had been done on this ground for many years previous to 1927, when Delmue, Underwood and Mathews Brothers took a lease upon it and mined a few tons of ore from the two adits. This was crushed in the 5-stamp mill and gave fair returns, but evidently the amount of ore indicated did not give sufficient encouragement for the lessees to continue work.

Beauty Mine. Located at Canada Hill 24 miles by road from Forest Hill, and described in past reports under the title Canada Hill Mines. After the 1927 report was written, a 10-stamp mill was erected

and about 1800 tons of ore was crushed in 1927 and 1928. In January, 1934, Beauty Mines Consolidated, Limited was given a permit to sell stock. Although surface improvements were reported in 1934, the mine was idle late in 1935 and so far as could be learned little new work had been done underground. The mill was operated as a custom plant for a short time in 1935 to crush ore mined on other claims nearby, belonging to other owners.

Big Oak Tree Quartz Mine. Lot 50 in Si of Sec. 33, T. 15 N., R. 9 E., adjoining the Rising Sun Mine on the south. It was originally located as the Milford, but no history of it under that name remains. It was relocated in July, 1883, under the present name and was worked until May 7, 1888, when closed by litigation. During this lawsuit, it is said evidence showed that a profit of $30,000 had been made between 1883 and August, 1887. Little, if any, later work was done until California Premier Mines Corporation produced some ore in 1924 and 1926; Paramount Mines Corporation also reported some production in 1931. The last ore was reported as yielding an average of nearly 0.6 oz. of gold per ton.

The Big Oak Tree vein is about parallel to and 320 ft. south of the Rising Sun vein and lies between diabase walls with gabbro nearby in the footwall. The strike is N". 80° E. and the dip nearly vertical. The ore is said to have averaged $28 a ton. An average width of 18 inches is reported, with a width of 10 inches in some of the deeper faces.

There are two shafts, the deeper being 175 ft. on 65° incline, with three levels at 77, 108 and 165 ft. No. 2 and No. 3 levels are each reported to have been driven nearly 500 ft., encountering faults on the east, one of which throws the vein 18 ft. south at about 225 ft. east of the shaft. On the west, the vein turns to the northwest. From No. 3 level, west drift, a winze has been sunk and No. 4 and No. 5 levels turned from it at 223 and 287 ft. A length of about 100 ft. was stoped just east of this winze and up to No. 3 level. Work has recently been begun on this mine.

Big Pine Mine. {See T. W. A.)

Big Shady Group of six claims and mill-site lie south and west of the Annie Laurie. David Bauer, R. F. D., Colfax, owner. One adit has been run over 300 ft. and another 80 ft. to prospect a ledge which the owner claims has yielded assays of $3.50 and $5.85 a ton across a width of 20 ft. There is a 1-drill compressor, and rail and pipe have been laid in one adit.

Black Hawk Mine is on the North Fork of American River, four miles southeast of Towle by trail. As mentioned in the report for 1927, it was reopened in 1927 and equipped with a second-hand mill of 10 stamps. In 1929 and 1930, Black Hawk Quartz Mining Company reported crushing a total of 110 tons of ore. In 1934, several hundred tons more was crushed, and a road was built.

Black Oak Mine. In SWJ of Sec. 35, T. 14 N., R. 9 E., 3 ¼ miles by road southeast of Weimar, on the railroad and state highway. A. J. Rupp had the property under lease for three years past, but recently (June, 1935) lease has been transferred to Gold Chain Mines Company, H. B. Palmer, local manager. On July 17 a crew of six men were preparing to resume work at the upper adit and sink a shaft just north of its portal. Other land adjoining on the south for a mile and a half is also reported under lease to this company.*

Although mapped as part of the Mariposa (Jurassic) formation, the country rock shows none of the common characteristics of the Mariposa slates in the recent workings (south adit). It resemble the Carboniferous rocks, being hard and imperfectly slaty. Fossil evidence is lacking. The vein swells and pinches, having a maximum width of 18 ft. but closing down to a few inches in places. It strikes about N.

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* This company has lately (1936) given up its lease and Rupp has resumed possession of the Black Oak.

10° W. and dips east at an average angle of 52°. The footwall is a hard dike mineralized with fine-grained disseminated pyrite and traversed by quartz seams.

The vein has been prospected and mined through shallow adits for a length of 1500 ft. On the north end it is said to be faulted 40 ft. by a cross vein. The old lower adit was started just south of this crossing and was run on the vein for 1000 ft. southward. It is claimed that in this distance two ore shoots 600 and 310 ft. long, respectively, and separated by 80 ft. of barren ground, were worked. Although the mine is claimed by the operators to have been an important producer, no official record of the output is available.

The upper or south adit follows the vein 528 ft. farther south, gaining a vertical depth of 130 ft. at the face. Several small stopes have been worked above it, the Moulton ore shoot having been mined to a maximum width of 12 ft. Over one-half of this adit is said to show ore, with the vein having an estimated average width of 4 ½ ft. Just outside the portal of this adit, is a shaft 23 ft. deep, from which a drift 120 ft. long was run. A crosscut from this near the shaft shows the vein in the form of a stringer lead 18 ft. wide, reported by Rupp to assay $9 a ton. Another crosscut 38 ft, south is reported to assay $5.60 across a width of 5 J ft.

There is a 5-stamp mill with one concentrator but if plans are carried out a ball mill and flotation cells will be installed, as over two thirds of the gold in samples taken near the face of the upper adit is in the sulphide. A limited amount of water for milling comes from the mine and from springs. There is an old style compressor run by an auto engine, a small electric generator set, shop and a few small houses on the property.

Blue Eagle Mine (formerly June Bug) is in the E ½ of SE ½ of Sec. 18, T. 12 N., R. 8 E., just west of Eclipse Mine. Address, Hall Livingston, R. F. D. 1, Box 25A, Auburn. Being worked by a partnership.

Some of the veins of the Eclipse Mine extend into this ground, but only a little work was done in the past here, yielding about $1200 from a shallow shaft. The present work is in this shaft, 135 ft. deep on 45° incline. Late in July, 1935, a level had been turned at 120 ft, and the west drift was 50 ft. long. This shaft was sunk on the June Bug vein which strikes south of west and is reported to average 18 in. wide so far, and to give assays of $10 to $15 a ton. A north-striking vein is said to yield lower grade material, of which some has been milled by the present operators. So far the gold from this was found entirely associated with sulphides, but free gold is reported in the drift.

A small single-drum hoist is operated by an automobile engine and a water wheel runs the pump. Power for the mill is furnished by a 25-h.p. Fairbanks Morse Y-type engine. A Straub 10-stamp mill and small ball mill crush ore. Two cuts of concentrate, the first and richer carrying gold, galena and pyrite, and the second a lower grade concentrate, are taken from the Overstrom concentrator. The table tailing passes to two home-made flotation cells, each using a one-third h.p. electric motor.

Bonnie Bee. South of Bear River, and 2 ½ miles west of north of Blue Canyon. Reported to have three veins, 4, 6, and 12 ft. wide, in the Blue Canyon (Carboniferous) slate. Veins strike northwest and have nearly vertical dips. The canyon permitted prospecting by adits, one reported as being 500 ft. long in 1903. In that year, a small mill was put in operation, and a few hundred tons of low-grade ore was crushed. There was also a small production in 1905, since which time there is no further record of activity.

Centennial Mine on Duncan Hill, two miles southwest of Auburn, is an example of a type common in the district. The vein is about 30 inches wide, in amphibolite schist, but pinches down at intervals. It strikes N. 80° W. and dips 70° south. The ore occurred in small rich shoots, from 2 to 50 ft.

long, the formation of which appeared to have been influenced by 'iron crossings,' the miners' term for zones rich in pyrite and chalcopyrite in the amphibolite schist. Ore was mined in 11 or 12 shafts, the deepest 180 ft. After this, adits were run from each end of the claim, one 700 ft. long and the other 900 ft., connecting a few feet apart vertically at one of the shafts. The plan was to mill the entire vein, but this was unsuccessful. The total production was $150,000 or more. The estimated value of ore in the rich shoots was $8 to $12, but the vein as a whole is low grade.

In 1929, some of the rich ore that occurs in places in this vein, was found and stimulated further work. A few hundred tons of ore was milled, but gave low returns, on the average.

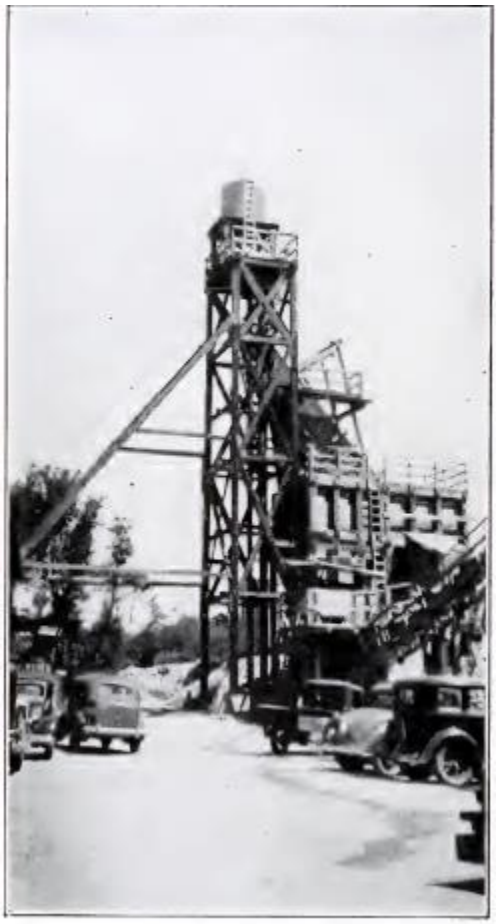
In 1931, Paramount Gold Mines Corporation, Ltd., took this claim and the adjacent Conrad under lease and option to purchase. The plant was placed and most of the work was done on the Conrad, but a crosscut was run to the Centennial. In 1931, the claim was locally credited with the production of a few thousand dollars from a small lot of good ore milled at the Rising Sun mill, near Colfax.

Central Mine. In the canyon of North Fork American River north of the mouth of Humbug Creek seven miles by trail from Towle. The vein strikes northwest in the Blue Canyon (Carboniferous) slates and schists. It was worked in a small way between 1897 and 1903, producing a few thousand tons of ore from an open cut and from stoping above an adit level driven as a crosscut about 140 ft, then drifted on the vein about 200 ft., so far as could be told at time of visit, when caves from the old stope partly blocked the adit. A length of about 75 ft. and from a few inches to 7 ft. thick, had been removed in the stope seen. The ore formed a lens of solid quartz, standing nearly vertical between walls of interlayered grey altered igneous rocks and black slaty schists, typical of the Carboniferous in the Sierra. The walls are hard and stand well, requiring little timber. Ore was reported low-grade.

Lately reported taken over by American River Mines Company in connection with the Dorer Mine, adjoining, and nearby placer mining claims.

Chicago Mine. In Secs. 35, 36, T. 12 N., R. 7 E., 1 ¼ miles east of Penryn. Lessee with option to purchase, Auburn-Chicago Mining Company, 3443 Wilshire Boulevard, Los Angeles, c/o Auburn Auto Sales Corporation. A. N. Sweet, manager. The Elizabeth on the south and Mary Len claim on north of Chicago, are also under option.

The Chicago Mine was worked to a depth of 300 ft. in the 1880 's. The Elizabeth was worked in the 1860 's and both were producers. No reliable record remained of this work, and even the depth and extent of the mine openings were uncertain. The old Chicago shaft, No. 1, is 430 ft. north of present working shaft called No. 2, which is 110 ft. north of the north line of Elizabeth claim. No. 2 shaft is vertical, 405 feet deep, one-compartment and manway. The 110-ft. level has drifts 150 ft. north and 325 ft. south. On the 300-ft. level, drifts were run by this company 420 ft. south and 430 ft. north to No. 1 shaft; thence northward, the old drift was



Head frame, Auburn-Chicago Mine, near Penryn.

reopened 550 ft. On 400-ft, level drifts 360 ft. south and 430 ft north. A sub-level at 360 ft. has a short drift and raise to 300-ft. level. From 400-ft. level, two raises reach 300-ft. level, one a little north of No. 1 shaft, the other 175 ft. south of No. 2. A winze has been sunk 100 ft. below the 400-ft. level. Nearly all the work has been directly upon the vein, including the shaft.*

The vein stands nearly vertical and strikes generally about N. 20° W. except where bent or faulted. It ranges from a few inches to 3 ft. wide, but is as a rule between 1 and 2 ft. wide in the ore shoots. The widest parts are reported low-grade and are composed of solid white quartz. There is little gouge and the granodiorite walls are unaltered and hard close up to the vein so that little timber is required. The best ore is reported to have zincblende in small amount, and galena and pyrite are common, though the total average sulphide content is small, well under 1%. About 40% of gold has in the past been saved in the concentrate. The average yield of ore during the first year of milling was nearly $17 a ton. Average assay widths ranging from 1.1 ft. to 1.85 ft. show wide variations in gold content but general high averages. The vein in the winze, sunk 100 ft. below the 400-ft. level, is reported to show an average width of 1.85 ft., an average assay of 1.38 oz. gold, and a block of ore stoped from it 32 ft. long by 100 ft. deep is claimed to have yielded one-half ounce gold per ton.

On the south, a fault cuts off the ore about 220 ft. from the shaft on the 400 ft. level. The south part of vein is set over some 7 ft. horizontally to the west, looking south. On the 300-ft. level south a fault of more pronounced character appears to be associated with a change of the wall rock from granodiorite toward gabbro, with a black gouge. Secret Ravine probably follows the surface trace of this faulting. Gabbro outcrops about one mile southeast of the mine. There are a number of other flexures in the vein, and the small bodies of higher grade ore are quite possibly associated with obscure sheeted or shear zones in the wall rocks.

Hoisting is done in buckets by a 25-h.p. electric hoist. Separate chutes receive ore and waste. From the grizzly, undersize goes to a bin and oversize to a 9 in. by 16 in. jaw crusher. A 4J ft. by 6 ft. ball mill has replaced the rod mill formerly used. Pulp from it passes to a concentrating table, where a high cut is made for amalgamation. A classifier takes the table reject and delivers fines to five flotation cells, returning coarse to the mill. Flotation concentrate and tailing from the clean-up barrel are sent to a smelter. The capacity of mill is about 65 tons a day and 65% to 70% of the gold recovered is saved by amalgamation.

Conrad Mine. The claim covers about 1200 ft. along the vein, and like the Centennial was worked at times from 1868 to 1890. The vein dips 40° to 50° south and is parallel to the Centennial. It averages about 2 ft. wide but pinches down at places. It lies between amphibolite walls.

The mine has been worked through a tunnel 784 ft. long (180 ft. below outcrop) which is open all the way, and shafts have been sunk from the surface and raises put up from tunnel level wherever pay was found. There is a winze about 60 ft. below tunnel level, but it is said to be off the pay shoot. The largest pay chimney was found 30 ft. above the tunnel and yielded $15,000. The property is credited with about $50,000 production.

The ore resembles that in the Booth more than the Centennial, and is said to run from $4 to $8 a ton away from the rich chimneys.

In 1931, this and the adjacent Centennial claim were taken under lease and option by Paramount Gold Mines Corporation, Limited. A shaft was sunk on the Conrad claim. This was 225 ft. deep on an

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* In April, 1936, the 550-ft. level had been run 125 ft. north and 625 ft. south, and A. N. Sweet stated a length of 190 ft. and average thickness of 18 inches gives good assays.

inclination of 45°, at time of visit. It was later reported to have been sunk to 300 ft. It crosses the old adit at 125 ft. inclined depth.

The mine plant includes a wooden headframe, single drum hoist with electric motor, air compressor and 100-h.p. electric motor, and drill sharpener. The milling plant comprises a Chilean mill of 40 to 50 tons capacity, 40-h.p. motor, small gyratory crusher and motor, and three amalgamating plates. Very little ore was crushed.

John K. Wright is reported to be in charge of these claims since the death of E. C. Klinker, former president of the company.

Crater Hill Mine was one of the principal producers of the Ophir district. Although at times credited with a total yield of $750,000 the writer has been able to find definite figures for only a little over half as much. It was actively worked in the 1870 's by St. Patrick Mining Company, with a gross output of $146,334 from 1873 to 1875, inclusive. Again in the early 1880 's there was considerable production. The mine was closed down in 1884, after the workings had reached a depth of 800 ft. All ore found had been stoped out from the 800 ft. level to the surface. In 1907, W. P. Hammon began unwatering the mine and spent considerable time in exploring the old workings, but is said to have done little new work, except running a crosscut 180 ft. on the 800 ft. level, and drifting ahead a few feet from some of the old faces. A 10-stamp mill was erected, but had crushed less than 2000 tons of ore when the property was closed in 1910 and has been idle since. The underground work extended for a maximum length of 700 to 800 ft. on the strike of vein, and stoping was done principally on the east of the shaft after passing below the 300-ft, level. The principal or hanging wall vein lies between granodiorite walls, strikes nearly east and dips 45° south. J. H. Crossman, the superintendent for the St. Patrick Mining Company during the mining down to the 300-ft. level, described it as having an average width of 20 inches; but the width varies from a few inches to 3 ½ ft. in places. The principal ore shoot was triangular in vertical section, increasing in stope length from 40 ft. near the surface to 203 ft. at a depth of 212 ft., and much longer at 312 ft., where the vein was reported 2| ft. thick. The ore raked east at about 45°.

At the surface the footwall ledge lay 32 feet north of the hanging wall vein and was reported to have been of good grade when worked in early days; no details remain to indicate much later work on it. There are a number of other veins and stringers upon the property, but none of these is known to have been productive, except on and near the surface which was extensively mined in the early days. The two productive veins were connected in Crossman's time by a crosscut at the 150 ft. level, and a shaft on the footwall ledge was used for pumping, there being steam engines at both shafts, 135 ft. apart, supplied from one boiler. The footwall vein supplied some ore that yielded $19.13 a ton, while the hanging wall vein gave $31.52 in gold a ton in the upper levels. Sulphide apparently carried about $100 a ton and formed about 4% of ore. Of this gold content, about 60% was saved by working in pans.

Daniel Webster Mine is 1 ½ miles northwest of Michigan Bluff. It was worked 30 to 35 years ago, yielding small amounts of gold from shallow workings. The veins occur on a placer mining patent, and some seam mining was done. Later, Daniel Webster Mining Company produced a little quartz gold (1921-1922). From 1931 to 1933, Black Bear Consolidated Mining Company had a lease on the ground and reported producing about $4000.

Dairy Farm Mine. Dairy Farm Gold Corporation, Box 326, Lincoln, California. M. C. Lake, president. E. R. Hathaway, superintendent.

Open-pit mining of gold-bearing gossan ore at Dairy Farm Mine, 1935.

This was one of the gossan-capped mines of the foothill copper belt which was first worked for the gold and silver found in the oxidized zone. It is in the Si of Sec. 27, T. 14 N., R. 6 E., 8 miles northeast of Sheridan. The above company had a lease and option on 77 acres.

From 1904 to 1906 inclusive and from 1913 to 1918, this mine produced considerable copper, gold and silver. In the later years the cyanide plant that had been erected to recover gold was not used, and sorted ore was shipped out to a smelter over a narrow-gauge railroad which connected with the Southern Pacific main line north of Sheridan. The yield of the three metals varied greatly, ranging from $1.25 to over $4 a ton in gold, from a few cents to $1.70 in silver, and from less than 1% to 15% copper, the latter probably coming from picked ore, not mined by the shrinkage method usually followed. Work stopped in 1918 when the price of copper fell, and the mine lay idle until the last company began operation in 1933. The reduction plant began running in December, 1933, on the remaining gossan ore, and was in operation about 2 years.

Surface plant at Dairy Farm Mine, near Sheridan, 1935. The cyanide equipment has recently been removed.

In different parts of the open cut, where mining was done with a Thew three-fourths cu. yd. shovel, the textures and grades of ore varied so widely as to affect the success of the treatment. In spots, a soft, friable gossan composed principally of iron oxides and breaking up into slimes and fines was found. Elsewhere, the ore was hard enough to yield a satisfactory coarse product on crushing. Again, the amounts of free acid, silica and clay varied in different places, some old fills and dumps being especially high in acid. To give as nearly uniform a product as possible for the cyanide plant, the shovel was moved about to dig the various kinds of material and a system of stockpiling was used from which mill feed could be drawn.

Ore was delivered in trucks to the bin and was broken in a 9 in. by 36 in. Wheeling crusher, screened through a 3 ft. by 4 ft. Colorado impact screen and oversize crushed in 26 in. by 15 in. rolls. It was given a preliminary washing with water for 16 to 24 hours to remove free acid before cyanide treatment. There were six leaching tanks, four of them 25 ft. by 8 ft. and two 25 ft. by 10 ft., each loaded

with from 100 to 125 tons of ore. From 8 to 12 lb. of -10 mesh Auburn Chemical lime was used per ton of ore. Strong, weak and barren solution storage tanks carried solutions containing from 1.2 lb. to 0.6 lb. of sodium cyanide per ton of solution. The charge received strong, weak and barren solution washes in turn followed by a final water wash. Solutions were moved ahead as they increased in gold content, finally going to the new charge. Pour sump tanks each had a pump operated by an automatic float switch. From the gold solution tank, pregnant solution went to Merrill-Crowe precipitation equipment and solution was then returned to the circuit by way of the barren solution storage tank. The cycle of treatment required six days. In July, 1935, about 100 tons a day were handled, with a total crew of 19 men. Recovery was reported to be from 80% to 90%.

The open cut where mining was going on was about 600 ft. long and 30 ft. wide at the bottom. It was about 125 ft. on the dip from the top of footwall, or 90 ft. vertically to the top of the sulphide zone. Mineralization was said to extend into the hanging wall 65 ft. The old mine workings, where sulphide ore was mined, extended about 500 ft. below. The footwall was 'porphyry' and hanging wall, greenstone (amphibolite schist). The sulphide ores occurred in lenses reported to have been 10 ft. to 60 ft. wide, and this accounts for the variations in the character of material mined in the open cut.

This mine was closed down early in 1936, and the cyanide plant was sold and removed.

Devon Mine. California Mines, Incorporated, and four subsidiary promotions reported to be based on prospects south of Weimar and on the west side of North Fork of American River, on the J. A. Graves and Livingstone and Elder holdings. Recently the company relinquished at least part of its holdings, which are now (November, 1935) being prospected by other parties.

Dorer Mine. In the canyon of North Fork of American River, 2 ½ miles southeast of Shady Run and north of Humbug Bar. The vein, striking northwest in the Carboniferous schists, was mined through adits run between 1888 and 1904. Pay was said to occur over a length of 150 ft. and reported width was 4 ft. The production ranged from $1,100 upward annually for several years. A 10-stamp mill was used, and ore was delivered to it by an aerial tram.

The Central claim adjoining, was worked during the same period and produced about the same grade and quantity of ore.

Late in 1934, these claims were reported as having been taken over from Lee Dorer, together with some old placer mining ground at Humbug Bar, by American River Mines Company. Work on both quartz and placer was going on in 1935 and it was expected the 10-stamp mill would be started during the summer.

Drummond Mine is about 10 miles by road from Forest Hill, on a long ridge between tributaries of North Fork of Shirttail Canyon, and extending into the canyon. It contains 320 acres, patented. The early operations are described in former reports. The work was done principally between 1889 and 1899 by C. F. Reed. No mining has been done for a long time. The record of production, given only in round numbers, indicates a total yield of between $150,000 and $200,000.

The country rock is amphibolite schist, locally called 'diorite.' The Drummond or hanging-wall strand and Lynn or footwall strand of the main vein produced most of the ore milled, while the Eclipse, a 'pocket lead' near the north property-line, is said to have yielded considerable 'high grade.' The Wolford is another pockety vein that made some production. The Drummond and Lynn strike N. 60° W. and dip steeply northeast, while the Eclipse and Wolford, regarded as spurs of the first, but not yet so proven, strike east. The widths of the veins vary from 6 inches to 18 ft. of quartz according to J. B. Hobson, and the width between walls of the main vein is in places 30 ft. The older mine workings are mostly inaccessible.

In the No. 1 tunnel, a block of ore 100 by 100 ft. and 3 to 5 ½ ft. thick was stoped by Drummond, the discoverer, and Hobson. To the east the so-called 1st level was run 490 ft. In this, the Lynn strand was stoped 330 ft. long and Drummond strand 70 ft. long by 100 ft. deep. No. 3 adit or '2d level' is only 50 ft. deeper, and 1000 ft. long with stopes 40 and 110 ft. long. The '3d level,' reached by a winze 70 ft. below No. 3 adit, is 350 ft. long, with a stope 190 ft. long and reported 5 to 8 ft. wide. About 350 ft. vertically lower, an adit was afterward run 2000 ft. as a crosscut, drifts were run 150 ft. west and 450 ft. east, and a crosscut was advanced 190 ft. from the face of the west drift. This adit is still open. Some ore is claimed to remain in the old, upper workings. All buildings except one cabin have been burned. A deeper tunnel site is available farther down the canyon.

Eclipse Mine. In NWJ Sec. 17, T. 12 N., R. 8 E., one-half mile northeast of Ophir. Lessee, Grimshaw Properties Company, R. F. D. 1, Box 22, Auburn. V. A. Van Horn in charge.

This mine was a producer from the early 1880 's at intervals until 1906. From 1889 to 1906 the recorded output was about $60,000. The record of earlier yield is not available, though rich ore is said to have come from the Morning Star vein on or near the south line in 1882 or 1883, and the Eclipse claim is mentioned as having been officially surveyed in 1872, covering a length of 2475 ft.

Seven or eight veins or spurs have been mapped by Lindgren on this property. They strike generally a little north of east and dip south usually 30° to 45°, except the Morning Star vein which strikes nearly north and dips east, up to the Good Easter or Eclipse vein. The walls of these veins are both granodiorite, with a streak of soft schist on the hanging wall which had to be removed in mining the two veins named.

The old shaft is 530 ft. deep on 45° incline, with levels called 200-, 300-, 400- and 500-ft. Down to the 300-ft. level the ore has been stoped over a reported length of 750 ft. The Morning Star vein is reported to have been the principal one worked. It is said to strike the Eclipse vein about the 300-ft. level, and to lie on its hangingwall to about 350 ft. deep. Below there, the Eclipse vein steepens and the two are 40 ft. apart at 400-ft. level. The later workings include 520 ft. of drifting on Morning Star vein, a 40-ft. crosscut and 150 ft. of drifts on Eclipse vein on 400-ft. level, a drift 90 ft. east on Morning Star vein on 500-ft. level, a 70-ft, raise from 400-ft. to 300-ft. level about 400 ft. east of shaft, and two small stopes. One of these about 40 by 40 ft. and extending from 350 ft. deep to within 10 ft. of 300-ft. level, and one about 50 ft. high above the 400-ft. level are the deepest. The vein is reported to be narrow and disturbed between the 400-and 300-ft. levels. The veins vary in width from 6 ft. down to a few inches.

On the 500-ft. level the gold is said to be nearly all in the sulphides, which are pyrite, galena, and argentite and form up to 2% of ore, according to V. A. Van Horn, who was in charge of unwatering and prospecting the mine in 1933. Old stopes were found as much as 16 ft. wide. The ore carries up to 9 oz. silver per ton and gold fineness is 664 to 671. In 1902 the average yield per ton was $7.54.

The surface plant comprises a hoist with a depth capacity of 1000 ft., run by an automobile engine; Gardner compressor, one drill capacity, with a 20-h.p. electric motor; a 10-stamp Straub mill said to have a daily capacity of 9 tons, taking one-half to three-fourths in. feed, and run by a 7 ½ -h.p. electric motor, and one concentrator. The mine was idle when visited July 27, 1935.

Elizabeth Mine. Adjoins Chicago Mine, east of Penryn, and under lease to same company. The Chicago shaft No. 2, through which operations are now going on, is only 110 ft. from the Elizabeth north line, so that the south drifts are in the Elizabeth ground.

In addition, work was done upon this claim in the 1860 's when a shaft is reported to have been sunk 120 ft. deep and drifting produced ore which was crushed in a 5-stamp mill, giving a reported yield of $15 a ton.

Ferrier Diggings (Johnny Rafael Mine). L. G. Embree, Forest Hill, lessee in 1935. This is the next claim north of the Garbe & de Maria, on Lady Canyon on the steep north side of the canyon of Middle Fork of American River. Like the latter, it has been a producer of specimen ore, some production having been reported nearly every year since 1919, besides that previously taken out by Ferrier. The principal production was made by Andrew Ferrier, the discoverer, who is reported to have taken out a small fortune from the claim when he traced the source of gold-bearing clay used by neighboring miners in building a forge.

Garbe & de Maria Mine (Dry Hill, Blue Jay). On Lady Canyon on the steep north side of the Canyon of Middle Fork of American River. For many years this mine has been noted for occasional 'pockets' of coarse crystallized gold. At the time of visit, the workings consisted of a network of crooked drifts in the oxidized zone, on a flat seam dipping east about 15° in rock too badly decomposed to classify but probably originally intrusive in the rocks of the Carboniferous series near the serpentine contact. The operators professed to be at a loss to recognize any sure signs of 'pay' The gold is said to occur at times either with or without manganese oxides or iron oxides; at times with quartz and again in mud-filled seams almost devoid of it. A few years ago a small stamp-mill was put on the mine to crush accumulated quartz.

Gold Blossom Mine. One of the more important of the former producers in Ophir district, and frequently described in past reports. It was among the holdings of the St. Patrick Mining Company in 1873 when a shaft upon it was 70 ft. deep and ore yielding $7.50 a ton was reported. By 1890, the shaft was 218 ft. deep, and the Gold Blossom and Marion lodes were being worked, supplying ore to a 10-stamp mill. The ore was reported as containing, besides free gold, a " large percentage of argentiferous galena, zincblende and pyrites containing copper, iron and arsenic." Concentrate at the time was saved on canvas blankets, and cleaned on a Frue concentrator. Some sorted sulphide ore was shipped. Assays of some shipments of concentrate showed from $17.55 to $255.00 gold and from $57.04 to $75.52 silver a ton (silver $1.18 an oz.).

The principal period of recorded production was between 1896 and 1899 inclusive, when over $200,000 was produced. Although the tonnage was not definitely reported, it has been claimed that the ore milled yielded about $8 a ton, but that remaining in the mine was of much lower grade. Most of the production appears to have come from above the 400 ft, level. The main shaft was sunk 480 ft. by 1907 and little has been done since.

The Gold Blossom vein strikes a little north of west and dips south 70° to 85°, being traceable for a mile westward to its junction with the Marion spur vein, and beyond this for another half mile through the Ohio, Trio and Pacific quartz can be traced. Most of the work was done on the two veins near their junction on the westerly Gold Blossom claim, although many shallow holes have been sunk along the outcrop, and one tunnel produced ore. The vein is 2 to 3 ft. thick. The country rock is granodiorite, with a dike of diorite on the hanging wall of the Gold Blossom vein and a dike of amphibolite schist on the Marion vein.

Two mills, the last of 20 stamps, were operated on the Gold Blossom. This mill and some buildings remain at the main vertical shaft but are in poor shape.

Gold Dike Mine. H. H. Marsh, owner, 415 Mill Street, Grass Valley. John D. Leedy, lessee, 3816 Eastern Avenue, Seattle. Four quartz locations in lots 21 and 22, Sec. 5, T. 15 N., R. 13 E., in Canada Hill district 10 miles from Westville. Elevation is about 6300 ft.

The country-rock is the Blue Canyon formation (Carboniferous) showing in the vicinity quartzite and some slate with greenstone dikes. The work in the shaft, which was 108 ft. deep early in August,

1935, on a vein dipping 58° west, was just entering unoxidized rock showing splotches of pyrite and galena. The vein, as shown both in surface cuts and underground, is lenticular. The shaft was sunk on one of these quartz lenses on Gold Dike No. 1 claim. It showed an average width of about 18 inches of quartz. A level was run from the bottom of shaft 50 ft. south and 40 ft. north and both faces showed the quartz pinched, but the continuity of the vein is indicated on the surface by another outcrop starting about 500 ft. from the shaft and extending some 200 ft. southwest with a width up to 3 ft. exposed in open cuts. In the level the quartz varies in strike from N. 37° E. to N. 10° W., probably due to the entry of a dike from the west side with a strike of N. 60° W.

Gold Dike Mine, Canada Hill District.

Ore taken out in sinking the first 50 ft. of shaft was hauled to custom mills in Auburn and Nevada City in 1933, yielding a maximum of $72 a ton and an average of $34. The claims cover a length of over 3000 ft. Gold Dike claim, on the southeast side line of Gold Dike No. 1, has some pits showing bunches of quartz.

The shaft has a hoist operated by a 4-h.p. gasoline engine. Two men were working in August, 1935.

Late in 1935, some ore taken out during' the summer was being crushed in the mill on the near-by Beauty Mine.

Golden West. This is near the North Fork of North Fork American River, about three miles south of Blue Canyon. The prospecting work which was done 35 years ago on a wide body of Blue Canyon (Carboniferous) slate carrying quartz stringers, is said to have included two adits and a shaft 100 ft. deep. No record remains of the results. One adit is reported to have been run 1500 ft.

Grass Ravine and **Workman veins** are in the extreme western part of Ophir district, in the SW ¼ of NW ¼ of Sec. 12, T. 12 N., R. 7 E. The former is about in the line of strike of the Crater Hill veins, and the latter, to the south, is nearly parallel to the Gold Blossom vein series. Both dip south and lie in granodiorite.

The Grass Ravine Mine in 1900 had a shaft which was then reported 325 ft. deep. A mill-run of 150 tons was reported to have been made from this property in 1899 at the St. Lawrence mill but the results of this run were not shown in the year's production records, and the mine name does not appear in any available mint records as a producer.

The Workman is credited with about $6000 production in 1895 and 1896.

The Grass Ravine is being reopened in 1936 by South Star Development Company. Early in April a depth of 150 ft. had been reopened in the old shaft.

Green Mine, three-fourths mile northeast of Ophir, is on a vein striking north of west in amphibolite schist. It is from 6 inches to 3 ft. thick, and dips south 45° to 70°. This mine was a producer of very rich ore in small amounts in the 1870 's. In 1871 a small crushing plant treated some lots of a few tons of ore each, which yielded from $50 to $1,100 a ton. It was reported locally that a 2-weeks run at that time with four stamps gave a total of nearly $50,000. The shaft was sunk to 240 ft. and nothing further was recorded about it after 1873. Most of the amount mentioned came from above the 125-ft. level.

Green Emigrant Mine. This old pocket mine, which was famous in early days, is 4 ½ miles north of Auburn and one-half mile west of Grass Valley highway. It was found by Pike Bell on New Year Eve, 1864. Secrecy was maintained regarding its production, and no reliable contemporary record of the output existed, but Bell's son advised the writer that it had yielded $150,000.

The vein, striking northwest and dipping east in amphibolite schist, occurred as flat stringers of quartz, but on the west on a hill 6 ft. of quartz outcrops. Caved ground and old tunnel portals indicate that several crosscuts and short drifts were run on the stringers. A depth of only 25 to 30 ft. was reached. A length of over 1500 ft. was prospected and mined by shallow cuts and shafts. Pay is said to have been best where "iron crossings" and limestone met the vein.

The Two Orphans prospect on the north, opened deeper, showed auriferous pyrite and chalcopyrite and galena. The Black Lead, a former producer, lies nearby to the south.

Hathaway (Buttes or **Butts) Mine**. In Ophir district, one-half mile southwest of the old town of Ophir. The first record of operations was published in 1888, when it was said that 1500 tons of ore had been milled, yielding about $8 a ton in free gold, besides an unstated amount in the sulphides. The ore shoot outcropped at the surface for a length of over 1200 ft. with a reported width of 4 ft. Besides the shallow workings there was a shaft 210 ft. deep with a lower level. The 5-stamp mill was increased to 20 stamps in 1888, and in 1889 a large yield was reported from the tunnel operations which tapped the upper ore, as well as from the level about 200 ft. deep, where stoping extended over a length of about 700 ft. The record for the next several years is only fragmentary. Yearly production was reported from 1895 to 1903, inclusive, after which time the mine does not appear as a producer. In 1900, when the shaft was 630 ft. deep, the Standard Mining Company of Bodie was furnishing capital for the operations of Hathaway Consolidated Gold Mining Company which held under option the Plantz, Jacobson, Kirkland, Hathaway, Butts Extension and Eureka claims, covering 6756 ft. on the Hathaway vein. This company deepened the shaft to 837 ft. on the incline in 1902, and over 5000 ft. of drifts were run, but details of their work are lacking, although some stoping was done as far down as the 720-ft. level.

The Hathaway vein has been traced at least 8000 ft. It strikes north of west and dips 60° to 75° south, lying in granodiorite. Sheets of altered igneous rock, now amphibolite schist, accompany the vein at the Hathaway mine workings, and at the Kirkland. The vein is 1 ½ to 2 ft. thick in most places. It carries considerable silver, and the percentage of sulphide is 1 ¾ to 2%. The concentrate saved in the earlier operations yielded as much as $230 a ton. Besides pyrite and galena, there were also sulphides of zinc, copper and arsenic reported. Gold was more evenly distributed in this vein, it is said, than in most of those in the district.

Besides the work on the Hathaway claim, a shaft on the Eureka No. 1 claim is reported 280 ft, deep, with levels at 130 and 280 ft. This is on the Hathaway vein west of the Hathaway, in Sec. 13. On the east, the Kirkland claim was worked years ago through a shaft reported 200 ft. deep, but concerning which nothing is recorded. The Eureka No. 1 produced a few thousand dollars in 1902-1903, and was prospected a little in 1915. The last work on the Hathaway was in 1915 when the unwatering of the shaft was started but never completed. All the old plant was removed years ago.

Herman Mine, five miles south of Westville on the road to Deadwood, has been described in our older reports. It was a producer from 1895 annually until 1902, and irregularly from 1903 to 1915. The total reported yield was over $200,000 and from such tonnage figures as are available for the later years, the ore produced $4 to $4.50 a ton. The equipment was operated by steam power using wood fuel. Thirty stamps were used in later work.

In 1935 the 1448 acres in the holdings were reported as having been sold to James Maxfield and associates, 2619 Wilshire Boulevard, Los Angeles. In August, 21 men were employed and a cook house and club house were being built. It was planned to use steam to generate electric power and a generator was being installed. A large storage tank for fuel oil was proposed. Little work was being done in the mine. Arthur Seafang, manager.

La Trinidad (Sterrett) Mine. In Sailor Canyon south of North Fork of American River, 15 miles by trail from Cisco. The vein occurs in the Sailor Canyon formation, composed of calcareous slates which have been classified as of the same age as the Mariposa (Jurassic) slates. Granite is reported on the hanging wall side. This vein strikes northwest and dips about 45° NE., varying in width from 2 to 8 ft. Most of the oxidized ore was stoped between 1897 and 1905 through an adit reported to have been run over 1700 ft., of which 900 ft. was on the vein. The sulphide ore remaining shows antimony, pyrite, chalcopyrite and arsenopyrite besides some gold and silver. The 10-stamp mill used to crush the oxidized ore gave low returns in the last two years of work on the unoxidized rock. Later stock companies made little progress and no work has been done recently. The stamp mill was wrecked by a snowslide, and although work was started to rebuild it, this was not completed.

Live Oak Mine. In SWJ Sec. 23, T. 14 N., R. 9 E., three-fourths mile from State Highway east of Weimar. Owner, Geisendorfer Estate. Lessees, Jones and Slayden.

The lessees are prospecting on a limited scale, doing the work themselves in a winze which is said to be giving good assays from a stringer. An old shaft is reported 175 ft. deep.

Lost Emigrant Mine. This mine, first found in pioneer days and re-discovered in 1895 after a five years' search, is in the high mountains 12 miles by road southwest of Soda Springs station. The first production was made in 1901 and a few thousand dollars was produced annually until 1905; again in 1909 the mine was active, and a tonnage greater than all previously worked was milled, but it proved to be much lower grade than the ore taken out near the surface. No more work was done until 1933. Since then a 10-stamp mill has been erected, but could not be operated because of water shortage in 1934. In the summer of 1934 old mill tailing left from past operations was cyanided. In July, 1935, the sale of the eight claims to Lost Emigrant Gold Mining Company was reported. This is a Delaware corporation. Sanborn H. Smith, agent, 68 Post Street, San Francisco.

The vein which has been worked the most is in diabase porphyrite, and varies in width from 1 ft. at the surface to 4 ft. on the 300-ft. level. It has been prospected to an inclined depth of 500 ft. with short levels at 65, 200, 300 and 500 ft. Some of the oxidized ore from the vein was of very good grade, yielding 2 to 3 oz. gold per ton, but with increased depth the gold recovery dropped and pyrite became more plentiful.

Merz Mine. Six quartz locations in Sec. 4, T. 15 N., R. 13 E., near the head of Antone Canyon. A. Merz, W. Wardell and L. Schnoll. These claims were located in May, 1934. A shaft had been sunk 40 ft. early in August, 1935. There is a new headframe with 40-ton bin and a hoist and small compressor operated by automobile engines, on No. 1 claim. Good assays are reported from the shaft where the hanging wall vein of banded quartz is 8 inches wide, and is separated from footwall vein by 10 ft. of dike

rock heavily impregnated with coarse pyrite. The veins strike N. 40° E. and N. 27° E. respectively, in the Blue Canyon formation. No drifting had been done at time of visit.

Mina Rica (Patented in part as **Daylight claim**). This old mine, a mile north of east from Ophir, is on a vein striking northeast in amphibolite schist. Originally, it was 400 by 2700 ft. in area, on a vein one to two ft. wide, traceable for 1000 ft. It was located in 1865 and the surface quartz, and ore taken out 6 to 8 ft. deep, is said to have given "highly remunerative results"; but no definite record remains of this. In 1873, a shaft that had been sunk 60 ft. was said to have yielded $15,000. Another shaft was sunk, finally reaching a depth of 275 ft. in 1882 and three levels were run, from which a maximum length of 400 ft. was drifted, and an unknown amount of ore was taken. The mine was again productive from 1891 to 1896, with a 10-stamp mill. During these later operations, over $40,000 was produced. No record of the workings from which this ore came was kept in reports made during that period, but later notes indicate a depth of only 150 ft. was reached.

Monarch (Gratz Brothers) Mine. In Sees. 14 or 11, T. 13 N., R. 9 E., two miles southwest of Spring Garden, on east side of canyon of North Fork American River. A. D. Hadsell and sons tried out on this property the first Hadsell mill in 1931. It had a wheel 16 ft. in diameter and was operated by a 20 h.p. engine at about twice the speed later used at the Beebe Mine.

The deposit worked is a wide, oxidized body probably similar in character to the Annie Laurie, but too much decomposed at the point where work was going on to permit an accurate classification.

Moore Mine. Near Auburn Ravine, one-fourth mile south of the Conrad Mine. The vein strikes east, crossing the contact of granodiorite and amphibolite. The dip is 55° south and average width 10 inches. The vein was 'pockety.' It was explored by an inclined shaft 480 ft. long sunk in the ore shoot, giving about 200 ft. vertical depth, and drifts were run about 80 ft. east of shaft. It is reported to have been stoped out to an inclined depth of 440 ft. and length of 80 ft. Work continued until 1898. The total yield, according to Ira Tharp, formerly a part owner, was $180,000. The gold was principally free, and much of it carried enough silver to be classed as electrum.

Ophir District.

The quartz veins near Ophir and on Duncan Hill were discovered and worked superficially soon after placer mining started. Under the miners' rules, a quartz claim in Lone Star district could not be over 200 ft. long by 600 ft. wide. The veins that had supplied gold to Auburn Ravine and other streams in the region were worked only in a small way and by 1867 the Julian or Schnabel Mine, with a shaft 105 ft. deep, was the deepest in that section. Many rich strikes had been made at or near the surface. The Green Emigrant, north of Auburn in Rock Creek district had been the most sensational, with a reported yield of $100,000 in 1867.

Mining on a more pretentious scale began about 1871. In that year the St. Patrick Mining Company had a shaft 220 ft. deep. There had already been produced from their property $75,000 from a pocket. In 1871, a crushing of 194 tons yielded about $11,000. The Green Mine, one-half mile east of the St. Patrick (and not to be confused with the Green Emigrant) produced the same year, with four stamps in a run of two weeks, nearly $50,000; one lot of 12 tons yielded $15,000. The Bellevue (in late years part of the Oro Fina) in 1872, was said to have yielded in all about 600 tons of an average value of $30 a ton. Crater Mine had a shaft 130 ft. deep on a vein reported to average 12 inches wide yielding $50 a ton. The Julian had four shafts, one 230 ft. deep, with a vein reported 20 inches thick, yielding $6 a ton in free gold. The St. Patrick Mining and Milling Company grew into a consolidation covering 14 ledges. For their fiscal year of 1873 this company crushed 3149 tons which yielded about $20 a ton. From the Crater

Mine, where they found an ore shoot 203 ft. long at the 212 ft. level, they took that year 1535 tons of ore which yielded $31.52 a ton, the vein averaging 20 inches wide. They also worked the Spanish and Gold Blossom. In all, 18 mines were reported as producing in Ophir district in 1873. Veins varied in average width from 8 to 36 inches. The deepest shaft was 320 ft. A total of 59 stamps, crushing 1-J to 2 tons each daily, were in operation. Wheeler pans were used to regrind concentrate.

In spite of such a favorable beginning, most of these mines did not continue long in operation at the time, though some of them later became producers. The Crater Mine produced $73,951.66 down to the 300-ft. level in the year ended October 30, 1875. Work was resumed on the Gold Blossom in 1881, and in 1883 a 10-stamp mill and a roasting furnace were erected. The same year the shaft of the Crater Mine reached a depth of 800 ft. and a production of $225,000 was reported from it. It was stoped out to the 800-ft. level and work stopped in 1884. If the total production of $750,000 credited to this mine (for half of which no official record is available) is correct, it was the largest producer of the district.

Little more was heard from the district until 1888 when the Butts or Hathaway and the St. Lawrence mines were worked. From 1889 to 1934 inclusive, the mines of the Ophir district made a total recorded production of $1,882,000. The total production of the district, if allowance is made for the many small lots of rich ore mined in early days, of which no definite record remains, must have been close to $3,000,000. Although there has been some production every year since 1889, the amount has fluctuated greatly, the annual output having exceeded $100,000 only in 1889, 1896 to 1898 inclusive, 1902, 1904 and 1916. Since 1921, when the Oro Fina Mine was closed after reaching a depth of 800 ft. with a production of $430,000, there has been no work of importance in the district.

Production of principal mines in Ophir district.
Except where noted, these figures are for period 1888-1934.

Bellevue and Oro Fina	$503,274 (includes $18,000 before 1872)
Crater[1]	383,000 (1873-1910, inclusive)
Gold Blossom	216,741
Hathaway	336,994
St. Patrick	148,980 (to and including 1873)
Three Stars	415,000

[1]This is the amount for which definite figures are available, and is only one-half the amount locally credited to the mine.

Other mines, for which complete production figures are not available, but which yielded substantial sums, are the Eclipse, Mina Rica, Green, St. Lawrence, Conrad, Centennial, Moore and Julian.

Oro Fina Mine. This mine, the last important producer worked in Ophir district, was a consolidation of claims, some of which had been worked in the earliest days of the camp. It included Bullion, Bullion No. 1 and No. 2, Golden Eagle, Bellevue, Last Chance, Buckeye, California, Smiths Extension and other claims, covering 96 acres in all. Of some of the veins on these claims, it was said in 1871 that they

> "used to be worked by shafts from 30 to 50 ft. deep or until water or hard rock was reached; then the shaft would be abandoned and another sunk. In that way it was prospected or worked for about 1600 ft. to the depth stated; the ore taken out paying from 30 to 100 ounces per ton by arrastre reduction."

Little more was heard of them until about 1899, when the Bellevue became a producer and continued active until 1911. Oro Fina Mining Company took the property in 1913. A new mill was erected and a new shaft was sunk. Work continued until January, 1922. This company produced about $430,000 and the total output of the claims, so far as can be learned, has been over $500,000.

The main vein strikes north of west, and dips 65° south. The Oro Fina Mining Company controlled about 4500 ft. on the strike. The walls were amphibolite schist to a depth between 600 and 700 ft. on the dip, on the west side of the shaft, where granodiorite was found. Work had not gone far enough to prove whether this was the main batholith underlying the amphibolite, or a dike. The new shaft on Bullion No. 1 claim was sunk to a depth of 860 ft. on an angle of 72° in the hanging wall. It connects on the 300-ft. level with the Bellevue shaft, 312 ft. deep. From 200 to 800 ft. inclined depth, levels were 100 ft. apart. Two ore shoots, one on each side of the shaft, were worked. That on the west was about 150 ft. long and the vein was apparently not cut off at the granodiorite contact, where it had a width of 16 inches. On the east the ore was stoped for a length of 250 ft., and raked away from the shaft. The vein occurred as lenticular quartz bodies, seldom over 2 ft. wide, and the walls were hard with little gouge. The average grade of ore in the later operations was nearly $8 a ton (at the old gold price), although specimen ore sometimes was found, one body yielding $90,000. Levels were run as follows:

No. 2--1080 ft. east, 130 ft. west
No. 3--1400 ft. east, 800 ft. west
No. 4--1250 ft. east, 200 ft. west
No. 5-- 300 ft. east, 500 ft. west
No. 6-- 900 ft. east
No. 7-- 100 ft. east at time of last visit, but was run farther before closing
No. 8— 200 ft. east.

Unlike many mines in the district, the ore here carried most of the gold in the free state. The sulphide, principally pyrite, with some galena, formed 1% to 1 ¼ % of ore and carried $60 to $75 a ton in gold and $4 to $8 a ton in silver. Ore was milled with 10 stamps of 1000 lb. each and two Deister concentrators saved sulphides. The cost of operation ranged from $5.55 to $7.85 a ton.

The present operators have formed the Oro Fina Consolidated Mines. In April, 1936, the shaft had been dewatered and underground prospecting had been started.

Orpheum Mining Company (Kittler Consolidated). In Ophir district, adjoining the St. Lawrence on the west. It was worked in early days by a shaft 150 ft. deep and an adit, and a small production was made. In 1909, Orpheum Mining Company began reopening it. A 5-stamp mill was erected that year and later was increased to 10 stamps. The mine was operated several years and produced a few thousand tons of ore which yielded from $6 to $7 a ton, with about 1 ¾ % concentrate which was low in gold content, and relatively high in silver. No details of the underground conditions are to be had as the property has been closed for over 20 years. A depth of 300 ft. or more was reached.

Paragon Prospect. At different times, two quartz veins have been found in the adits run at the Paragon placer mine at Bath, for drift mining. One was struck in the Golden Gate adit about 300 ft. from the portal. Another occurs in the Paragon tunnel 480 ft. from the portal, and work was done on this in 1931 and 1932. When visited in July, 1932, a winze had been sunk upon this vein to a depth of 50 ft. It showed a width of 6 inches to 1 ft. and was claimed to give good assays. It strikes N. 45° W. and dips 48° NE. The adit at this place is only about 6 ft. below the bedrock of the old hydraulic pit.

A small mill containing two stamps, one Wilfley concentrator and a rock-breaker was erected outside the adit and a little ore was crushed, but work stopped in a short time. A small air compressor was in use, and power was furnished by gasoline engines.

Penryn Gold Mines Company. William Anderson, manager, Box 155, Auburn. Home office, 515 Standard Stock Exchange Building, Spokane, Washington.

This company has lately begun sinking a vertical shaft in the footwall of a vein on the Sakui ranch north of the holdings of the Alabama California company. Late in July, 1935, the shaft was 60 ft. deep, with five men employed. It is planned to sink to 200 ft. before drifting. A vein 2 ½ to 4 ft. wide is reported to have given good assays, with possibilities of a good ore shoot indicated. It is believed to be on the northward extension of the Alabama vein.

Between this and the Alabama mine there is about 1500 ft. in length across the Swesey ranch controlled by the Alabama California Gold Mines Company which is reported to have been leased recently to the Alabama Extension company.

Early in April, 1936, the shaft of Penryn Gold Mines Company had reached a depth of 200 ft.

Pioneer Mine. This is the deepest and most extensively worked quartz mine in the county. In total gold production, it ranks second in the county. It lies on the steep south slope of the canyon of American River, five miles south of Towle by trail, or it may be reached by road from Forest Hill. It is an old mine, part of it having been worked from 1854 to 1862. It lay idle then until 1880. Some parts of the first mill, built in the 1850 's, are still to be seen. In 1889, a 20-stamp mill was built by James G. Fair and A. E. Davis and active work went on for many years. In 1895 Pioneer Gold Mining Company took the mine over, and reported net operating income until 1900, when the visible ore of good grade appears to have been worked out. Little more was done until 1911, when production was resumed on lower grade rock. In 1922, the last year of mill operation, the yield per ton was the best realized since reopening. For several years, prospecting has been done on a small scale.

The total production of the mine since 1889 has been over $900,000 of which the larger part was produced before 1900. The writer has no record of the yield before 1889. In 1897 and 1898, Pioneer Gold Mining Company gave out reports indicating average yield varying from $9 to $21.77 a ton. The tonnage handled was small, due to a limited water supply for power; in the most favorable season, less than 1000 tons was milled monthly with a crew of 40 to 50 men. This better grade of ore, which permitted payment of some dividends on the $1,000,000 of capital stock came from between the 500- and 1000-ft. levels (the latter being No. 4 adit) where the vein often reached 5 ½ ft. in thickness.

Of the two developed veins, called the Lynn and the Pioneer, the Lynn has been the principal producer and most of the work has been done upon it. This vein strikes N. 32° W. and dips 70° NE. It follows a strong dike most of the way and is from 1 to 10 ft. wide, but averages 4 ft. or more in most places and is composed of good-looking ribbon rock. It occurs in the Blue Canyon (Carboniferous) formation, having a hard black slate footwall and gray slate and slaty schist hanging wall.

No. 3 crosscut adit cuts the Pioneer vein at a distance of 390 ft. and the Lynn vein at 1400 ft. from the portal, and at a depth of 700 ft., and follows the latter 2525 ft, No. 7, 525 ft. below No. 3, is a crosscut 2800 ft. long to the Lynn vein and is drifted on that vein for 1475 ft. A winze was sunk 242 ft. below No. 7 adit, showing the vein to be 2 to 9 ½ ft. wide on the bottom level, where it was drifted 225 ft. In all, 13 levels were run. Between No. 3 and No. 4 levels, the vein was stoped nearly continuously for about 1200 ft. The North Lynn stope was 300 ft. high by 700 ft. long, and 1 to 4 ft. in thickness was stoped. The Lynn stope was 325 ft. by 450 ft. by 1 to 6 ft. In later years, stoping extended for a length of about 200 ft. between No. 5 and No. 4. Some stoping was done from the 80-ft. level of the winze

workings for a length of 250 ft, to 50 ft. above No. 7, and this is about all the mining done below No. 5 level. There are a number of blocks of the Lynn vein about No. 7 level that offer possibilities, and good prospects are claimed elsewhere on the holdings, which embrace several hundred acres. The Lynn vein has been opened to a depth of 1440 ft. but the Pioneer vein was not prospected below No. 3 level. The company has a complete assay map of workings.

The old 20-stamp mill is about 550 ft. below No. 7 level, and ore was delivered to it by a tramway 1128 ft. long. It has been in bad shape for years. Though it has been stated the sulphides formed 2 ½ % of the ore and were worth $50 a ton, the concentrate treated in later years, in a small cyanide plant, was considerably less in percentage and lower in recovered value than the above. The amount of silver in both bullion and concentrate is low, being less than 1% by value of the gold content.

Providencia Mine {Providence). Four quartz claims just south of the old Copper Bottom drift mine, in Iowa Hill district. Providencia claim is patented. The steep slope to North Fork of Shirttail Canyon permitted running an adit, about 400 ft. long, in which some good assays have been obtained in a vein 3 ft. or more in width. No equipment and no recent work reported. The vein strikes northwest and dips 80° NE. in the Carboniferous formation.

Rawhide Mine. On Texas Ridge, between the branches of North Fork of American River, and reached by road and trail from Towle, or by trail from Pioneer Mine. The first available record of activity was for 1899 when a 3-stamp mill was in operation. Rawhide Quartz Mining Company was incorporated in 1901, and a 10-stamp mill was started in December of that year. They had the property until 1909, when it was taken over by Helester Mining Company. This company continued operation and made some production nearly every year until 1915 when succeeded by Canyon Mines Corporation. Between 1918 and 1934 little was done at the mine but in 1934 production was resumed. The total recorded production has been a little over $300,000, from ore which averaged slightly under $4 a ton in gold (old price) during the principal period of production, 1902-1910 inclusive.

The vein principally worked is a stringer lead in a dike lying between a hanging wall of slate and a footwall of igneous rock, both wall rocks being members of the Blue Canyon (Carboniferous) complex. The width of the lode varies from 4 ft. to 140 ft. The steep surface permitted exploitation by adits, of which four have been run as follows:

No. 1 (upper) 1137 ft. long, giving 400 ft. depth
No. 2 1862 ft. long, giving 510 ft. depth
No. 3 2350 ft. long, giving 696 ft. depth
Mill adit 840 ft. long

A ball mill of 35 tons capacity is reported to have been used for milling during the past year. Thirty men were employed in May, 1935. The ore milled in 1934 yielded less than 1% concentrate, which, however, was of good grade, containing about 40% of the gold saved.

Redstone (Red Rock) Mine is two miles southeast of Blue Canyon near North Fork of North Fork of American River. It was first worked in the 1860's, when a 4-stamp mill was in operation, and production was made from an open cut. In 1896 a 10-stamp mill was built, and a few thousand dollars was produced annually until 1902. The ore at that time came from stopes above adits, of which three were run, giving a depth of 250 ft. The tonnage mined was small, however, during this latter period, and the ore was low grade, the adit workings, width of vein and free water power for milling permitting a profit.

Nothing more appears to have been done until 1932 when Paramount Gold Mines Corporation, Limited, began a new lower adit to give greatly increased backs below the old workings. The activities

of this company ceased with the death of the promoter, E. C. Klinker. There is an old 10-stamp mill above the new adit level.

The Redstone deposit occurs in the Blue Canyon formation and consists of a massive vein of quartz, and a stringer lead of quartz seams in slate, forming a low-grade lode up to 15 ft. wide. It strikes nearly north and dips 60° W.

Rip Van Winkle (Page & Buckman or **Lady Bedford) Mine**. J. D. Dodds, 1614 26th Street, Sacramento, and heirs of Ben Buckman, owners. It is six miles south of Westville in Sec. 29, T. 15 N., R. 12 E.

The vein was worked first through shallow shafts and an upper adit at an elevation of 3520 ft. A lower adit was then run S 80° 50' W. 237 ft. to vein and 89 ft. beyond it, and a drift run 532 ft. in a general northerly direction, at an elevation of 3250 ft. No ore was mined from the lower adit. Nothing has been done at the claim for about 20 years and at present the portal of the lower adit is caved.

Two small stamps were operated on ore from the upper workings from 1894 to 1897 inclusive, and a total of a few thousand dollars was produced.

The Schultz Mine, presumed to be upon the northward extension of the same vein but separated from the Page & Buckman mine by 1000 ft. belonging to the Herman Mine, also had a 2-stamp mill in 1897.

Rising Sun Mine is a mile and a half west of Colfax. It was opened in 1866 and was operated eight years with a 5-stamp mill, and from then until about 1884 with 10 stamps. The latter mill had a daily capacity of only 20 tons. In spite of this limited capacity, the mine was reported to have yielded over $2,000,000 which, if correct, would make it the leading gold-quartz producer of the county. In 1869, when it was 230 ft. deep, the average yield was given as $25 a ton. In 1875 when a depth of 520 ft. had been reached, the average width of ore was 15 inches and average yield $21.50 a ton. The total production to July 1, 1875, was about $405,000. Unfortunately, no public record remains of operations from then until the closing about 1884. The mine lay idle thereafter until 1919, when a stock company erected a modern 10-stamp mill and unwatered the mine. They reported milling less than 1000 tons before quitting. Again in 1925, the same promoter, with a company called California Premier Mines Company reported milling about 1000 tons of good ore. Considerable dead work was done to complete a drain adit from the Bear River slope connecting with the workings about 30 ft. above the 600-ft. level, and the plant was improved. The same interests did some work on the adjacent Big Oak Tree Mine, and in 1931 were succeeded by Paramount Gold Mines Corporation. This company made some production in 1931 and 1932, working in both mines, and some of this output in the latter year was credited to the Rising Sun.

The vein is said to have averaged 18 inches wide in the upper levels and lies between hard diabase walls. It strikes northeast and dips 85° south to the 7th level where it reverses its dip. Below this 'roll,' the vein widened to 4 ft. or more, and became softer. The oldest shaft, from which the early production came, was sunk to the fifth level, and another to the third level. A later and deeper one was sunk northeast of these, to 749 ft. on the dip of vein. West of it, according to the late James Richards, a former superintendent, was a pay chimney about 40 ft. long, so rich in free gold near a cross-fault that "the gold literally held the quartz together." This fault apparently bounded the rich ore on this side, and possibly had influenced its deposition. East of this shaft, pay was in stringers. On the west, it paid well to a depth of 700 ft. where the 'roll' in the vein occurred.

Of the last ore milled, and credited to this mine, sulphides formed about 1.7%, and yielded 2 oz. gold per ton. The promoter, however, was interested in several mines in different parts of the county, from which lots of ore may have been milled in this plant; so individual figures can not be safely given.

Rublin Mine is about one mile southwest of Last Chance. About 1908 to 1911, a shaft was sunk 150 ft. and an adit run about 860 ft. Less than 1000 tons of ore mined from the shaft workings was reported as yielding from $4 to $11 a ton in a 2-stamp mill. The adit is said to have not struck the vein, but a winze sunk 30 ft. below the adit is claimed to give good prospects. Some low-grade material was milled in 1929 and 1930. Recently work was resumed and in August, 1935, five men were employed. It was not visited by the writer, but the vein is reported to be from 6 inches to 2 ft. wide.

Shady Run (Midas) Mine. It is about a mile and a half northeast of Shady Run. Work began in 1900 and a 10-stamp mill was put in operation in 1902. In three years, about 6000 tons of low-grade ore was milled, after which little appears to have been done, although Shady Run Mining Company is still in existence and gave a lease in 1927 to Thomas W. Wells. In 1934, a few ounces of gold was produced from low-grade rock. Mining was done through adits and a shallow shaft. The vein is reported to show a width of 20 ft. or more and consists of a Quartz stringer lead in a dike, carrying considerable sulphide including some arsenopyrite.

Snowbird Mine is one mile from Sugar Pine Mill, on the divide 14 ½ miles east of Forest Hill. Two veins are claimed to exist, but these show little quartz, and what ore has been found is mostly in talc zones in serpentine, which strike northwest and dip 60° N. E. Nevada- Pacific Exploration Company prospected the ground for two years, 1919-1921. A shaft was sunk nearly 300 ft. on 60° incline, with levels at 56, 134 and 285 ft. depths. Short drifts were run on each level, the most extended being on the 134-ft. level where the 'footwall vein' was prospected for 150 ft., a crosscut was run 140 ft. and the 'hanging wall vein' was followed 190 ft. by drifting. A little rock was stoped between this level and the next above. The mill in 1921 contained five light stamps, a 50-ton ball mill and a small cyanide plant, all removed since.

Southern Cross Mine comprises four patented claims, covering 2560 ft. in length along the strike of veins on the south side of the canyon of South Fork of North Fork of American River, five miles south of east from Towle, and adjoining the Pioneer Mine on the northwest. From Towle it may be reached by road and steep trail. The principal period of work was between 1903 and 1908, during which time the production of about 4800 tons of low-grade ore was reported. The recorded figures are only approximate, but indicate a yield of $3 to $5 a ton. Fred M. Miller, who has made an excellent report on the property, estimates a much higher probable yield. The plant was burned down some years ago, and later part of the 20 stamps were removed.

Three veins called West, Southern Cross or middle, and Poole or east vein occur, striking west of north in the Blue Canyon formation. Most of the work has been done on the Southern Cross vein, through No. 1 tunnel, which starts about 50 ft. above the south bank of the river, runs as a crosscut south and then east 540 ft. to the vein, and follows the vein as a drift 180 ft. south, and 320 ft. north. The north drift emerges near the river at the east portal, which is 400 ft. upstream from the main entry. From this level two small stopes were mined. This vein has two strands and the stopes are on the hanging wall section. Frenzel stope is nearest the portal and is 70 by 100 ft. in area and 5 to 6 ft. wide, reaching to the surface. The other stope is about 50 by 50 ft. in area. On the footwall side is a stockwork of quartz stringers which is 42 ft. wide where crosscut by the main adit.

No. 2 adit level is 215 ft. above No. 1 and has a total of 200 ft. of work, of which 120 ft. is on the hanging wall strand of vein, with a raise through to No. 3 adit level, 75 ft. higher. Small stopes were mined above the latter, on both strands of the vein. About 2500 tons in all was mined here, some of it reputedly above the average grade for the mine.

On the Poole vein, which Miller thinks is the northward extension of the Lynn vein of the Pioneer Mine, a length of 30 to 40 ft. was stoped from the Upper Water adit, 387 ft. vertically above No. 1. This adit was scarcely 100 ft. long and the stope went to the surface. Another adit 45 ft. lower and the same length, did not reach the ore shoot indicated by the stope above. The outcrop of this vein is said to be traceable thence for 2100 ft. to the Pioneer end-line, where its probable connection with the Lynn vein is claimed to be indicated. In both properties, the vein is accompanied by a dike.

The Southern Cross development work, consisting of a total of about 2500 ft., has been done almost entirely on the Southern Cross and Poole claims. Due to their location, they offer exceptional opportunities for prospecting by adits. No. 1 level of the Southern Cross is 1100 ft. vertically below No. 7 level of the Pioneer, and 858 ft. below the deepest development in that mine. It would have to be extended about 2000 ft. southward to enter Pioneer ground, which extends more than a mile farther south on the strike.

St. Lawrence Mine. In Ophir district, one-half mile northwest of the old town. It had a 6-stamp mill in 1873, and was worked irregularly for 25 years or more. Some ore was shipped to a smelter, some treated in a nearby mill and in the 1890 's a Huntington mill was installed. The complete record of output is not available, but for a few years, 1893 to 1897, a total of $21,370 was reported. Between 1903 and 1912, there was also some production from this claim.

The work was done principally on the eastern part of the claim, where the vein strikes east and dips 20° to 45° south. The vein is from 1 ft. to 20 inches wide of glassy quartz carrying up to 2% of pyrite and galena, with some stibnite. Two ore shoots were claimed, 180 ft. and 100 ft. long. The bullion was only 650 to 700 fine. Both walls are granodiorite with a diorite dike on the hanging wall of vein. Much, if not all, of the ore is said to have come from a stringer in the hanging wall parallel to the main vein. Farther west, the vein or one which joins it, strikes nearly due southwest.

The shaft, 300 ft. long, was intersected by two tunnels, the upper reported 650 ft. long and the lower 350 ft. long in 1896, the latter connecting with the bottom of shaft and giving a vertical depth of about 150 ft. In the later work the adits were extended.

St. Patrick Mine (Doig Consolidated). What was later known as the Doig Consolidated Mine was originally called the St. Patrick and was quite actively worked in the 1870 's by St. Patrick Mining Company, which operated as well at other nearby properties. The St. Patrick shaft is in the SW ¼ of SE ¼ Sec. 7, T. 12 N., R. 8 E, on the southern contact of a tongue of amphibolite about 500 ft. wide and one-half mile long, which lies like a peninsula in the granodiorite. The St. Patrick vein is at the southern tip of the peninsula, and is one of several which strike northeast across it.

This vein is said to have yielded near the surface a 'pocket' of $75,000. In March, 1871, between $11,000 and $12,000 was produced from a small tonnage of ore, and for the year ended October 30, 1873, the company mined and milled from the St. Patrick vein 3149 tons which yielded $16 to $20 a ton. In that year, J. H. Crossman, the superintendent, reported his conclusion that the main shaft had passed through the ore shoot at the 200-ft. level, and that the shoot raked east at such a flat angle that a drift 800 ft. long would be required to reach it at the 300-ft. level. Accordingly, he quit work on that vein and later activities of the company were on other mines, including the Crater and Spanish. Crossman reported the shaft as being 320 ft. deep, with 425 ft. of drifting on a vein averaging 20 inches thick. It dips about 45° E.

The Doig vein is the next east of the St. Patrick, and only 120 ft. from it, but to the south it curves until its outcrop strikes nearly wrest in the granodiorite. Although this vein has been traced about half a mile, the only payable ore found so far in it was a few hundred feet northeast of the St. Patrick shaft,

where, at its junction with a narrow, nearly vertical vein called the Little Doig, a good-sized 'pocket' was extracted. In this place, the vein is in the amphibolite schist.

Tahoe Treasure Prospect. In 1932, publicity was given a discovery of auriferous sulphides made near Quail Lake in the high Sierra Nevada, about one mile south of west of McKinneys, a resort on Lake Tahoe. A number of locations were made, some of which were later found to be on land claimed by others under patents issued years before. The elevation is from 6750 to over 7000 ft.

Fresh sulphides occur almost at the surface in several places on the claims, in contact-metamorphic rocks, originally principally sedimentary and believed to be of the same age as the Sailor Canyon formation (Juratrias?). The strike of schistosity in the altered sediments (quartzite and slaty schists) is in general N. 20° W. These rocks form a small roof-pendant, flanked on the south and east by morainal deposits and on the north and west by andesite and granodiorite. The bands of sulphide mineralization, in places at least, appear to follow the direction of the schistosity. The cliff on the south side of Quail Lake is heavily iron-stained, and the first prospect hole here showed plentiful fresh iron sulphide with traces of copper. A short adit just south of the lake at that time showed about one-half the face occupied by granite. A 50-lb. sample here was said to show 7 lb. of concentrate assaying well, though the sulphide did not appear as plentiful here as above.

Since 1932 a total of over 400 ft. of underground work has been done. Several stock companies have been based on the prospects, and it is said that about $100,000 has been spent in connection with them. An electric power-line was built from the state highway to the claims, a 10-room dwelling, and expensive assay office and other buildings were erected, and an air compressor, drill sharpener, etc., installed. It is said a dog-team was used in the winter of 1934-35 to haul in steel and provisions.

Assays indicate widely varying gold content, from a trace to over one ounce. Cyanide and gravity concentration tests are reported to give unsatisfactory recoveries. The last company reported in control is Tahoe Treasure Consolidated Mines, Incorporated, which continued work during 1935.

Three Queens {Four Aces) Mine is part of a group of claims extending for 2 miles along a dike of serpentine and its contacts with schists, in Volcano Canyon 1 mile north of Middle Fork American River. A road 3 miles long from Forest Hill drops 1800 ft. in reaching the camp, which is at an elevation of 1360 ft.

The first reported production was of $14,000 in early days; the first recorded was made by George Wingfield in 1907 and amounted to over $30,000. This was taken from a small 'pocket' orebody only a few feet underground. In 1909 and 1919 Mortimer Savage, the owner, reported production of a few thousand dollars. Some gold was also taken out in 1925 by Three Queens Mining Company. Four Aces Mining Company was in control of the mine from 1926 to 1928, inclusive, and reported output of over $80,000. M. Savage resumed work in 1930 and the mine has been producing gold annually since.

The area mapped as peridotite and serpentine contains strips of black graphitic schists, which were torn from the older Carboniferous rocks by the invading intrusive, as well as completely altered rocks probably once dikes. The serpentine also carries talc and ankerite stained by mariposite in places. To the west lies amphibolite schist.

The work done up to July, 1927, showed a quartz vein 3 to 4 ft. wide, striking northwest and dipping 30° to 40° NE. It had there a hanging wall of black graphitic schist and altered dike, with ankerite stained by mariposite on the footwall in those sections where the best ore was reported. Three stopes, the longest 90 ft., had been opened. High-grade ore occurs in small bunches showing considerable free gold in this vein. It evidently formed along the hanging wall by repeated opening and the graphite, and the carbonates in the ankerite, were favorable precipitants. Near the southeast end of the adit drift, 348 ft.

from the portal (which is near the trough of Volcano Canyon) a floor dips N. 20° W. Gold occurs in the filling of this flat seam. Such seams are probably due to hillside drag. About 1000 ft. southeast from the face of this drift there is a winze 148 ft. deep on the Scorpion claim. To the northwest, 1250 ft. away, 120 ft. of workings along the contact are reported to show good assays. A 5-stamp mill, 40 h.p. semi-Diesel engine, air compressor and several good buildings are on the claims. In October, 1935, Mrs. Rena Morgan et al. were working the property and another strike of specimen ore was reported from the same ore shoot previously worked by Wingfield and the Four Aces Company, at a depth of about 265 ft.

Three Stars (Columbia) Mine. The three claims, called North Star, Middle Star and Morning Star, lie at the northwest end of the Ophir district, on Doty Ravine, seven miles northwest of Auburn. Although considerable work had been done before 1900 on these claims, no history of it remains. By that time, three shafts had reached the following depths: Main vertical shaft, 725 ft., Belmont vertical shaft 524 ft. and Belmont incline, 500 ft. The principal period of activity was from 1902 to 1907 inclusive, during which time over $400,000 output was reported. Most of the deeper work is reported to have been done in a winze sunk from the 700-ft. level to 1300 ft. depth. The owner has a map showing the extent of workings. The ore was of low grade, yielding $3 to $6 a ton. Sulphide concentrate saved formed 1% to 1 ½ % of ore and carried $40 to $50 a ton in gold and $2 to $10 silver. Tailing assays were low. Milling was done with 20 stamps.

This mine is in the granodiorite and the veins strike north. Not much work was done on the Almont vein, from which a few thousand dollars was produced in 1889. The main vein is said to have been about 3 ft. thick in the ore shoot.

T. W. A. (Big Pine Mine). In Ophir district, about one-half mile from Wise power-house. A. N. Sweet, trustee. C. H. Brown, superintendent, Auburn.

The date of the first work on this ground is not known. It was reopened, however, in 1898 by Bouk & Bushnell and worked in a small way until about 1907 with the production of a few thousand dollars from ore which yielded from $3.50 to $10 a ton in gold. Copper sulphide was reported at a depth of 170 ft. It lay idle thereafter until 1934, when it was reopened and sampled. Early in 1935, a plant containing a balanced rod mill, concentrator and three flotation cells was installed and milling started. There are levels 100 ft. apart, the longest drift being 250 ft. east and 240 ft. west on the 300-ft. level. A. N. Sweet reported average assays of about $10 a ton from a vein averaging 18 inches wide. The mill was crushing 35 tons a day in June, but work was reported to have been suspended late in July.

Two Orphans Prospect adjoins the Green Emigrant mine on the north, five miles from Auburn in NW ¼ Sec. 30, T. 13 N., R. 8 E. It was worked superficially by Pike Bell as a pocket mine about 1865. Two veins strike northwest and dip 54° east, having a maximum width at and near the surface of 2 ft., and averaging 14 to 18 inches. Shallow shafts were sunk at close intervals for 1500 ft. on the strike. The deepest shaft prior to 1920 was only 75 ft. deep on the dip. A shallower shaft on the other vein is said to have shown it breaking into stringers and lenses of quartz assaying well. The ore on this claim shows considerable pyrite, chalcopyrite and galena. The walls are hard greenstone.

Valley View (Harpending or" Whiskey Hill) Mine, six miles north of Lincoln in the foothills just east of Sacramento Valley, is one of the old copper mines of the foothill belt which had an interesting early history as a gold producer from gossan ore, similar to that recently worked at the Dairy Farm mine.

Whiskey Hill had a 40-stamp mill crushing the gossan ore in the 1860's. The deposit had been studied by Professor Silliman, who reported the presence of gold in angular grains or small ragged pieces; films of metallic silver upon the "talcose masses," and the occurrence of such minerals as coquimbite and cyanosite.

The mineralized zone has a width of 200 ft. between amphibolite schist walls, striking N. 80° W. and dipping 72° northeast. In this zone the gossan was about 100 ft. wide. The deposit from which the gossan came and which carries copper and zinc ores in depth, is in two altered dikes, probably originally andesite. The oxidation of the rock carrying sulphides, and the action of the acid-bearing water left a skeleton of residual quartz and kaolin in places as well as the usual gossan. Copper sulphides and pyrite were found at a depth of 85 to 100 ft. In the lower workings, zinc sulphide and pyrite increased and copper content became less.

There are three shafts and several open cuts and adits on the mine. South shaft is 130 ft. deep, southeast shaft 180 ft. and northwest shaft 280 ft. deep. From the last, ore was stoped from 120-ft. level to the surface. In southeast shaft, at a depth of 150 ft., a drift was run 125 ft. During the last period of operation, in 1916 and 1917, a few hundred tons of ore was shipped yearly, which yielded from $3.50 to $5 gold, $1.50 to $2 a ton in silver, and 3 ½ % to* 5% copper. There still remains a small tonnage of the gossan ore.

For many years the water flowing from an old adit connecting with a winze has been used locally, and has been bottled and sold under the name of Kilaga Water, for the treatment of certain skin diseases and poison oak. An analysis of this water was published in our Report XVIII, page 603.

Van Avery Mine (Alder Creel- Gold Mining Company). It is 1 ¼ miles southeast of Blue Canyon. It was first mentioned as having a 3-stamp mill in 1896. In 1897, Alder Creek Gold Mining Company took it over and worked about 3 years, having 28 men employed in 1899. Two adits were each run 300 ft. or more according to report. Three veins are claimed, one of which is 5 to 6 ft, wide. No record of the production is available, and no work has been done in late years.

Victory (Russell & Phelps) Mine is in the SE ¼ of SE ¼ Sec. 13, T. 15 N., R. 9 E., five miles northeast of Colfax by road. Agricultural patent.

Some prospecting was done 35 years ago on this land and in 1901 about 1 ½ tons of ore was shipped which yielded an average of over 2 oz. gold and 1 oz. silver per ton. Work stopped at a depth of 81 ft. and nothing more was done until Russell and Phelps discovered an outcrop of heavy gossan ore near the old workings in 1931. This showed no visible free gold, but assayed well, and 21 tons taken out in sinking 58 ft. yielded 2.2 oz. gold and 12.2 oz. silver per ton at Selby smelter. Another lot of 23 tons yielded over 1 ½ oz. gold and 9 oz. silver per ton. At a depth of 88 ft. the assay returns indicated enough decrease in gold content to discourage the lessees and work was suspended until 1934 when Loufek, Johnson and Springer reported production of over 1000 tons of ore.

The ore occurs in lenses of heavy sulphide (principally pyrite) in the Carboniferous rocks (locally called Cape Horn slates) where narrow bands of igneous rock, now rendered schistose, are interlayered with the slate. The strike is nearly north and dip 72° E. The upper 35 ft. of the discovery vein is 3 ft. in the footwall from the lower segment. At 55 ft. a crosscut 16 ft. in the footwall revealed another vein of the same kind and about 3 ft. wide. A fault striking N. 40° W. and dipping 45° SW. cut this vein off above this level, and if this is the same fault that moved the first vein, the upper segment would lie west also.

The later work (1934) has been done in a winze sunk in the floor of an old adit run in 1901 about 250 ft. east from a nearby ravine toward this latter (west) vein from which the first shipments came.

Vore (Golden Scepter, Chubb) Mine. In Sec. 3, T. 13 N., R. 9 E., two miles east of Applegate on Codfish Canyon, and about one mile south of the Black Oak Mine. This is one of the seam mines, which was hydraulicked years ago and later worked in a small way. Recently prospected, and a 5-stamp mill was operated for a short time by Navone.

The deposit is at the contact of Carboniferous rocks with a small outcrop of serpentine.

At present (July, 1935) litigation has been started between the lessee and owner.

Wubbena Mine. This is 10 miles in an air-line south of Soda Springs station, and not far from the Lost Emigrant mine. Due to the rugged topography, lack of a road and the occurrence of sulphide ore, little has been done in years past. In 1934, a small tonnage of good ore was mined and packed out over a trail to Robertson Flat on the road for shipment to the smelter. The expense of handling it was said to have used up most of the proceeds.

GOLD PLACER MINES

Little definite, written history of the early-day shallow placers remains, except in the names of numerous bars along the American River, where many mining camps, some of them once containing several thousand people, have disappeared. Wherever it was possible to do so (and few obstacles seemed too great to the pioneers) the waters of the main river, and of the North and Middle Forks upstream from their junction just east of Auburn, were turned from their beds to permit gleaning the harvest of millions of years concealed in these great sluices. This river mining, beginning in the 1850 's after the exhaustion of the exposed gravel, had been nearly finished by 1880, when the Boles and McBride Mine was the only producer reported. A few river projects, notably the working of Mammoth Bar by hydraulic elevators, were carried on afterward. In later years a few dredgers, all now out of commission, have been operated successfully on the river. For the most part, however, the bars and beds of these streams are not adapted to working by bucket dredgers, drag-line or mechanical shovel outfits because of the hard bedrock, and large boulders. Farther downstream in Sacramento County, where the American River left the rocky canyon and entered the valley, the richness of its gravel is attested by the heavy production from the dredging fields of Folsom and Natoma. Several places on the main river have been prospected by divers but none of these have found gravel rich enough to pay for mining by this method, with which unit costs are necessarily high.

Following the exhaustion of the surface placers came the tracing, prospecting and intensive exploitation of the ancient river-channel systems, forming a complex network below hundreds of feet of volcanic muds and boulders. In extent and richness, the deposits of this kind worked by drift mining under the Forest Hill Divide have been equaled by no other section. The lava covering of this divide, which separates the North and Middle Forks of American River, extends from the canyon of the Middle Fork five miles southwest of Forest Hill for an air-line distance of 23 miles to Secret Canyon, where erosion in Tadpole Canyon separates it from the gravel of Canada Hill, elevation 6500 ft., and almost on the summit. South of Canada Hill, in Duncan Canyon, are a number of short, steep channels of local character, which have derived gold from nearby veins on the slopes of Duncan Peak. Coming into the Duncan Canyon drainage basin from French Meadows is a large channel about which little is known, although it can be seen where Duncan Canyon crosses it, and has been worked a little.

Drift mines have been worked along the entire length of Forest Hill Divide, and the region was noted in the 1860 's as having been highly productive.

Besides this complete river channel system (having in places two or three channels directly above one another), attention must be given to the immense bodies of exposed gravel in the Dutch Flat and Gold Run districts, which are linked with the deposits in Nevada County; also to the Iowa Hill drift and hydraulic gravels, as well as to the old mines at Yankee Jim, where hydraulic mining began in this county in 1852.

Several interesting and valuable general reports have been published upon the courses, geology and correlation of the different channels. Due to the extensive post-volcanic erosion, long sections of the

ancient rivers, which had been covered by andesitic mud and boulders, have been removed and re-concentrated by the present streams, in canyons sometimes 1000 to 2000 ft. below the original surface of the andesite. It is often difficult to correlate the remaining segments of channels. This can best be done by comparing characteristics revealed by actual work upon them. Some of these criteria are the fineness, color, size and coatings (if any) of the gold particles; the nature of the rocks forming the gravel and boulders ; the presence or absence of some certain rock such as a highly colored quartz or jasper; the character of the volcanic ash or boulder beds which accompany the channel ; and the difference in elevation of bedrock at various openings.

The most ancient of the trunk streams are often wider, more uniform in grade and in gold content (though not necessarily richer) than any of the later ones. Such channels have sometimes been worked successfully for miles as at the Hidden Treasure Mine. They are often characterized by immense quantities of quartz cobbles and boulders, due to the long continued erosion of the surface of the Cretaceous peneplain. The rhyolite ash flows which initiated the long series of volcanic eruptions, covered these stream deposits but were not in sufficient volume nor did they continue long enough, to blot out the drainage, so that inter-rhyolitic channels were at times superimposed directly over the ancient stream. Such gravels contain rhyolite pebbles and quartz and have a false bedrock and roof of rhyolite.

The later flows of volcanic mud and boulders were of more basic rock minerals (commonly classified as andesite) and of such immense volume as to completely fill and obliterate the mountain canyons. The elevation of the mountains to the eastward had meanwhile become sufficient to give the new drainage system a steep grade, resulting in rapid erosion of the andesite. The resulting channels were of no value unless or until they eroded deeply enough to reach and re-concentrate the gold-bearing gravels of the more ancient streams. This they frequently did, enriching their gravels for a short distance below the junction, so that these sections became profitable to mine.

The late intervolcanic channels, such as some of those found in Duncan Canyon, cut steep and generally narrow trenches in the sides of mountain spurs which must have been high enough to be above the covering of andesite that had already mantled the surrounding country. This bedrock, though not containing many large quartz veins, was nevertheless rich enough in gold-bearing seams and lenses of auriferous quartz to produce profitable gravel. Such buried streams are the counterparts of the present ones in the high mountains. They have waterfalls, followed by stretches of stream bed flat enough to permit gravel accumulation, and sections where the grade was so steep that no gravel remained and the later lava ash closed down directly upon the bedrock.

Morainal deposits, remaining undisturbed as they were dropped by the ancient glaciers, are occasionally seen in the high mountains. These show unassorted angular rock fragments and soil with some gold.

American Hill Mine is four miles south of Secret House on a ridge between Lost and Antone Canyons, tributaries of North Fork of Middle Fork American River. The deposit is presumed to be an upstream segment of one of the channels mined at Last Chance years ago. The principal channel section here is reported 1700 ft. long by 250 ft. wide, with a smaller channel up to 40 ft. wide. The deposit was mined by drifting on bedrock until the late 1880 's, with average results reported, but no record remains of that work. Gravel is reported to vary from 10 to 100 ft. in depth. Water is available in Antone and Big Secret Canyons, requiring several miles of ditch in each case.

Pendleton Brothers have been engaged for several seasons digging ditches to bring water to the ground.

Azalea Prospect is in Sec. 22, T. 16 N., E. 11 E., two miles southwest of Blue Canyon. Blue Canyon Mining and Development Company carried on prospecting here for many years, searching for a profitable channel deposit under the rhyolite and andesite capping which is a mile or more wide and extends for many miles from south of Towle to near Cisco. The adit was started at an elevation of about 3800 ft. and 589 ft. below the Southern Pacific railroad. It was run in a general northerly direction for 4700 ft. Near the face a raise 200 ft. long (160 ft. vertically) was put up, and W. J. Holmes reported this showed large wash boulders at the top. A drift was run 100 ft. from the top of this raise. Fifty feet below the top, another drift was run about 300 ft. but failed to show gravel. Only small amounts of coarse gold were produced, the last reported being $900 in 1932.No regular channel was found. The reports concerning the property are not clear, but the adit was perhaps too low.

Bake Oven Placer. On North Fork of Middle Fork of American River, 6 miles by trail northeast of Michigan Bluff. About 60 acres of the ground was leased 1933-1935 to Woodruff and Morgan and some hand mining has been done at intervals. The deposit consists of a high bench covered with gravel about 150 ft. above the present stream. Only a little prospecting has been done but the gravel deposit is believed to be 1200 ft. long, with 35 ft. of gravel and 15 ft. of overburden where opened. The small amount of work done gave returns which might pay for ground sluicing or hydraulicking if water were available.

Baker Divide {Volcanon Mining Corporation). Over a long period, little work was done on these extensive holdings on the Forest Hill divide east of the Paragon property. On the south, along Volcano Canyon, a lease was given to C. H. McCarthy on the N ½ Sec. 20, T. 14 N., R. 11 E. This was subleased in 1929 to Volcanon Mining Corporation, who operated several years in a small way.

A narrow channel, which is reasonably assumed to be the same worked in the Hazard and Weske Mines farther upstream, crosses this leased land from east to west. A length of 1200 ft. of it was worked up to 1884. The next claim east, the Hazard, was worked for about 3000 ft., and from the Weske Mine an incline was run downstream for a reported distance of several hundred feet into the Muir Tunnel claim, also held under lease by Volcanon Mining Corporation.

This company's work consisted of driving a new crosscut adit 290 ft. long through the south rim bedrock to the old workings 600 ft. upstream from the old adit, and thence following the channel upstream. Late in 1932, this work had extended 1000 ft. upstream beyond the old face. The channel was found to be usually 30 to 40 ft. wide, but narrowing in places to 8 or 10 ft. The gravel was from 6 inches to 3 ft. deep. The results of work had not been as good as expected and the yield reported was small. The reason was believed to be the hard bedrock found; the best pay was reported where the channel crossed soft strips. The grade was 30 ft. in a distance of 1900 ft.

Bald Mountain Mine. This occupies the upstream section of the channel worked in the Glenn Mine, between Duncan Canyon and Deep Canyon in the mountains east of Westville. (See map in Report XXI.) Little has been done except assessment work since the 1925 report. Most of the old work was along one rim as sites are lacking for an adit low enough to bottom the channel. Late in 1935, the claims were reported leased to Frederick Vincent, San Francisco. This ground has produced some coarse gold similar to that found at the Glenn.

Big Dipper {Herman or Waterhouse & Dorn and Irish & Byrne). The upstream section of the Morning Star channel, having its inlet on the Gleason Mine in the SE ¼ of Sec. 4, T. 14 NT., R. 10 E., Iowa Hill district, was worked successfully at the Horman Mine (later known by the names above), Horman began hvdraulicking in 1858 and produced up to 1882 between $100,000 and $200,000. Thereafter, it was an important drift mine and was in steady operation from 1890 until 1902, producing

over $1,000,000 in that time. The channel was worked downstream a distance of 4700 ft, until a connection was made with the Morning Star mine workings.

The blue cemented gravel in these mines had to be milled. At the Big Dipper, a Bryan roller mill was used first; later 10 stamps were erected. Gravel was extracted through a bedrock tunnel 37 ft. below the channel, with raises into gravel. The original depth to bedrock was about 130 ft, A depth of 6 ft. next to bedrock was mined. Breasts as much as 370 ft. wide were opened, and posts and caps were used 8 ft. apart. Several benches above the main channel were worked on the east side; potholes occurred in the hard bedrock and these also paid well in places. In 1890 the gravel yielded $9 per carload of 1 ton; the average of that worked was said to be $6 a ton.

The last work done at this mine was by Stanislaus Development Company in 1917-1920. Prospect shafts were sunk and an open cut 600 ft. long by 4 ft. wide and up to 50 ft deep was made, in search of unworked gravel. A few thousand cars of bench gravel which had been left by the previous operators probably because of its low gold content, was mined and milled.

Big Gun Mine. This old hydraulic mine at Michigan Bluff was the largest producer of 20 or more placer claims worked profitably in early days. The present holdings include the Big Gun, Thompson & Powell, (unpatented), Red Hill and Van Emon Placer Mines (patented). Although the Big Gun was worked by Irydraulicking regularly from 1854 to 1883 and was a producer at intervals until after 1901, details of output are lacking except for the small-scale operations in which from a few hundred to $8,000 a year was recovered between 1888 and 1901. The production up to 1882 was claimed to have been about $1,000,000. In early days the principal mine of this ground was called the North American and was worked by the Van Emon family. First surface sluicing and then drift mining were begun in 1854. Hydraulicking started in 1858 and in 1860 a bedrock adit 1400 ft. long was run. The introduction of nitro-glycerine at this mine in 1867 for blasting 'pipe clay' which overlay the pay gravel is said to have resulted in as much work being done by 15 men as had previously been done by a crew of 28. The company used 400 inches of water under 300 ft. head. (See also Michigan Bluff Drift and Hydraulic Mines.)

There is remaining unworked at the Big Gun over 2,000,000 cu. yds. of gravel. The old reports do not mention the yield per yard from this mine, so the gross value can not be given.

Big Spring Mine. This adjoins the Dardanelles Mine on the west, and the two claims were so located along the course of the deep blue lead as to divide it nearly evenly. The Big Spring Mine was opened in 1854 as a drift mine and was worked until the late 1880's. Part of the work was done through an adit shared jointly with the Dardanelles Mine, besides which the Big Spring adit was about 1400 ft. long. The total production is not known but up to 1882 was said to have been about $150,000. At one time it had a 10-stamp mill.

Blue Eyes Prospect. This extensive group of claims between Deep Canyon and Spruce Canyon on the west side of Duncan Canyon, was described and mapped in R. XXI, 1925. Since then the work done has not led to any important discoveries, and lately only assessment work has been carried on.

Bob Lewis (Damascus) Drift Mine. This old mine adjoins the Mountain Gate mine on the east. It contains a cemented blue gravel channel which entered the ground from the north and flowed east of south for 2000 ft. in this claim, along the east rim of the primary white quartz channel mined in the Mountain Gate and Hidden Treasure mines. It eroded away part of the east rim of the earlier channel. This blue gravel was worked from 1860 to about 1885 by the Damascus company and a yield of from $8000 to $10,000 a year was reported in the later years.

The gravel was blue and cemented. It was 4 ft. thick and was worked 150 to 200 ft. wide. The stream had cut the bedrock 35 ft. deeper than in the adjoining white channel, and the gravel carried some

large quartz boulders from the earlier deposit. A 10-stamp mill crushed 25 tons a day, which was mined by a crew of five breasters and one carman. The roof stood well, requiring only one post with a cap 30 inches long in each square of 30 ft. The total length of channel worked in this mine is uncertain, although a map published in 1890 indicated about 1100 ft. had been mined.

Burns Mine. Reopening of this old drift mine, one-half mile from Michigan Bluff, was started in March, 1934, by D. Young, J. Simpson and A. M. Dunlop. It had been lying idle for many years, after activity which started in early days. Details of the earlier work are lacking. It was relocated in 1887 and until after 1900 considerable work was done by Michigan Bluff Mining Company who had two adits, the upper one 900 ft. and the lower 1050 ft. long. An incline from the upper one reached gravel and between 1895 and 1900 some production was made, but water was reported to have stopped the work. Four unpatented claims held since that time by the old company's stockholders were believed to cover three-fourths mile of a channel which is not known to be connected with any of those worked in nearby mines, but presumed to have run south under the andesite capping.

The present operators cleaned out and retimbered the longer adit and drove a new tunnel about 600 ft, long, where gravel was reported late in 1934. A winze was sunk 67 ft. and preparations for mining were made early in 1935.

Carmack (Pacific Blue Lead) Mine. At Canada Hill about 10 miles from Westville. It was described in Report XV under the latter name. Soon after, it was sold to George Carmack, who did some further prospecting and drilling, as described in Report XVII. The principal work was in an adit reported 600 ft. long, but partly caved so that only 350 ft. of it could be seen at time of visit. Through this adit Harris worked a bench deposit of white quartz gravel 20 ft. by 60 ft. in area and 2 ft. to 4 ft. deep which is said to have averaged $2.50 a car (weight not stated). The white gravel is on the rim of a deeper and later channel which has not been prospected. Carmack sank two shafts in search of it, one 70 ft. deep near the creek below the old workings, and one 75 ft. deep from a point 350 ft. inside the adit mentioned. His death prevented completion of the work. Part of the claims have since been patented by Mrs. Marguerite Carmack, Seattle.

Copper Bottom Mine. This is on the Succor Flat channel upstream from the old Succor Flat mine, 3 ½ miles north of east from Iowa Hill. The Copper Bottom was credited with the production of $31,400 before 1882, but much of the gravel in it is supposed to have remained unworked. There is reported to be an upper run or bench deposit about 50 ft. above the main channel, on which some work was done in 1922. The deeper channel was reached through an adit 400 ft. and a slope 300 ft., requiring a vertical lift of 120 ft. for water. The length of channel worked is unknown.

Dam Mine. This lies just east of the Hidden Treasure Mine, and while the middle section of the white quartz channel was being worked in that mine, the Hidden Treasure management bought part of the Dam claim along the course of the Dam tunnel and used it to work their own gravel.

The Dam claim contains an intervolcanic channel which is believed by some of those who are acquainted with the area to be the downstream section of the Red Point channel. They claim that this channel did not entirely cross the Hidden Treasure white channel, but followed along its east side and finally turned southeast through the Dam claim. This claim was first worked in 1858, and in the early 1880's the main adit had already been run 2700 ft. At that time it was producing about $1,000 a month and the channel was being worked for a width of 100 ft. Later it was worked out to the Hidden Treasure line. The data available do not definitely identify this channel with the Red Point channel, which is stated by Lindgren to have “cut through the older white channel of Mountain Gate to a depth of 90 ft. below its bedrock." It can reasonably be connected with the Bob Lewis channel, which was mined in the claim of

the same name just east of Damascus. This channel followed the east rim of the Mountain Gate-Hidden Treasure channel and eroded it for some distance, at least, leaving the white gravel on a bench to the west.

The Dam channel cut through high bedrock at the south end of the Dam claim. In June, 1934, new work was begun to prospect for gravel which might remain between the section already worked and this high rock on the east. From a point in the tunnel 450 ft. from the portal, a crosscut was run 300 ft. to the high bedrock. No unworked deposit was found during this work, which was stopped in July, 1935, although a little gold was mined while passing through the old workings.

The claim is equipped with two small gasoline engines, a small air compressor and pipe. Besides the Dam claim of 175 acres, there is also a narrow claim 1000 ft. long extending from the tunnel portal down the west branch of El Dorado Canyon, where the dump and sluices are located.

Dardanelles Mine was opened in 1853, and was originally worked as a drift mine, but later also by hydraulicking. Erosion took away the south rim and part of the deep blue channel, permitting the hydraulicking of the entire "front" of the claim. The average height of the bank was 150 ft. and it is reliably reported that 3,630,000 cubic yards was worked by hydraulicking by 1889, with an average yield of 13 cents a cubic yard. In November, 1879, a bank blast of 36,000 lb. of Judson powder, distributed in chambers along a 1000-ft. front, broke down and shattered half a million cubic yards of gravel.

Drift mining was carried on for many years upon the deep blue lead, up to the place where a later volcanic channel is reported to have cut it off. The cemented gravel in the main channel was 5 ft. high and was mined on the average 75 ft. wide. The main channel was divided here lengthwise between the Dardanelles and Big Spring claims, the latter being on the west. It was also an important drift mine. When the Dardanelles adit reached a length of about 2700 ft. where the later channel was encountered, an incline 330 ft. long was sunk to bedrock and considerable drifting done upon this channel. The mine was involved in litigation for a long time, and few details are available regarding the results of the drift mining between 1882 and 1894. In the later work a 5-stamp mill which began work in 1888 was used to crush gravel. Electric power was used for hoisting gravel from the incline, for pumping and for illumination.

Dead-wood Drift Mines (Double O). Rube Manling and associates of Michigan Bluff have been prospecting for five months (1935) on part of this property, formerly consolidated by Double O Mining Company (which company was suspended in 1931 for failure to pay its corporation franchise tax). They are said to have produced considerable coarse gold recently (June, 1935).

In years past many thousand feet of adits have been run to work the ancient channels in Deadwood district. The maps of these workings by which the channels might be correlated with those of the Forest Hill Divide have not been made available to the writer. It is generally supposed that the channels from Last Chance entered the present Deadwood Ridge on the east side at Devils Basin, running west and southwest across the ridge with the outlets exposed by erosion a little north of Deadwood. The channel sections which may have once extended from there westward for two miles to connect with the Hidden Treasure and later channels of the Forest Hill Divide have been completely eroded by Indian and El Dorado creeks. The correlation between the channels of Deadwood and Last Chance on one side and Forest Hill Divide on the other is made by the similarity of the volcanic cappings, and the comparison of grades. The older channel of the series has a grade of 120 ft. per mile for the two miles across Deadwood Ridge. This channel has not been as extensively worked at Deadwood as have the intervolcanic channels. Of the latter, the Rattlesnake channel was worked for about 7000 ft., having a grade to the west of 240 ft. in that distance; and the Elkhorn-Washington channel has also been extensively worked. In the later years of work (1897-1914) practically all the placer claims at Deadwood, including the Harkncss, Washington,

Elkhorn, Devil's Basin, Devil's Basin Consolidated, Rattlesnake and Lofruth were held under the ownership of R. Lofruth and J. E. Ferguson as the Devil's Basin Consolidated Mines.

Dixie Queen Mine. Since the last report,[1] this mine was worked irregularly by drifting, and during the past few seasons by hydraulicking in a small way. In 1933 Prank Escher made a short run, and since then Davidson Brothers have worked the claim.

The former drift mining was done through an adit driven 800 ft. south along The course of the channel. Breasting was done for a length of over 200 ft. and a width of 55 ft., about 15 ft. above the adit.

Dutch Flat District

The Dutch Flat gravel mining district, covering about two miles in length between Bear River and the Central Pacific Railroad, on the great ancient river deposits which extend north and south through Nevada and Placer counties, was formerly one of the heaviest gold producing sections of the county. As at Gold Run, where the deposits are on the same old-river system, little mining has been done there lately, although considerable unworked gravel remains. These mines north of the railroad drain into Bear River, where the debris disposal problem became aggravated at an early date. As early as 1867 it was said that tailings from the placer mines there had already accumulated to a depth of 70 ft. in the river, and proposals had been made to drive a tunnel about three miles long through the ridge separating Bear and North Fork of American River to permit sending debris into the latter. Though appearing to promise great profit ultimately, this project was too expensive for private means.

Placer mining began at Dutch Flat in 1849 and hydraulicking on a moderate scale was started in 1857 on the Phoenix, American, Buck-eye, Dutch Flat and Queen City claims, although some piping was done as early as 1855 on the Teaff and Boston claims. Most of these claims were small, and used only 200 to 300 miners inches of water each, but the yield was high. A production of $150 a day was apparently the average for a claim using 250 inches of water and employing four to six men. By 1868, most of the upper, easily washed gravel was worked off. Drift mining began in 1856 and several claims, including the Blue Cut, Potosi, Whynot, and Badger paid well for years, the Badger being credited with dividends of $192,000 in four years. In 1867 the first shaft was sunk to bedrock on the Buckeye claim, giving flattering prospects in the blue cemented gravel. The first mill for crushing this cemented gravel appears to have been put to work the same year on the Ohio claim. Subsequently most of the bedrock of the deep blue lead between Dutch Flat and the railroad is said to have been worked by drifting. The detailed history of none of these claims is to be had in available publications, and only a few were described in contemporary reports. Most of them were unpatented, and in later years were relocated under other names. The mines of the district do not appear in the lists of producers for many years after the anti-debris injunctions until 1895, when the Southern Cross and Polar Star Mines worked alternately both by drifting and hydraulicking, were credited with small outputs. They continued active until after 1900. In 1900, the Polar Star was using 2800 inches of water under 450 ft. fall, with 8-in. and 9-in. nozzles. There was only sufficient water to permit work five hours daily with two nozzles of these sizes in the spring of that year. This work was done in the cemented, coarse gravel in the lower part of the channel. A log crib debris dam in Bear River was used jointly by this mine and Liberty Hill mine in Nevada County. Drift mines that were active about the same time were the Dutch Flat Blue Lead, working in the bottom cement gravel which was crushed in a 10-stamp mill; the Alta Mine and the Bartley Consolidated, on the branch channel coming down from Alta, on the east side of Little Bear River. Both of these produced low-grade

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[1] "Ancient channels of the Duncan Canyon Region, Placer County," R. XXI of State Mineralogist, 1925.

gravel, considered from the drift-mining standpoint.

The main deep channel between Indiana Hill and Little York in Nevada County has bedrock which rises 100 ft. in a distance of four miles from the south end to the town of Dutch Flat, but in spite of this, it has been considered by many that the stream flowed north. Near Dutch Flat railroad station it turned from its previous northerly course to the west, crossing the present Bear River about one mile west of Dutch Flat. Smaller channels entered the district, one from Liberty Hill in Nevada County running through Elmore Hill, the Polar Star and Southern Cross Mines and under the town in a southerly direction. The upper gravels in this were fine or medium but on and near bedrock many heavy boulders were found. Another channel entered from Alta through the Bradley & Gardner, Bartley and Mutual claims. In the main channel, having a depth of around 300 ft., the lower part was of coarse blue cemented gravel 100 to 200 ft. deep. In the branch channel from Liberty Hill, the coarse, cemented bottom gravel left after early hydraulicking at the Polar Star and Southern Cross was from 60 to 160 ft. deep. The total superficial area of gravel at Dutch Flat was about one square mile.

Jarman in his report to the State Hydraulic Mining Commission (1927) estimated that if the channel trough maintains the same cross section here as at Gold Run and Bear River, there remains about 34,573,000 cubic yards of gravel. It has been estimated [1] that in all 105,000,000 cubic yards have been washed at Dutch Flat, Nary Red and Elmore Hill. This was mostly top gravel, though work was carried to bedrock in pits on the Southern Cross and Polar Star. William Nicholls, who did this deeper hydraulicking, estimated that where the deep ground had been previously drifted it produced 25 cents a cubic yard by piping, and where not drifted the yield was 40 cents a cubic yard. In some of the later drifting at a nearby claim, a thickness of 15 ft. next to bedrock was said to give from 90 cents to $2.50 a carload (presumably one ton).

The total production of the Dutch Flat mines can only be guessed. Writing in 1867, J. Ross Browne stated the shipments of gold for the first six months of that year from Dutch Flat totaled $307,600 and said that in 1858 "the monthly gold yield was thrice as great as now." The camp was one of the leading hydraulic producers for 12 years before 1867, and had a record of a dozen or more small mines which had been in steady operation every season for periods of from 6 to 12 years, producing $100 to $200 a day (gross) each for 6 to 8 months annually. The figure of over $3,000,000 production at times credited to the district therefore seems too low, and $4,500,000 to $5,000,000 is probably much nearer the mark.

Dutch Flat Townsite. In 1933, Francis G. Fabian and associates of the Enterprise Leasing Company obtained mining rights under a number of lots in the town of Dutch Flat, as well as under school property and the streets, for the purpose of prospecting the unworked gravel deposit on which the town was built. A shaft was sunk about 125 ft. and considerable drifting was done in 1934, with a production of less than 100 ounces of gold reported. In 1935 these parties quit the project, and in August, 1935 Lyman Gilmore and associates were reported to have filed a mining location on the deposit, or so much thereof as had been excluded from the grant made in 1867 for the townsite.

There is a mill and other machinery which was placed on the property by the former operators. The Federal Drift Mining Company as late as 1915 prospected the deposit through a nearby shaft.

El Dorado Drift Mine. This old mine at Startown, one mile from Last Chance by trail, has been worked only in a small way in late years, though formerly the largest producer of the district. The geologic conditions revealed here underground are very interesting and have apparently never been

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[1] House Executive Documents 2d Session, 51st Congress, Vol. 36, pp. 83-86, 1891.

adequately described. Work began in the 1850 's and the most of the production was made before statistics were regularly kept.

Three channels occur in the property, lying almost directly above one another. The lowest and youngest is the El Dorado channel, but the Sharpstick channel lying 9 ft. above it was first worked for 3000 ft. to where it was cut off by the El Dorado channel. The former channel has a pipe-clay roof and carries large boulders. El Dorado channel was a steep, narrow mountain stream from 10 to 100 ft. wide, but usually being under 25 ft. wide. It carried a scanty amount of gravel, which is absent in places, where the andesite is in contact with the hard schist bedrock. Pay was found in this channel near where it cut the older one. Gold in it is coarse and nearly all in crevices in the bedrock. The main tunnel followed it 5200 ft. At a point 4500 ft. from the portal the El Dorado channel branched, and a branch drift was run on the left fork, northeast, for 900 ft. The general course of channels is southeast and the bedrock rises about 125 ft. going from the portal to the face of the left fork of drift, a distance of 5400 ft.

The Big channel is 42 ft. above the El Dorado channel and was cut off twice by it. This channel has a maximum width of 800 ft. and has been worked through raises from the El Dorado tunnel for a length of 1800 ft. in this property. The gold content was found to be spotted, but generally low, and the gravel was partly cemented.

Other important old mines in the district are the Pacific Slab, 1 ½ miles southwest of Last Chance, where the Big channel was found to be cut by a later one 3500 ft. underground; and the Home Ticket, described herein.

Excelsior Claim had the first shaft sunk near the middle of the lava cap, one-half mile west of Forest Hill, in search of the main deep channel. This struck bench or rim gravel, and the company installed a steam power plant for hoisting and pumping, and a mill for crushing gravel about 1880. Unlike the Mayflower Company which put down a shaft shortly after from their old hydraulic pit to gravel on the same west rim a mile and a half upstream, and then began a long bedrock tunnel to bottom the deep gravel, the Excelsior operators sank an incline called the Excelsior slope, from which considerable production was made until they were driven out by water.

On the **Independent** claim, next upstream from the Excelsior, an incline was also sunk, but in this case from the southeast rim. This bottomed the channel at 2696 ft. elevation, not far from the foot of the Excelsior slope. The two claims together had less than 1000 ft. of channel. The section of this deep cemented channel upstream from the Independent Slope in the Independent, New Jersey and Jenny hind claims {Jersey Consolidated) was not opened until 1915, when a new company, Excelsior Gold Mines Company obtained control of the claims by buying control of Reamer Consolidated Mining Company, which had held the claims for many years. Between October, 1915, and February, 1918, a total of $253,817 in gold was. produced by Excelsior Gold Mines Company of which $212,123 was reported as coming from the Independence, New Jersey and Jenny Lind claims, where about 1200 ft. of channel was worked. Stockholders of the Reamer and Excelsior companies had a lengthy dispute regarding the accounting for proceeds of operations, and many details are lacking. From what can be learned, however, this gravel must have yielded about the same average gold return as in the Mayflower, i.e., $7 to $8 a ton. It was said to have been much richer in places.

The work was done through the New Hope tunnel, with its portal in Sec. 35 and running upstream in bedrock below the gravel. This tunnel was 4786 ft. long when it reached the Garland Mill Slope claim; how much farther it was run in that claim is not known by the writer. It permitted draining the Excelsior and Independent Slopes and the working of the channel thence upstream through raises, from which breasts were opened for a width of 100 to 150 ft. in the Reamer Consolidated claims. Excelsior Gold

Mines Company quit work in December, 1918, and it was reported then that they had "lost the paystreak." In 1919-1920 Haines Gridley as trustee did considerable more work, amounting to over 1000 ft. and advancing about 400 ft. upstream, giving a total length of a mile or more. He reported low-grade gravel, with the rims far apart. Since then, work has been intermittent and production small.

It was in the claims discussed (Independent, New Jersey and Jenny Lind) under the town of Forest Hill, that the pioneer miners found exceptionally rich gravel in the Forest Hill channel, a primary stream deposit of which about one mile in length, flowing west through the west half of section 36 and east half of section 35, remained between the canyon slope and the deep blue lead. These claims had made the following reported productions before 1868 from one-half mile of this channel and its benches:

Independence $450,000 (3500 ft. of tunnel)
New Jersey , $850,000 (from an area 500 ft. by 400 ft.)
Jenny Lind $1,100,000

The hope of finding the western segment of this channel, beyond the point where it had presumably been cut off by the deep blue-lead, has been the incentive for much of the work done since the death of J. W. Reamer, a pioneer operator of the Jersey Consolidated. His widow consolidated and held finally all of the claims between the Dardanelles and the Gore claims, including the old Baltimore Consolidated and Forest Hill Slope, which had been sold at sheriff's sale in 1868 to Alvinza Hayward. These claims became the Reamer Consolidated in 1902 and passed, as noted above, to Excelsior Gold Mines Company in 1915, and finally into the hands of W. F. Detert, now deceased.

The Excelsior company in the last operations on the blue cement channel used stamps for crushing the fine gravel and a tube mill for scrubbing the boulders. Large lumps of cemented gravel and coarse pieces of bedrock were crushed in a rock breaker before stamping.

Flora Dean (Glencoe) Mine. Prospecting on a small scale is carried on irregularly at this old mine north of Roach Hill in Iowa Hill district. In 1935 a raise was being put up in a branch adit about 1300 ft. from the portal of main adit.

The channel on this claim was considered a tributary of Succor Flat channel. In early days the Glencoe mine was credited with a production of $13,400.

Georgia Hill Mines. These old mines, near Yankee Jim on Devils Canyon, were last actively prospected in 1919-1922 by Georgia Hill Gravel Mining Company, Incorporated, which had 757 acres under lease. An adit, designed to bottom the channels and permit drift mining, was run south, starting on the Trafton claim and entering the Kerr claim. At the time of visit in 1921 this adit was 1400 ft. long, and is reported to have been run about 500 ft. farther the next year. At a point 850 ft. from the portal, the adit was directly under the face of the old hydraulic pit, and 175 ft. vertically below the bedrock surface. At 1350 ft. in, a raise was put up 206 ft. and from its top an upper level had been run 22 ft. south and 136 ft. west at time of visit. It was entering gravel carrying heavy granite boulders. The steep grade indicated has been explained by some as due to the raise being put up through a bedrock island in the channel. At any rate, the company discontinued work without making any discovery of good pay. Besides those named, the Buchanan, Armbruster, Gillespie and Adams claims were included in the lease.

Gleason Consolidated Mine. At Wisconsin Hill, two miles south of east from Iowa Hill adjoining the Big Dipper. The Columbia claim, worked by James Gleason as an hydraulic mine, was the principal one of the group, and had made a reported gross production of $350,000 by 1880. The Ravine and Tenyke claims are said to have produced $113,000 more up to that time. For some time after, the ground was worked by Chinese and their output is unknown. The upstream part of the Big Dipper-

Morning Star channel was exposed on the Gleason ground by erosion in Refuge Canyon, and the work exploited the main channel and bench gravel. Refuge Canyon, into which the mine tailing was dumped, also produced much gold up to 1897. At the Gleason a bank 220 ft. high was worked, with the main channel about 325 ft. wide, and a much greater width of bench gravel. In later years lessees have made some production. In 1933, the last of these, Goodman Mining Company, began producing gold from drift mining and have since been realizing substantial returns, up to the fall of 1935, when four or five men were working.

Glenn Mine has been for many years the principal producer in the Duncan Canyon region, in the mountains six miles east of Last Chance, and reached by 55 miles of road from Auburn. Gold has been produced intermittently since 1919. The channel courses south and southeast from the Bald Mountain mine to Duncan Canyon. About a mile in length lies in the Glenn mine, and the larger part of this has been prospected or mined through a series of adits at different levels, from 5000 to 5345 ft. elevation.

The channel is steep and narrow and the gravel is mostly of hard schist from the bedrock, with little quartz in it. In the lower workings the gravel was 12 to 15 ft. wide and from 0 to 2 ½ ft. thick, being overlain by coarse volcanic sand, which in places closes directly down upon the hard, polished schist bedrock. The gold there was mostly in the crevices of the bedrock. In the upper workings a width of 35 ft. was breasted. In the Shields tunnel a crevice 22 ft. by 55 ft. yielded $9000. In a length of 1500 ft. in this tunnel the channel raised 140 ft. This included many sheer drops of several feet, which were evidently waterfalls in the old stream, and not faults. In sections with flatter grades gravel accumulated. It is a late prevolcanic channel which collected coarse gold from the erosion of the nearby mountain region, where gold occurs in seams and stringers.

The mine has been worked most of the time in late years by different lessees with small crews. It was active in 1935 and for some years has been producing from $2000 to $10,000 a year. The mines in this section of the county were described, and a map of the district was printed in our quarterly, “Mining in California,” for July, 1925.

Gold Run District.

The Gold Run-Dutch Flat ancient channel section has been divided by the erosion of modern streams into two sections, separated by the ridge occupied by the Central Pacific Railroad between Gold Run and Dutch Flat, The drainage to the west is into Bear River, and to the east into Canyon Creek and North Fork American River. On the eastern section between the railroad and Canyon Creek, both hydraulic and drift mining were extensively carried on, but although much gravel remains unworked there has been little activity in recent years.

The best estimates of the total amount of gravel mined in this section are necessarily only approximate, as very few of the old hydraulic miners had an accurate idea of the yardage mined. Estimates given by government investigators in 1891 indicate that 84,750,000 cubic yards had been mined. The later and more careful work of G. K. Gilbert in 1908 led him to believe that previous figures for the yardages mined in the American and Yuba River drainages should be increased by 51% and if this correction is applied to the Gold Run district it would indicate a total of about 128,000,000 cubic yards removed.

As a result of the uncertainty concerning the yardage mined, it becomes nearly impossible to arrive at accurate estimates of yield per yard. In 1871, Professor Pettee estimated that 43,000,000 cubic yards mined by hydraulicking up to that time had yielded $2,074,356 or 4.82 cents a cubic yard. This was the low-grade top gravel. The above total production was arrived at by adding 50% (on account of gold

thought to have been sold outside) to the amount of gold sold to Moore & Miner, bankers at Gold Run between 1865 and October, 1870. Later figures for production and yardage are conflicting. In 1872 incomplete figures were kept for two companies which do not show yardages handled or duty of water, but from which a yield of from 8 to 15 cents a cubic yard may be estimated by figuring water duty as high as five or as low as two cubic yards per miners inch daily. Lindgren stated [1] "The yield per cubic yard of hydraulic gravel is said to be 11 cents." His report was written after hydraulic mining had been enjoined and the source of his figures is not given. By 1873, those deposits had been worked down to a level where the natural outlets of the upper part of the district were becoming choked with tailings, and work had been started on a drain tunnel from Canyon Creek by Gold Run Ditch & Mining Company which with its branches finally aggregated over 4000 ft. in length. Little has been recorded concerning the later hydraulic mining. One run of 60 days made in June and July, 1908, resulted in a production of $64,564.81 from 237,400 cubic yards of the cemented bottom gravel in a place not previously drifted. This was an average of 27.2 cents a cubic yard for a depth of 80 ft., where considerable dynamite and black powder were used for blasting and 2000 miners inches of water under 450 ft. head was employed.

The mining claims of this district, once said to have been worked by about 40 small companies, came in later years under the ownership of a few, of which Stewart Gravel Mines has the largest acreage, other owners being Nicholls Estate Company, J. L. Gould and Gold Run Ditch and Mining Company.

The cemented gravel or 'Blue Lead,' occupying the deep trough under the deposit of loose and finer material mined by hydraulicking, was worked extensively by drift mining from the south end, where the river canyon exposed the deposit. Hydraulicking at this end, called Indiana Hill, started in 1857 in a small way, but the claim of Indiana Hill Blue Gravel Mining Company was worked from 1854. They erected an 8-stamp mill for crushing the cemented gravel in 1864. For three years, 1872-1874 inclusive, this company produced 19,997 carloads of gravel which yielded $75,422.47 or an average of $4.71 a ton,[2] with a profit of $2.17 a ton. The previous production of the claim was estimated at $125,000. Between December 1, 1874, and August 21, 1875, Indiana Hill Cement Mill and Mining Company produced $56,446.47 at an operating cost of $24,000. From 1876 to the end of January, 1879, Indiana Hill Placer Mine produced $152,225.90. Details of later production are not at hand, but the total is reported at $750,000. Details are lacking regarding the numerous other claims worked in the district, mostly by hydraulicking.

The upper beds of gravel in this immense deposit vary from a width of a few hundred to 3000 ft., averaging one-half mile, and with a length of about 12,000 ft., of which about 1000 ft. has been worked entirely to bedrock beginning at the lower end of Indiana Hill, and in the Indiana Hill pit about 1600 ft. long by 2000 ft. wide was worked out completely. In addition, most of the top gravel is gone from the rest of the claims, and the bottom has been drifted to an extent not exactly known. The upper gravel was ideal for hydraulicking, with no overburden nor very large boulders. The maximum depth to bedrock was 300 to 400 ft. There remains unworked in the deposit an amount of gravel that has been variously estimated by different parties as follows:

46,000,000 cubic yards of hydraulic gravel ultimately available. (House Executive Documents, 2d Session, 51st Congress, 1890-91, Vol. 36, pp. 83-86).

92,000,000 cubic yards (estimated, Lindgren, P.P. 73, U. S. Geological Survey, p. 145).

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[1] Lindgren, W., U. S. Geol. Survey, Prof. Paper 73, p. 145.

[2] This does not include boulders stored underground.

75,000,000 cubic yards (Arthur Jarman, Report of the Hydraulic Mining Commission of California, 1927).

In 1874, Indiana Hill Blue Gravel Mining Company was working the bottom gravel by drifting, through an adit then 1600 ft. long. They were then "carrying forward a 'breast' 110 ft. in width and taking out from 6 to 7 ft. in depth of gravel inclusive of the bedrock picking" They employed 25 men who extracted from 40 to 50 carloads, containing 1600 lb. of gravel each, in 24 hours. This was coarse, cemented blue gravel containing many large boulders. In places a height of 10 ft. was breasted. This deep blue lead has been only slightly prospected between the Indiana Hill drift workings and the railroad, between which places it is believed to be continuous, with a grade of 25 ft. per mile.

Golden Fleece Prospect is on the lava-covered ridge between Westville and the Hogsback claims. As at the latter, an adit was run from the north side of the ridge in a southerly direction in search of gravel. This adit was about 3300 ft. long and encountered what was reported to be a bench deposit of white quartz gravel, in which about 1000 ft. of the adit was run. A winze into deeper ground is said to have been stopped on account of water. The course of the supposed intervolcanic channel through this ground has not yet been proved.

Gould Mine. In Sec. 23, T. 15 N., R. 10 E., about 3 ½ miles northeast of Iowa Hill, in Indian Creek Canyon. The Gould channel which flowed southwest toward the Strawberry Mine, has been prospected for a number of years' through an adit with a total of about 2600 ft. of work done. The production has been a few thousand dollars.

In the course of the work two other small channels were encountered named Success and Flying Dutch channels both claimed to be earlier than the Gould channel. The latter was prospected to within a short distance of the line of the Bee claim which lies between the Gould and Penn Valley mines.

Grey Eagle Mine. The intervolcanic channel in this property on the extreme west end of the lava-capped Forest Hill divide near Spring Garden has been prospected extensively through adits from Owl Creek on the north, as described in Reports XIII and XV of the State Mining Bureau. The longest adit was run after a shaft had been sunk 360 ft., and it was supposed this shaft had bottomed the channel. After the adit had been run it was found, however, that the channel had not been bottomed and the adit was too high. This adit was a crosscut for 3000 ft. more or less, and was run 4000 ft. more upstream. The last work was done in 1915-1916 by California Chief Development Company. The channel was prospected more thoroughly at this time, and considerable of the cemented gravel was run through the old stamp mill, but the average returns were evidently not satisfactory as the owners quit work soon after.

Hard Climb Prospect. This is reached only by trail from the Glenn or Pine Nut Mines and is on the east side of Duncan Canyon on what is generally identified as a segment of the Chalk Bluff channel which here ran nearly parallel to the present course of Duncan Canyon, which has eroded away much of it. The data on which this gravel is connected with deposits in nearby mines are probably not sufficient to permit a definite conclusion. So far as known, no complete line of levels has been run to connect the various openings. It is quite possible that some of these mines are on bench deposits of earlier age than others, though all are parts of the deposits of the great river that flowed from this section to the Ralston Divide.

At the Hard Climb a number of short adits have been run, varying from 155 to 213 ft. long at time of visit, exposing channel gravel deposited by a stream which flowed S. 37° W. as indicated by shingling of the gravel. The channel is about 300 ft. wide and carries little quartz among the boulders, which are of bedrock material. Over 1000 ft. north of the north adit a shaft was sunk 45 ft. on the west rim. Though the

money spent on development has exceeded the amount saved, some of the gravel is said to have yielded as much as $4 a ton (old price). There is a ditch 2500 ft. long but little water is available.

Haskell (Gaylord) Placer Mine. This is 2 ½ miles southwest of Auburn. The intervolcanic American River flowed through this property, depositing gravel of two different periods. The earlier channel was considerably eroded, so that only remnants in the form of benches remained. Several of these bench deposits, of which the larger were 150, 175 and 325 ft. long, were worked between 1900 and 1906. Few details of earlier work, which was carried on irregularly and in a small way for years, remains. The Haskell Gold Mining Company, owners, quit work in 1897 and later work was done by lessees. The principal pay came from the earlier channel benches. The channels were covered by andesite and the pay gravel was cemented, and was crushed in a Huntington mill. Gravel was breasted to a maximum height of 5 or 6 ft. and a width of from 25 to 150 ft. The total production is claimed to have been over $115,000.

An adit was run 1100 ft. to prospect the deeper and later channel. There seems some doubt as to whether or not this adit reached the bedrock, but according to Lindgren the trough of the channel was followed 500 ft. upstream and was found to be filled with andesite sand, with little gravel, and that of low gold content. East of the road 3000 ft. of work was done through old adits, besides the crosscut run from the deeper adit to work bench gravel. A number of prospect shafts were also sunk upstream east of the bench workings, but no gravel was breasted from these.

Hidden Treasure Mine. This old mine, the largest producer among the drift mines of the state, has been described so many times that it need not be covered in detail here. It was discovered in 1875 by William Cameron. The late date of finding this southern end of the deposit was due to the fact that a late volcanic channel, coming down the ridge from the north on the east side of the primary channel, had eroded away the gravel on the outlet end of the latter, leaving no white gravel exposed. Cameron based his calculations for a tunnel on the elevation of the Mountain Gate workings, on the north end of the channel, and was fortunate in striking the bedrock of the white channel in 600 ft. Thereafter, the mine was worked profitably for 32 years, with a gross production reported as a little over $4,000,000.

The mine was worked on a large scale and became a model of drift mining, with many improvements in practice, and low costs. The earlier work was done through a tunnel with its portal at Sunny South. This tunnel followed the channel upstream, partly in gravel and partly on bedrock for about 8500 ft. It had an average grade of 18 inches in 100 ft. The gravel was loose, free-washing white-quartz gravel on soft bedrock, neither requiring much powder, which was used almost entirely for breaking boulders and bedrock. A crew of 120 men mined and washed 275 one-ton carloads of gravel in 24 hours, at a total cost of 99 cents to $1.10 a ton in 1889-1890, when gravel was being mined 7700 ft from the portal. Two-thirds of the crew were Chinese, who were paid $1.75 a day and are said to have been good miners; white men received $3 a day. Loaded cars ran out by gravity to the dump. Timbering was an important item of expense, because of swelling bedrock. Both the main tunnel and the breasts had to be closely timbered.

Work through the tunnel having its portal at Sunny South continued until 1896, when the quartz gravel was cut off by the later blue gravel channel worked in the Dam Claim. It was soon after that part of the Dam claim was purchased and the site of work was moved into the Dam tunnel with its portal at Centerville. [renamed: Bullion] This tunnel was run on the Dam channel to a length of 6000 ft., then run on a slightly steeper grade for 2000 ft. farther, to reach the older channel, the bedrock of which was 32 ft. above that of the Dam channel. The white quartz channel was picked up again 200 ft. beyond the place where it was found cut off by the blue channel. Thereafter, both channels were worked, furnishing from 250 to 350 tons of gravel and 25 to 30 tons of waste a day. The ground was finally worked out up to the

Mountain Gate, the tunnel reaching a length of about 10,100 ft. by 1902. Electric power was generated at the property during this later work by utilizing water under 850-ft. head. This power was used for running an electric locomotive which hauled gravel trains of 15 to 30 carloads each, and for hoisting, pumping, etc. To work the blue gravel it was found necessary to sink a winze from the main tunnel, and from these winze workings a width of 150 ft. and a length of 1400 ft. was reported having been opened by 1901, when the blue channel was producing 100 carloads of gravel a day. The white channel widened in this section so much that No. 5 gangway, 7000 ft. north on the main channel, was run west 1100 ft. and then northwest 440 ft. to work gravel on that side. This channel had an average grade of about 70 ft. in one mile. Generally speaking, with exceptions as in the case noted above, it was breasted about 250 ft. wide and 4 to 7 ft. deep including one foot or more of soft bedrock. The yield, and the cost of operation, varied considerably. Gravel carrying as little as 50 cents a ton was washed, but the average gross yield for the first 7700 ft. was $1.75 a ton. The average yield per linear foot of channel is said to have been from $184 to $244. The total amount of dividends is unknown; for 11 years, 1877 to 1887, inclusive. $268,092 in dividends was paid from total receipts of $898,699.43.

Hogsback Prospect. This is 2 ½ miles east of Westville and is thought to be on the Red Point intervolcanic channel, the nearest workings on which are three miles west of this land.

In the 1890's the Hogsback ground was prospected by three adits driven southeastward from the north slope of the ridge near the west line of Sec. 2, through bedrock. The longest of these adits was run 2900 ft. or more and a raise was put up 152 ft. Some gravel was found at the top of the raise, and an area of 30 ft. by 40 ft. which was worked is said to have prospected well, but according to J. A. Ferguson not enough work was done to learn much of the size of the channel and its possibilities.

Home Ticket Drift Mine. Since October, 1933, parties reported to be connected with Black Bear Consolidated Mining Company, a Nevada corporation, have operated this old mine 1 ½ miles northeast of Last Chance. It had been extensively worked years ago through an adit nearly 5000 ft. long, from which much breasting was done to a height of 7 ft. along a channel 300 to 400 ft. wide. This previous work, which began about 1855 to 1860 and continued until 1918 in a small way, was stopped when the channel was cut off, and the remaining gravel could not be profitably mined on account of high costs during war time. In 1921, Threlkeld and Davis began sinking an inclined winze from the adit level about 4000 ft. from the portal, in search of a deeper channel thought to underlie the one previously worked. This work was abandoned before completion.

The recent work has consisted of mining and milling cemented gravel left in old mine pillars and on the rim, at places 2000 ft. to 3000 ft. from the portal. Gravel was drilled and blasted with 40% dynamite, and eight men on a shift, including one timberman and one mule driver, were reported to have mined and delivered to the mill 28 to 32 carloads of about one ton each during the winter of 1934-1935. A Krogh gravel mill with a capacity of about 70 cubic yards in 24 hours, is operated by a 25 h.p. diesel engine. This mill has screens with one-fourth and one-eighth inch slots, and about 60 ft. of sluice is used. Water from Grouse Canyon is brought 1 ¼ miles by ditch. The supply runs short in late summer, and only two men were employed underground when visited in August, 1935.

The old production figures for the Home Ticket mine are not available but according to Dave Ray who operated this and other gravel mines in the district for many years, the mine produced about $200,000 before 1920. In 1934, the production of nearly 500 fine ounces put the mine in third place among the placer operations in the county.

Iowa Hill Gold Mining Company. A stock company based on the General Grant and adjoining gravel mining claims in Iowa Hill district, Sections 27, 33 and 34, T. 15 N., R. 10 E. A number of old hydraulic mines along the Indian Canyon front in these three sections were productive before 1880.

This company reopened an old adit and advanced it to a total length of 1600 ft. with a raise 70 ft. into gravel. Work has been going on intermittently for some time, but principally in 1934 and the first half of 1935. In September, 1935, work had been suspended. The gravel is cemented.

Equipment on the property when work was stopped included an 8-ft. Price mill, Dorr classifier, trommel, two Deister concentrators, air compressor direct-connected to a diesel engine, ore cars, tractor, trucks, drill sharpener, electric generator (with diesel power) and several buildings. Less than 1000 cu. yd. of gravel was produced before work was halted.

Jack Robinson Claim. This is one of the Blue Eyes group, bordering on Duncan Canyon just above Spruce Canyon. In 1924-1926 work was renewed on an old adit which had been started in coarse gravel above bedrock some years before. This was run 1300 ft. without bottoming the channel. It is quite likely the same channel found in the Dixie Queen Mine. (See Report XXI, p. 277.)

Long Point Mining Company (Jupiter Drift Mine). The Long Point channel, which ran about southeast through the west half of Sec. 35, T. 15 N., R. 10 E., then south through Sec. 2, T. 14 N., R. 10 E., in the eastern part of the Iowa Hill district, has been worked for about a mile from the south end. It was mined for a width of about 60 ft. and was spotted in gold content, going as high as $18 a car, or $200 a running foot in places. The gross production was about $200,000. About 1800 ft. of channel was worked under the supervision of Wm. Rose of the McGeachin Company about 1909 to 1912.

Long Point Mining Company for several years has been prospecting upstream on this channel. In the summer of 1935 their adit was 3400 ft. long. According to F. Huntington Clark, manager for this company, which controlled at the time a mile and a half of the channel under lease, a volcanic channel had cut below the bed of the Long Point channel above the old workings and had eroded the channel for some distance. In going upstream through this later barren material, remnants of pay gravel were occasionally found, but the channel had not yet been found intact. The work at the time was several hundred feet south of the south end of the Golden Streak claim. Some gold was produced in 1932.

Lost Camp Hydraulic Mine is two miles by road from Blue Canyon, at an elevation of 4300 ft. The channel contains interbedded layers of soft rhyolite tuff and free washing white quartz gravel, and has no soil overburden. The boulders are mostly of quartz and are medium sized.

The Slums Cut on Texas Gulch on the rim on the northeast side of the deposit is said to have paid well for ground sluicing. The Miller Cut, on the rim on the southeast has an area of about two acres. Boston Cut, on the Blue Canyon side, was also worked over an area of about four acres and a maximum of nearly 100 ft. deep. Some drift mining was done after the cessation of hydraulicking. The work upon the property was done over such a long period and by so many different people that no definite idea of the production is obtainable. The gravel is supposed to have paid for hydraulicking, and at times some coarse gold was found. About one-third mile of channel, 50 to 75 ft. deep, remains. In view of the lack of data regarding the value of gravel, and the fact that considerable of the best pay was taken out by drifting, the amount that may remain that will pay to work by the hydraulic process is uncertain but may amount to several million cubic yards, depending on the width mined.

During 1934 and 1935, a company of Sacramento people have had a crew of men at work preparing this mine for a resumption of hydraulicking. A sluice tunnel has been run and buildings have been erected. Besides a water right claimed in years past on Blue Canyon Creek, water can be purchased for six months in winter and spring from Pacific Gas & Electric Company. There is ample room for

tailing storage in Blue Canyon Creek. Some tests of the gravel made in 1934 yielded a few hundred dollars in gold. J. O. Ziegler is president and George F. Buell is in charge at the mine.

Macedon Prospect. This is on the Whiskey Hill channel, next downstream from the Whiskey Hill (Greek) mine, and is one mile south of Secret House. A length of about one-half mile along the channel is presumed to lie in the Macedon. The old Greek tunnel, through which about 600 ft. of the channel in the adjoining mine was worked in the 1880 's, was reopened in 1921 and was continued a reported distance of 200 ft. downstream in the Macedon, with a small production. It is a narrow, steep channel carrying coarse gravel and some coarse gold.

Mayflower Mine. The original Mayflower Mine had an area of 370 acres. Over a long period, however, one after another of the old drift and hydraulic mines of the Forest Hill and nearby districts have been absorbed until the present holdings of Mayflower Gravel Mining Company exceed 3000 acres. Among the claims owned are the Texas, Sacramento, Washington, Garland Mill Slope, Excelsior, Hope, Uncle Sam, Green Spring, Live Oak, Small Hope, New Jersey (mineral rights), Brushy Slide, Dardanelles, Oro and many less well known. Several of these were important producers and have been described in past reports, to which reference should be made.

Mayflower Mine was worked first by hydraulicking. Later it was an important drift mine, working the same channel as the bottom lead in the Paragon, with which workings the Mayflower drifts finally connected about 1897. The principal production, about $1,600,000, was made between 1888 and 1899 inclusive. The gravel ranged from 2 to 14 ft. thick, is said to have yielded an average of $7 a ton, and was worked for an average width of 75 ft. It was cemented and was crushed in a 20-stamp mill which had a capacity of 6J tons per stamp day, using 850-lb. stamps dropping 100 times a minute. The battery screen was iron plate punched with holes 0.2 inch diameter, and in place of amalgamating plates grooved boards were used in front of the stamps, with quicksilver in the grooves.

The Mayflower operators worked downstream on the bottom or main lead to the boundary of the Garland Mill Slope claim (then under other ownership), as well as upstream to the Paragon line. The amount of work done on the upper lead, 150 ft. above the bedrock of the main channel, is not known to the writer, although at one time it was supplying considerable gold.

Some interesting figures for the Mayflower were quoted by John Hays Hammond. From December 11, 1888, to September 24, 1889, a total of 33,787 tons of gravel was mined from a length of 1620 ft. of channel and yielded on crushing $272,616.50 or $8.06 a ton.

McGeachin Placer Gold Mining Company, Sacramento. This company owns a number of the placer mines of the Iowa Hill district, including the Jupiter Consolidated, Irish and Byrne, Winchester, Schmidt, Insolvent and Dolly Varden, Morning Star, Pritchard, Hazelroth and others less well known with a total of 1684 acres shown on the assessor's rolls, as well as the Grizzly or Big Dipper, Zurmublen, Union, Iowa Hill Canal and Lower Humbug ditches, and a reservoir site of 73 acres in Sees. 16 and 17, T. 15 N., R. 11 E.

Although many of the mines named were formerly leading placer gold producers, the present company has done little mining in late years. From time to time lessees have done some work and produced small quantities of gold; the last of these noted being Long Point Mining Company, who for some time were engaged in a search for the pay streak in the unworked portion of the Jupiter or Long Point channel. This company made some production in 1932, and in 1933 found enough gold to encourage further prospecting in the hope of again encountering gravel such as made the Jupiter locally known for a time. (See Long Point Mining Company.) Some of the leading mines mentioned above are described elsewhere in this report.

Michigan Bluff District.

Michigan Bluff Hydraulic and Drift Mines. On the canyon front near this town a remnant of the primary white-quartz channel of the Forest Hill Divide was left which was worked first by drift mining and then by hydraulicking from 1853 steadily until injunctions stopped this form of mining without dams in the 1880's. Some work was done as late as 1900 in a few of the mines, particularly in the Big Gun. The greatest activity, however, was before 1870. Between 1853 and 1858, gold shipments were as high as $100,000 monthly. In 1866, the county assessor estimated the output of this camp at $400,000 for the year. In 1869, with 20 companies operating, the total production was $108,600. From an area of about 40 acres, most of which has been worked, it has been estimated that 6,000,000 cu. yd. was mined, which yielded a total of about $5,000,000. The Big Gun Mine was reputed to have produced $1,000,000 up to 1882, and still has considerable gravel.

The deposit was almost entirely of white quartz in the form of sand, gravel and coarse boulders. There was a remarkable number of large quartz boulders of all sizes up to 20 tons. The maximum depth of gravel is said to have been 80 ft. and the average depth 40 ft. If this average is correct, the total yardage mined from 40 acres could not have been half the estimated 6,000,000. It is probable, as is usually the case with such round estimates, that both figures of yardage and yield are in error. But there is no doubt that the camp was one of the most profitable from the standpoint of unit yield. Two men in one case took out 1200 ounces of gold by drift mining in one week. On another claim, an area 100 ft. long and 30 to 40 ft. wide produced $30,000. On the Franklin claim, 2000 sq. ft. produced $37,000 from drifting. The yield per man employed was said to have been commonly from twice to several times the wages paid in the later work.

Monumental (Oriental) Mine. This is in Canada Hill district, 24 miles from Forest Hill and at an elevation of about 6000 ft. The deposit is of angular local gravel, slightly cemented, containing little quartz, and probably is largely morainal. About 2000 ft. in length all told was worked over a long period of years up to 1920, on a channel reported 80 ft. wide running N. 60° W. Work was stopped when the pay was lost, presumably by faulting. Later prospecting consisted of sinking three shallow shafts, the deepest 57 ft., through the volcanic ash overburden. These did not show gravel, and the adit was caved at time of visit, preventing inspection. Gravel was reported spotted in gold content, some being of good grade. It was sufficiently cemented to require working in a small mill.

Morning Star Drift Mine. This was the largest producer among the drift mines of the Iowa Hill district. The channel flowed west through the claim and was eroded by Indian Canyon just east of the town of Iowa Hill, the westerly segment, with its benches underlying the townsite where it was hydraulicked. The portal of the Morning Star drift workings and the mill were just east of Indian Creek. The channel was followed eastward and upstream about 4800 ft. where connection was made with the Big Dipper workings.

This mine was worked off and on from 1854, but the larger part of the output was made by Morning Star Drift Mining Company from 1886 to 1901. In that period, $1,500,000 in gold was produced. The total production previous to that time is unknown, but up to 1881, it was stated the mine had yielded $250,000.

The channel here was reported to have an average width of 200 to 300 ft. It was one of the few mines in which gravel was systematically blocked out and measured before extraction; the tunnel had already been run 2600 ft. by 1888 and 73,629 cubic yards of gravel was blocked out before heavy production started. It was estimated that one-third of the above yardage was boulders and waste. Pay also

extended as much as 18 inches into the slaty bedrock. Gravel was breasted 7 ft. high and on account of the cemented roof only posts and caps were required. As in the case of the Big Dipper, the tunnel was in bedrock below the gravel channel, which was worked through raises. The gravel was fed by hand to a 10-stamp mill fitted with a screen punched with one-fourth inch holes. About 90% of the gold saved was in the mortars and 10% in the broad apron sluices outside which took the place of the usual plates. The first 10 months' run by this company 1859 tons, yielded $11 a ton. The average for the mine was reported to be about $7 a ton. The mine paid 103 dividends averaging $4 a month per share; cost of operation was reported to be about $3 a ton.

Mountain Gate Mine. This old mine at Damascus covered the inlet of the prevolcanic, white-quartz channel which flowed south through the Hidden Treasure. Work began in 1852 on some of the claims later included in the Mountain Gate. The original Damascus drift mine, later called the Bob Lewis Mine, was upon the cemented or blue gravel channel lying just east of the white channel. The Damascus company ran a mill for some time on the cement gravel, and a length of about 1000 ft. was worked. This cement channel had eroded away part of the east rim of the white channel.

The main prevolcanic channel was mined for a length of 5400 ft, with a production of $600,000, or $111 a linear foot. The gravel was loose, white quartz gravel as in the Hidden Treasure, easily mined and washed but requiring considerable timbering. It was 300 ft. wide, was breasted 5 ft. above bedrock and yielded over $1 a ton. It was worked principally by the owners, of whom there were originally 16. Water was troublesome as they worked downstream, and finally at about 5400 ft. they encountered a trough cutting across the white channel. On sinking through this, they encountered cemented gravel. Another tunnel was then started, and in turn proved too high, as the preliminary work on the cement channel had not bottomed it, and it finally had to be worked through an incline. This deeper channel, generally considered the same as the one worked in the Red Point Mine, is claimed to have produced $175,000 in the Mountain Gate Mine. After the lapse of so many years, during which no detailed record of mining operations was kept, it is impossible to definitely state the relationships of the Bob Lewis, Dam and Red Point channels, all of which were later than the white channel. Doubts that the Red Point channel cut clear across the ancient valley of the white channel and continued westward have been strong enough to induce prospecting for its down-stream section on the east side of the white channel in two places. So far this work has not given positive results.

New Basil Mine. It is an old drift mine probably on the Whiskey Hill channel, two miles east of Westville. A shaft was sunk to bedrock just east of Black Canyon in 1882 and work was carried on intermittently until 1896. About 700 ft. of the channel is reported to have been worked upstream from the shaft. It is a narrow and steep channel, up to 60 ft. wide, carrying coarse gravel and some coarse gold. The details of production are lacking, but it could hardly have been profitable under the conditions.

Occidental Drift Mine. This old mine in Iowa Hill district lies upstream from the Morning Star on the Grizzly Flat channel, being separated from the latter mine by the Julia claim. The channel was worked from the inlet downstream by an adit about 3000 ft. long, which lost bedrock about one-half way in, and was continued in the filling above the trough the rest of the distance to about the north line of Sec. 3, T. 14 N., R. 10 E., where a winze was sunk. This had not bottomed the deep trough when the last report was published on the mine in 1890. It was said it showed the bedrock sloping west 40°.

During the summer of 1935 a prospect shaft was being sunk on the northwest side of this claim near the line of the Julia claim. It was 130 ft. deep in September.

Paragon Mine. J. F. Thompson, owner, Forest Hill. Lessee, Alanta Mines, Incorporated, 6518 Selma Avenue, Hollywood. King G. Gillette, president.

This is a consolidation of Paragon Placer, Wm. Rousch & Company Placer Mine, Hosmer, Rosedale, Nip & Tuck, Sebastopol, New York Placer Mines and Paragon Extension Nos. 1, 2 and 3 placer claims, including 800 acres of patented land in Sees. 13, 18, 19, 30 and 31, T. 14 N., R. 11 E., two miles from Forest Hill at the former site of Bath.

Several of these mines were independent producers for years. The original Paragon claim had a frontage of 250 ft. and extended a mile and a half through the hill, with a width of 400 ft. at the back. It was first worked in 1852, and for 10 years apparently only by sluicing; because of the cemented character of the gravel, it had to be washed seven times during which a total yield of $10 a ton was reported. This gravel was described as "rusty gray gravel, four feet deep resting on blue gravel 100 feet deep." Mining was done through an adit run in the blue gravel 20 ft, below the pay streak and breasts were opened across the entire 'front' or width of the claim, with chutes 30 ft. apart to drop gravel to the adit. Finally a 'frontage' of 1600 ft. (length along the channel) was worked in this way. In 1864 a stamp mill was erected.

Gravel bank at Paragon Mine, Placer County, at the site of slide which buried monitors and pipe and killed one man in May, 1935.

Complete figures of the mine's production are not available, but according to reliable contemporary reports, the output up to 1871 was $750,000 and for the five years, 1865 to 1870, the annual output did not vary $5,000 a year from $100,000. Hydraulic mining replaced drifting soon after and in 1874 the mine was being worked on a large scale, a bank-blast of 17,500 lb. of powder having been fired that year. For six seasons, 1874-1879, the gold production was $243,075.87 of which $119,670.14 was paid in dividends. Drift mining from September 19, 1879, to April 14, 1880, with 40 men working, produced 4241 carloads which yielded $44,835.53 upon milling, or $7.05 a ton. From 1888 to 1901 inclusive, the production was over $500,000. Thereafter, some production was made by lessees, but the amount was never properly recorded. For the past three years some production has been reported annually, from drift mining in 1932 and from hydraulicking by the present lessee in 1933 and 1934. Taking the figures quoted in the Tenth Report of the State Mineralogist for the production up to August,

1890, which was given as $2,250,000 and adding the recorded output up to 1902, we have a total of $2,651,000 from which dividends of $600,000 are reported.

The geology of the mine has been covered so many times that it need not be repeated in detail. The Paragon upper lead, 150 ft. above bedrock, paid for a width of as much as 350 ft. but averaged 225 ft. wide and 5 ft. thick. It was 'picking ground,' requiring close lagging, and is said to have yielded $4.50 to $5 a ton car. It was worked as far as the main road two miles east of Forest Hill, where it was cut by the Orono channel. This was worked for 1250 ft. upstream and 200 to 250 ft. downstream from this junction, on this property. It cut nearly to bedrock of the main channel. Few details are at hand concerning it. Its reported width is 225 ft. but it is not believed to have paid except in spots. The bedrock or main channel was worked by adit for the entire length of the Paragon holdings, connecting with the Mayflower workings which were driven upstream on the same channel. In the Paragon, a width of 40 to 50 ft, and a height of 7 ft. was breasted. It yielded at times from $25 to $50 per carload of 1 ½ , tons; in 1882-1883 the average yield was reported as $31 a carload and in 1888, $9 a carload. This gravel was cemented, requiring crushing in a 10-stamp mill which handled 40^ tons in 12 hours, after the larger cobbles had been sorted out by hand, liaises were put up from the bedrock adit to work this gravel, which is said to have required little timber; it had to be drilled and blasted. The length of the adit is given in old reports as 7500 ft., but the distance from the mouth to the Mayflower line is claimed to be actually 1 ¾ mile. This bottom lead in the Paragon probably produced over one-half of all the mine's gold output.

The present company began preparations for hydraulic mining late in 1932, and a little gravel was washed in 1933. In 1934, after considerable work on the ditches, a substantial output, enough to make the mine the leading placer gold producer in the county for the year, was made. On May 29, 1935, about the end of the piping season, a serious bank slide occurred killing one man and completely covering the bedrock tunnel, monitors, much of the two 15-inch pipe lines, blacksmith shop and other equipment, When visited late in the summer, nothing had been done to reclaim the pit. The bank where the slide occurred is close to 400 ft. high, and the entire width of the channel as hydraulicked about 500 ft, The pay is principally in the lower 150 ft, (the distance between the bedrock and the upper Paragon lead) and of this, the best portion, judging from past hydraulic mining results, was in a thickness of 70 to 75 ft. which yielded 74 cents to 78 cents a cu. yd. Much drifting has been done since that hydraulicking (1879), and this would lower the average grade of remaining gravel decidedly. About one-half of the bank may be expected to prove barren, or nearly so, as it is composed of volcanic tuff and andesite. With an adequate water supply to permit six months piping, however, the mine might become an important producer. The Pond ditch, four miles long, is claimed to supply 600 miner's inches of water from Volcano Canyon; and Breece and Wheeler ditch from west branch of El Dorado Canyon is rated to yield 1000 miner's inches. The season for hydraulicking at this property was always short, but might be lengthened by fuller water development. When previously worked by this method, the average season's yield was apparently a little over $40,000.

Peckham Hill Gold Mines, Incorporated. The old Peckham Hill gravel mine is on the southwest end of the Forest Hill divide three miles southwest of Todds Valley, in the E½ of Secs. 7 and 18, T. 13 N., R. 10 E. The above company has been employing three or four men under contract during the past year or more, reopening an old adit.

An intervolcanic channel, believed by many to be the same one seen cutting the earlier gravels in several of the old mines from the Weske westward, occurs in this ground. It has at Peckham Hill a bedrock elevation of 2131 ft. in the Union tunnel in Sec. 17 near its outlet according to a survey by Ross E. Browne. In a length of one mile upstream from this tunnel several other attempts have been made

without success to find pay gravel. About 1500 ft. upstream from the Union tunnel, Rough & Ready tunnel was run through the west rim 750 to 800 ft. and an incline was sunk down the bedrock rim for a length of 260 ft. reaching a bedrock elevation of 2143 ft. at its lowest point. There is no record of production from there. The same company (Blue Gravel Range Company) sank a shaft one-half mile farther upstream reaching a depth of 214 ft. where it is claimed a good prospect of gold was obtained. The operators are supposed to have been driven out of this shaft by water before reaching bedrock. This work was done about 1873 to 1875. In 1904, the Peckham Hill tunnel was run from Snyder Canyon toward the Blue Gravel shaft. According to George McAulay, then superintendent, a raise put up at a distance of 1800 ft. from the portal entered a body of gravel which proved to be 91 ft. long and 55 ft. wide and which paid well. This tunnel was continued to a length of 2400 ft. besides which several hundred feet of drifts were run above it in search of more gravel. No other deposit of pay gravel was found, and the main tunnel was not carried far enough to be under the shaft. The present operators estimated about 800 ft. or less would have to be run to make the connection. Work was progressing slowly with hand tools in the summer of 1935.

Penn Valley claim comprises the northern and eastern part of the original Strawberry Mine on the Succor Flat channel east of Indian Canyon in NW ¼ Sec. 26, T. 15 N., R. 10 E.

In this claim the Succor Flat channel (which was worked upstream from the Indian Canyon side with a production of over $100,000 credited to the Strawberry) has been cut by two small later channels. Macy Brothers are prospecting the ground through an adit, and in September, 1935, were raising at a point 1800 ft. from the portal.

Pond and Company Mine. The hydraulic mining camp of Todds Valley was a heavy producer, most of the work there having been done before 1875. By that time most of the mining ground in the camp had passed into the hands of Pond and Company and the principal part of the unworked gravel is now within the claim bearing their name, and containing 178.73 acres.

The deposit of quartz bench gravel at Todds Valley was worked in a northerly direction from the canyon front until the andesite overburden began to be too thick for hydraulicking. Whitney, writing before 1875, stated that the deposit one mile long by one-fourth mile wide with a maximum depth of 60 to 75 ft. and an average depth of 35 ft. had produced 9,000,000 cubic yards which had yielded $4,000,000 or 45 cents a cubic yard. He cited one measured area of 3.1728 acres on the Pond and Company claim, which yielded 35.88 cents per cubic yard for the entire bank, or 51.257 cents per cubic yard of gravel. Later figures of 11,000,000 cubic yards mined with a production of $5,000,000 in all from the district, have been published. The production recorded from Todds Valley after 1888 was usually $2,500 a year or less, representing the results of work of individuals engaged in small-scale mining.

There remains 2,000,000 to 4,000,000 cubic yards of gravel on the Pond and Company claim, but the possibility of working it is problematical because of overburden which would interfere increasingly with hydraulicking beyond the present bank, and the average gold content, which is low for drift mining.

Ralston Divide Gravel Mine. The Ralston Divide lies between Long Canyon and Middle Fork of American River, and the property prospected by California-Hawaiian Development Company and its predecessors lies in townships 13 and 14 north, ranges 12 and 13 east. The above company once claimed about 9600 acres covering a length of 14 miles but only part of it was patented. The region is reached on the east by road past Soda Springs, and on the west by road and trail via Michigan Bluff or road via Georgetown and Barton's Cabin. The last company began prospecting in 1908, continuing until after 1920 and spent probably over $150,000 for equipment and prospecting. Previously, in the 1890's, a French company did considerable prospecting there.

The channel system underlying' this ridge has its outlet at the Pat Goggins hydraulic mine (bedrock elevation 3475 ft.) in the SE ¼ Sec. 22, T. 14 N., R. 13 E. The hydraulic pit here is 500 ft. long, 90 ft. wide and 60 ft. average depth. An adit was run 755 ft. from this pit with 750 ft. of branch drifts.

These deposits appear to be definitely connected downstream with the Bath channel and upstream with the gravel at Blacksmith Flat, Soda Springs and French Meadows. Hydraulic pits have been opened at several places in rim gravel on the north slope of Long Canyon, and some of these workings have been profitable. So far, however, no deposit has been found rich enough to pay for drifting on any important scale. The principal work of the California-Hawaiian Development Company was as follows:

No. 1 tunnel, with its portal in NE ¼ Sec. 5, T. 13 N., R. 12 E. This is 7 by 8 ft. and was 4700 ft. long at the time of the last detailed report. About 2500 ft. of drifts, 1000 ft. of raises and 15 diamond drill holes were run from this tunnel.

No. 2 tunnel is over one mile south and a little west of No. 1 portal. It was 145 ft. long with an incline of 153 ft. and 280 ft. of drifting from the foot of the incline.

No. 3 tunnel was started near the center of NW ¼ Sec. 8, T. 13 N., R. 12 E. and was run nearly northeast. It is 8 by 8 ft. in cross-section and over 1600 ft. long. It is connected by a raise of 14 ft. with the drift from the bottom of the incline sunk from No. 2 tunnel. A good deal of this later work was along the channel.

The prospecting of this area indicates the occurrence of wide stretches of flat river bed in which there has not been any important pay streak reported so far, rich enough to drift. The rim gravels or remnants of the earlier channel are interbedded with rhyolite tuff. A deeper blue lead is reported and this would correspond with the channel at Bath. To correlate these different runs of gravel with those in the Duncan Canyon region and northeastward to French Meadows, it is most reasonable to presume that the deep channel which crosses Duncan Canyon below the present drainage, upstream from the Glenn Mine is the later and deeper run; the deposits east of Duncan Canyon (Hard Climb, Red Star mines) are remnants or benches of the earlier channel, and the Glenn-Bald Mountain channel is not necessarily a tributary of the deep run. The accumulation of gravel and rhyolite beds on the Ralston Divide reaches a thickness of 250 ft.

Red Point (Golden River) Mine. In many respects, the story of the mining operations on the buried, ancient channel running through this property between Westville and Damascus is among the most interesting and instructive for this class of mines. Work started in July, 1886, and was carried on by a French company, Societe des Mines de Golden River, until 1903, and then under the direction of the last superintendent, John A. Ferguson, by lessees until 1916. The adit was run 20,620 ft. and to within 1 ¼ miles in an air-line from Westville (Indian Springs). The gross production was 56,000 ounces of gold, and some dividends were paid.

This channel, belonging to the third intervolcanic period, flowed across the line of strike of schistosity of dikes and hard schist forming the bedrock. According to Ferguson it must have been an open, flowing stream when covered by andesite. The thickness of gravel varied usually from nothing to 6 ft. but averaged 1 ft. to 15 inches. As much as 2 to 3 ft. of bedrock was mined, and andesite formed probably one-half of the material washed. The gravel was in part tight, but not sufficiently so to require milling. The main adit was run 7 by 8 ft. in cross-section in bedrock with machine drills at a cost of $12.40 a ft. Raises 20 to 40 ft. long were put up to mine gravel. In mining, holes were drilled with moils in the andesite for blasting, and pieces of andesite over six inches were sorted. The grade of main adit at first was quite flat. In spite of irregularities in the elevation of bedrock, due to variations in hardness, which resulted in holes full of gravel in places, and bare bedrock in others, the average grade was

uniform. Ferguson states that the channel raised 300 ft. in the distance mined, and that in one section of two miles he used a uniform grade of 19 inches in 100 ft. and found it correct. The width of channel varied from 12 ft. to 400 ft. Heavy timbering was required only where the gravel was thicker than the usual breasting height, or was so poor that it was left unmined. The average operating cost was $1.56 per one-ton carload and average yield, according to Ferguson, $2.25 a carload. These figures, for the average of the entire mine, vary considerably of course from results in certain sections. The low operating cost was due not only to efficient work but to the use of Chinese labor. These men were paid $1.75 a shift. White miners were paid $2.50 to $3.50 a shift. Fifty men mined and washed about 100 tons of gravel a day. In the later work a compressed air locomotive was used for hauling gravel trains. Water from the adit, supplemented by a supply from Humbug Canyon, was used for washing gravel. The natural flow from the workings was also used in four places where drop was available to drive water blasts for ventilation. A dry reheater for the air used in the locomotive is said to have increased its efficiency 40%.

Red Star Prospect. This is on the east side of Duncan Canyon one mile northeast of Jack Robinson tunnel and reached only by trails. Four adits at elevations ranging from 4500 to 4800 ft. were run years ago. Of these, the north adit on Hunted Hole Claim, gave the best idea of conditions. It branched 10 sets from the portal, one branch running north 130 ft. and the other northeast 145 ft. The prospect has not been visited by the writer for several years, and these adits may have been extended. High bedrock lay between the two and work had not been carried far enough to indicate with certainty whether this was a high reef in the channel, or if a junction existed. The gravel is well washed, carrying some quartz and large granite boulders. Although the average gold content had not been sufficiently high to pay steadily, rich places have been found from time to time, as in 1934 and 1935 when several ounces of coarse gold was produced.

The difference in elevation between this gravel and that west of Duncan Canyon, as indicated by aneroid, is so great as to indicate they are on different channels. A long ditch would be needed to bring water from Duncan Canyon.

Small Hope and Arthur Claim. Now part of the Detert Estate holdings (Mayflower group). On the northwest side of Forest Hill divide, two miles northwest of Forest Hill. The Small Hope and Sacramento claim adjoining it on the south were prospected through a series of adit driven south and east from First Brushy Canyon, and some hydraulicking had also been done. The production in early days is not recorded, but was only nominal after 1888. The channel is of intervolcanic cemented gravel.

In 1933 a permit to hydraulic the Small Hope and Arthur was. granted to A. A. Hoffmann and II. A. Dart. No production was reported that year, but in 1934 Bert Farrar operated for a short time and made a nominal output.

Star United Mine. This old mine, fronting on Indian Canyon 1 ½ miles east of Iowa Hill was quite extensively mined in earlier days by hydraulicking and drifting and was credited with a production of $43,000 up to 1882. In later years Herman Gosch did considerable drift prospecting and made some production up to 1934. A section of the Succor Fiat channel which crossed this claim was largely eroded away.

Brown Brothers and Good have had the property under lease during 1935, but report they have been able to do little mining on account of lack of water.

Succor Flat Channel entered the Iowa Hill district from the north but on the east side of Succor Flat Mine, in Sec. 26, T. 15 N., R. 10 E., it made a sharp bend to the northwest crossing that mine, the Schulbach and Strawberry. On the west side of the latter it was eroded by the present Indian Canyon but was followed and extensively worked on the west side of the canyon in the Stockton, Columbus, Shelby,

Empire, Dayton, White Pine, Wolverine and Aurora Mines. From the Star United on, it is supposed to have followed close to the present course of Indian Canyon, which eroded it for nearly a mile and a half downstream to Iowa Hill, greatly enriching the modern stream. This channel received two tributaries, the Glencoe and Wolverine channels on the west side of Indian Canyon. An immense deposit of gravel was formed at their junction with the main stream on the Wolverine, Columbus, Dayton and White Pine Mines.

The Succor Flat channel carried loose gravel with a great deal of serpentine. The width worked varied from 50 ft. to several hundred feet. It had an average grade of about 180 ft. per mile, and was of prevolcanic age. It has been worked for a length of about two miles, with the following approximate production records for the mines along its course. Most of this mining had been done before 1882:

Succor Flat Mine		$279,000
Strawberry (before 1882)		103,000
Strawberry & Penn Valley (1889-1897)		60,543
Stockton		41.000
Shelby	|	105,000
Columbus	|	100.000
Dayton	| At junction of Succor Flat |	
	|Wolverine & Glencoe channels |	156,000
White Pine	|drift & hydraulic	756,000
Wolverine	|drift & hydraulic	805,000
Star United		43,000
Phillips		80.000
		$2,528,543

Truro Placer Mine. On the North Fork of American River at the mouth of Pritchard Canyon. The gravel lies on an old river bench 150 ft. above the present stream. Many years ago, Truro Mining Company ran a crosscut adit 314 ft. through the rim 60 ft. below the bed of Pritchard Canyon and drifted on the gravel 75 ft. each way. Some breasting was done over a width of 46 ft., which yielded $1 a car. Nothing was done with the ground thereafter until the past year, when it was reported three men were working and that control of the old stock company was sold.

Weber claim in Iowa Hill district, is one of the holdings of the McGeachin company. About 1916-1917, Stanislaus Development Company had this claim under lease and drove an adit 1200 ft. long upon it, finding a barren intervolcanic channel 240 ft. above the bedrock of the Morning Star channel.

Whiskey Hill (Greek) Mine. This covered about 100 acres but included only 600 ft. in length on the channel of the same name, on the west side of Secret Canyon one mile south of Secret House. It was worked by a company of Greeks in the 1880's and is said to have yielded about $36 per running foot of channel, or $22,000 in all.

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Note: This file does not include Dredging and Tables; Pp.42 to 48 and Pp. 80 to 97