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San Francisco
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Los Angeles
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Redding
San Francisco
San Francisco
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COVERING

ACTIVITIES OF THE DIVISION OF MINES

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GEOLOGIC BRANCH

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SAN FRANCISCO FIELD DIVISION

SANTA CLARA COUNTY

By Herbert A. Franke, Junior Mining Engineer

Introduction.

Santa Clara County lies in the west-central portion of the state. It is bounded on the north by San Mateo and Alameda counties, on the east by Stanislaus and Merced, on the south by San Benito, and on the west by Santa Cruz and San Mateo. The area of the county is 1328 square miles. It was created February 18, 1850. The estimated population, June 30, 1929, was 139,806, while the 1920 census showed 100,676. Its assessed valuation in 1927 was about $129,813,207.

The county seat, San Jose, with an estimated population of 54,461, is 47 miles south of San Francisco, in the heart of the Santa Clara Valley, famous for fruit-growing. The other principal towns are Palo Alto, Santa Clara, Gilroy and Los Gatos. Among the educational institutions found in the county are Leland Stanford Jr. University, Palo Alto; the State College, San Jose; and Santa Clara University, Santa Clara.

Topography and Geology.

The chief topographic feature of the county is the great central valley, comprising nearly one-half of the entire county, which extends through from San Francisco Bay southeastward and on into San Benito County, a distance of nearly 100 miles. Two parallel mountain chains, part of the Coast Range Mountains, lie on either side of the valley. The westerly group, known as the Santa Cruz Mountains, separates Santa Clara Valley from the sea, and is a series of abrupt ridges whose peaks range in elevation from 2000 to 3000 feet. It is in general well timbered with oak, pine and redwood. The easterly group, which separates the smaller valley from the San Joaquin Valley, consists of several parallel ridges, between which are located other small but fertile valleys. The highest of these ridges culminates in Mount Hamilton, whose elevation is 4209 feet above sea level. These ridges contain only a scattered growth of oak, which is also the condition of the main valley.

Rocks belonging to the Franciscan group is the oldest geological formation found within the county. Its age has not been positively determined, but it is generally accepted as Jurassic.[1] It comprises the metamorphosed sandstones, cherts, and serpentines, which make up practically the entire eastern mountain group and the low foothills bordering the west side of the valley. A limited area of marine sandstones and shales, which have been identified as Cretaceous, overlies the Franciscan group southeast of San Jose. In the western part of the county, the Franciscan formation is overlain by heavy-bedded sandstones of the Miocene, which produces the comparatively rugged topography of the bold ridge which separates Santa Clara and Santa Cruz counties. The Quaternary formation is represented by the unconsolidated sands, gravels and clays (detritus of the older formations) which fill the valley bottom. Very few eruptive rocks are found in the county. Rhyolite occurs in the vicinity of the New Almaden Mine, southeast of

[1] Lawson, Andrew C., U. S. Geological Folio No. 193.

San Jose. Its occurrence was first described by G. F. Becker of the United States Geological Survey.[2] A few narrow basalt dykes are exposed along Coyote Creek east of Madrone Station.

Streams.

Santa Clara Valley has a notable peculiarity in that it is divided transversely by a scarcely noticeable soil-covered divide, whose summit is reached near Perry (elevation 345 feet). The southern portion is drained by the Pajaro River, but the northern portion drains through Coyote Creek directly into San Francisco Bay, and the alluvial plain is continuous across the divide. Coyote Creek, the chief drainage system of the county, rises in the mountains near the eastern boundary in the center of the county and flows southerly until it breaks through one range of hills south of Gilroy Hot Springs; thence northerly to a point three miles east of Madrone Station, whence it cuts through another range of hills and enters the Santa Clara Valley, flowing northwestward to San Francisco Bay. Los Gatos Creek rises in the Santa Cruz Mountains and flows northeastward, joining the Capitancillos or Guadalupe Creek at San Jose, whence it also flows northward to the bay. Los Gatos Creek and its tributaries form the main water supply for San Jose and Santa Clara. The northeastern part of the county is drained by Alameda Creek and its tributaries, which enters the bay below Niles. The Arroyo de las Llagas, Uvas Creek and San Felipe Creek are branches of Pajaro River, which flows westward into Monterey Bay. The numerous wells sunk throughout the length of the valley supply ample water for local use.

Transportation.

The coast line of the Southern Pacific railroad traverses the county throughout its length almost centrally, affording easy access to San Francisco and Oakland. A branch line runs from San Jose, via Los Gatos, to Santa Cruz. The Peninsula Railroad Company operates an electric system between San Jose and Palo Alto, via Los Altos, connecting with Los Gatos and Saratoga, and giving access to several small towns in the northwestern portion of the county. The Patterson and Western railroad has been discontinued.

The State highway passes through the broad, fertile valley, running parallel to the main line of the railroad much of the way. Practically the entire county is accessible over paved or improved roads. However, there are only a few mountainous roads which traverse the county east of the Mount Hamilton Range. The Arroyo Mocho road south of Livermore, Alameda County, is the only one leading into the mineralized Red Mountain district.

Mineral Resources.

Santa Clara County, essentially an agricultural county, reported a mineral output for 1928 of $1,021,541. It is the largest producer of magnesite in the state. The county's chief product from a commercial standpoint was miscellaneous stone which includes crushed rock of all kinds, sand and gravel. Other mineral substances found in the county are bituminous rock, brick, chromite, clay, copper, diatomaceous earth,

[2] Monograph XIII, Geology of the quicksilver deposits of the Pacific Slope.

limestone, manganese, mineral water, petroleum, quicksilver and salt. For many years this county was the largest producer of quicksilver in the state, and it is distinguished in that the New Almaden mine was the first producing quicksilver property in North America.

ASPHALT AND BITUMINOUS ROCK

The asphalt and bituminous rock deposits of Santa Clara County have been fully described in previous reports of this division from which the following brief description is extracted:

"The bituminous deposits and springs in the southwest corner of Santa Clara County occur in the foothills forming the eastern slope of the Santa Cruz Mountains. They are principally developed upon the Sargent Ranch, about 3 miles from Sargent Station, on the Southern Pacific Railroad. They are more or less distributed over about sixty acres, although the principal outcrop of the bitumen-soaked strata are confined to an area of a few acres, within which most of the tar springs occur. At this point the shales are light in color when not stained with bitumen, and resemble those in the foothills upon the western side of the Santa Cruz Mountains. A tunnel has been run for a short distance in this formation, but is now caved in. The shales are overlaid by sandstone. About 150 feet down the mountain, and distant perhaps half a mile, are several tar springs exuding from a serpentine formation."

There has been a small production from the above deposits, but not in recent years as this natural asphalt could not compete with that produced as a by-product in the oil refineries.

Bibl: State Mineralogist's Reports VII, p. 93; VIII, p. 548; X, pp. 607–609; XIII, p. 43; XVII. p. 182.

CHROMITE

Chromite occurs in small irregular kidneys and seams in serpentine areas of Franciscan rocks in the Red Mountain District in the extreme northeastern part of the county; in the hills above Alum Rock Park; and in the district 8 miles southeast of Los Gatos. The occurrences are rather limited and the ore is generally too thinly disseminated, or too low-grade to be of commercial value. It is stated that some ore was shipped from the district southeast of Los Gatos over forty years ago.

Kilday Ranch Deposit. Several small lenses of chromite have been developed on this property which lies along the top of a ridge, probably 1000 feet in elevation above Guadalupe Cañon and 8 miles southeast of Los Gatos. The ridge here is capped with a decomposed serpentine, and chromite has been found in several different places, but thus far no large deposit has been uncovered, and there is very little ore now exposed. About eighty tons of the ore was shipped out by the Farish Company, Insurance Exchange Building, San Francisco, during 1916, but no work has been done since.

Laurel Lake Ranch Deposit. J. A. Ferbrache of Gilroy developed a deposit of high-grade black chromite on this property 7 miles northwest of Gilroy. The serpentine in which the chrome ore occurs outcrops prominently along the ridge south of Uvas Creek. Associated with the serpentine is a peridotite, thin sections of which have been

SANTA CLARA COUNTY—MINERAL PRODUCTION 1850-1928.

Year	Quicksilver		Mineral water		Petroleum		Brick		Pottery clay		Sandstone		Limestone		Miscellaneous stone[1], value	Magnesite		Miscellaneous and unapportioned		
	Flasks	Value	Gallons	Value	Barrels	Value	M	Value	Tons	Value	Cubic feet	Value	Tons	Value		Tons	Value	Amount	Value	Substance
1850	7,723	$768,052																		
1851	27,779	1,859,248																		
1852	15,901	927,505																		
1853	22,254	1,235,648																		
1854	30,004	1,668,722																		
1855	29,142	1,560,564																		
1856	27,133	1,401,878																		
1857	26,204	1,374,381																		
1858	23,791	1,232,148																		
1859	1,204	61,690																		
1860	7,061	378,117																		
1861	34,429	1,447,739																		
1862	39,571	1,442,041																		
1863	32,803	1,380,360																		
1864	42,489	1,950,245																		
1865	47,194	2,166,205																		
1866	35,150	1,867,519																		
1867	24,461	1,122,760																		
1868	25,526	1,176,325																		
1869	16,898	775,618																		
1870	14,423	827,592																		
1871	16,568	1,171,641																		
1872	18,574	1,224,584																		
1873	11,042	887,004																		
1874	9,084	995,465																		
1875	20,000	1,098,000																		
1875	16,980	1,423,867																		
1877	27,930	1,228,920																		
1878	30,237	1,127,840																		
1879	24,924	820,000																		
1880	35,054	1,076,212																		
1881	30,135	934,185																		
1882	31,288	933,291																		
1883	26,208	824,542																		
1884	26,084	830,165																		
1885	20,000	610,000																		
1886	21,400	658,050																		
1886	18,000	639,000																		
1887	20,000	647,000																		
1888	18,000	765,000																		
1889	13,100	589,500																		
1890	12,000	630,000																		
1891	8,200	371,105																		
1892	5,563	220,470																80,000 cu. ft.	$4,072	Natural gas.
1893	6,514	248,064																		
1894	7,235	222,169	5,000	$1,250	3,500	$3,500	22,725	$119,250			24,000	$8,282								
1895	7,050	253,800	20,000	5,000	4,000	10,000	24,750	131,250							$33,600			800,000 cu. ft.	12,000	Natural gas.
1896	6,222	211,370	44,000	18,800	900	1,145	15,000	80,000					500	$600	5,000					
1897	4,700	199,200	39,500	17,500	4,000	10,000	19,000	105,000											1,300	Natural gas.
1898	5,875	235,000	25,363	11,358	3,000	6,000	13,098	65,490	200	$2,500					12,000					
1899	4,425	186,270	79,000	19,150	1,600	3,000	30,741	179,655					1,800	3,000	8,000	100	$1,350	33 tons	840	Asphalt.
1900	5,146	241,078	30,000	8,060			20,000	126,000	2,000	6,000	120,000	100,000	8,000	6,000		39	253	5 tons	75	Manganese.
1901	5,220	236,608	55,000	8,500			21,800	94,570			60,000	80,000			517	30	300			
1902	5,869	254,260	21,900	5,600			23,382	178,662			35,000	31,500						17 tons	255	Asphalt.
1903	5,603	233,130	50,000	12,500	4,695	3,966	26,069	188,284			112,350	225,000	7,000	7,000	100			2,000 cu. ft.	1,200	Granite.
1904	3,389	148,103	50,000	12,500	42,000	13,860	24,909	178,551							12,000			21 tons	47	Bituminous rock.
1905	2,993	98,993	5,000	1,900	41,000	14,555	28,486	204,357	700	1,050	100,000	150,000	10,000		3,000			11 tons	132	Asphalt.
1906	2,592	94,608	5,000	1,250	7,000	2,800	28,397	183,676	1,000	1,500			9,480	15,000						
1907	2,618	96,086	11,374	2,187	22,100	5,525	30,053	256,424			3,500	3,500	671	16,694		[2]2,700	33,800			
1908	2,460	103,964	371,685	39,955	25,400	17,700	15,000	53,618					2,221	1,417	45,143	[2]2,000	24,000	10,017 bbls.	10,017	Lime.
1909	3,747	158,490	373,387	40,754	63,780	76,536	5,000	30,000					4,284	4,150	75,916	360	3,000	1,000 bbls.	1,000	Lime.
1910	4,038	182,719	182,500	11,200	35,660	36,660	12,000	66,000	12,000	66,000			2,417	3,451	68,765	7,560	51,037		52,264	Unapportioned, 1900-1909.
1911	7,533	346,593	155,720	10,000	12,328	8,505	6,000	30,000					3,374	3,918	62,595					
1912	8,596	365,538	152,500	10,250	14,092	8,295	18,000	105,000					3,549	4,120	48,228	600	6,000	15,508 bbls.	10,154	Lime.
1913	3,709	149,213	101,000	10,750	20,000	12,000	18,000	95,000						4,200	29,377	70	560	13,197 bbls.	9,783	Lime.
1914	2,407	118,063	28,000	10,750	10,000	6,300	15,900	79,500							36,093	1,425	14,250	2,000 cu. ft.	500	Natural gas.
1915	4,385	375,319	38,400	16,770	16,617	11,067	10,096	57,754					[3]		28,342	7,323	74,807		340	Other minerals.
1916	4,016	375,496	50,000	11,300	16,368	10,901	13,100	82,800	2,024	2,293			[3]		111,974	23,207	232,156		25,028	Chromite, limestone, manganese.
1917	5,021	639,594	10,230	1,923	18,855	26,153	14,000	80,000	5,014	4,929					111,304	9,963	99,287		28,341	Chromite, manganese, tile, limestone.
1918	3,977	478,524	13,025	1,678	20,499	34,848	6,792	62,000					[3]		111,860	9,745	121,872		948,780	Chromite, manganese, clay, tile, potash.
1919	3,013	271,762	[3]		16,724	26,595	7,250	65,000	2,532	2,232			[3]		73,237	10,912	128,924		480,721	Manganese, limestone, mineral water, potash.
1920	2,893	233,199	3,360	480	16,095	23,901	11,890	164,650	1,900	4,600					129,582	26,612	382,580		89,870	Limestone and potash.
1921	[3]		2,500	375	13,964	26,943	7,501	110,961	1,126	2,300			[3]		138,584	25,800	280,000		191,645	Limestone marl, potash, quicksilver.
1922	[3]		3,500	325	[3]		11,409	150,057	3,836	7,372			8,252		235,125	28,650	301,875		199,282	Limestone (marl), petroleum, quicksilver.
1923	[3]		[3]		[3]		22,514	282,997	2,202	3,954			also marble	49,512	314,935	30,390	472 629		196,375	Mineral water, natural gas, petroleum quicksilver.
1924	[3]		[3]		14,417	20,481	24,271	217,172	5,341	5,666			[3]		259,023	[3]			648,059	Limestone, magnesite, mineral water, natural gas, quicksilver.
1925	[3]		[3]		13,828	22,594	24,250	251,059	1,516	3,216			[3]		453,275	[3]			590,715	Limestone, magnesite, mineral water, natural gas, quicksilver.
1926	[3]		[3]		[3]				[3]						478,231	[3]			197,998	Clay and clay products.
1927					11,994	14,212	20,254	199,472	4 373	4,361					457,703	[3]			352,277	Magnesite, mineral water, natural gas, quicksilver, petroleum.
1928	[3]		[3]		13,746	15,131	14,622	167,782	3,058	2,063			[3]		467,556	[3]			315,228	Magnesite and mineral water.
																			379,070	Limestone, magnesite, mineral water, quicksilver.
Totals	1,151,176	$59,283,002	1,938,374	$291,316	499,562	$477,262	604,859	$4,441,831	49,832	$119,936	454,850	$598,282	59,528	$119,062	$3,884,761	183,837	$2,109,967		$4,756,095	

[1]Includes crushed rock, rubble, sand, gravel.
[2]See under 'Unapportioned.'
[3]Estimated production of Guadalupe Mine previous to 1875.
[4]Erroneously credited to Alameda County in reports of those years.

examined microscopically and show phases high in olivine, and also approaching augite diorite. Although still retaining its original outlines, much of the olivine is seen to be altered to serpentine. One large boulder was uncovered in the loose soil capping and a tunnel was driven to cut some leaders which occur in the serpentine above. There have been some shipments.

Winship Properties. K. D. Winship, 350 Post street, San Francisco, owner. Chromite occurs on Section 11, T. 6 S., R. 4 E., and on SW¼ of Section 7, T. 6 S., R. 5 E., M. D. M. Holbrook and McGuire, as sublessees in the summer of 1917, shipped several carloads of high-grade chromite from this property. In the latter part of 1918 T. S. O'Brien et al., 200 Pine street, San Francisco, leased Section 11, and built a 50-ton concentrating mill.

Several test runs were made during the first part of February, 1919, and about 25 tons of concentrates were produced, averaging 50% Cr_2O_3. The mill was closed down after this owing to market conditions. It is claimed that there is several thousand tons of milling ore here, which will run around 10% Cr_2O_3.

CLAY

No commercial deposits of high-grade clays are known in the county. Common clays suitable for the manufacture of brick and tile are abundant throughout the valley portions of the county. On account of favorable manufacturing and marketing conditions, a number of clay-working plants have been established in and near San Jose and Santa Clara. Some of these plants use common clay from extensive deposits along Coyote Creek within the city limits of San Jose. The clay bed here is from 15 to 20 feet thick.

Garden City Pottery Company. N. J. Mahon, president; Frank Brown, vice president; Edith L. Gallup, secretary. Office and plant at 560 N. Sixth street, San Jose. This company was established in 1904, under the name of the Garden City Pottery. A local red clay from Coyote Creek is used for flower pots, while Lincoln (Placer County) clay is used for stoneware.

The stoneware mix is prepared by grinding, washing, and filter-pressing, followed by pugging. After shaping, the ware is dried in steam-heated drying rooms for a period of three or four days. Firing is done in four round down-draft kilns. Two of the kilns are 20 feet, and two are 18 feet in diameter. They are fired with oil, which is atomized with steam. The stoneware is fired at 2200° F. (about cone 5) in 72 hours, and the flower pots are fired to 1800° F. (about cone 07) in 48 hours.

The plant operates throughout the year and employs 30 men.

Bibl: State Min. Bur. Bull. 38, p. 229; Prel. Rept. No. 7, p. 96; Bull. 99, p. 219–220; State Mineralogist's Report XVII, p. 184.

Handcraft Tile Company (formerly San Jose Tile Company). L. W. Austin, president; Florence M. Austin, secretary.

The plant has recently been moved from the San Jose site on Coyote Creek to a point a mile and a half south of Milpitas on the Milpitas San Jose highway. Clay from Natoma Clay Company, Sacramento County; Lincoln, Placer County; and Ione, Amador County, is used

largely, although some local clay on the property is used for crude material. The equipment consists of a hammer mill, dry pan, elevators, screens, pug-mill, and two rectangular down-draft kilns. After the clay is prepared by machine the tile are made by hand. The kiln is fired to cone 8 (around 2400° F.) Electric power is used. Hand-made floor, wall and mantle tile are manufactured.

Bibl: State Div. Min. Bull. 99, p. 221.

Kartschoke Clay Products Company. Charles Gladding, president; A. C. Gladding, secretary. Plant at 1098 South Third street, San Jose. The clays are obtained from banks along Coyote Creek, with the addition of some clay that is purchased from the Yaru deposit at Ione, Amador County, and from Lincoln, Placer County.

The clays are ground in a dry pan and elevated to a double-shaft pug-mill from which the mix passes to an American sewer-pipe press. Drying is done in a building which is heated by steam during the winter. Four to five days are usually required for drying.

The ware is fired in four oil-fired round down-draft kilns, 28 feet in diameter. Cone 2 (1165° C.) is reached in 80 to 90 hours, the entire cycle, including setting and drawing, requiring about two weeks. Gas is soon to be installed to replace the oil fuel. Common brick are burned in a Hoffman kiln. About 45 men are employed.

The principal products of the plant are common brick, roofing tile, flue lining, sewer pipe and patent chimney pipe. About 30,000 common brick are produced daily besides 400 tons of other clay products monthly.

Bibl: State Mineralogist's Report XIII, p. 618; XVII, p. 182; State Min. Bur. Prel. Rept. 7, p. 97; Bull. 99, p. 220.

Platt's Premier Porcelain, Inc. H. D. Melvin, president; A. A. Baker, vice president; N. E. Wretman, secretary. Plant on Lafayette street, Santa Clara.

Several years ago sanitary porcelain was made from a mixture of English china and ball clays, Arizona feldspar, and California silica. The plant was idle when visited, January, 1930. The *American Vitrified China Company,* I. N. Poynter, president, of Los Angeles, recently leased the plant and are expected to start operations soon. The installation of gas is planned. Hotel china will be manufactured.

Remillard Brick Company. Mrs. C. Remillard, president; Miss L. Remillard, vice president; Victor Geroux, secretary. Office: 332 Phelan Building, San Francisco. Plant on Story Road, east of San Jose. Common red brick are made of a yellow clay on the property along Coyote Creek. Clay is worked by dragline and hauled to the plant by cable car. It is dumped into a hopper, tempered with water, and then pressed into wooden molds, six bricks to a mold. Green bricks are placed on pallets and conveyed to open air racks to dry. Drying in open racks requires from eight to nine days. A continuous kiln is used, with electric power for operations. The plant employs around forty-two men, but operates for only six months during the year.

Bibl: State Div. Mines Bull. 99, p. 221.

San Jose Brick and Tile Company (formerly San Jose Brick Company). A. G. Rhodes, president; G. L. Richards, secretary. Address:

P. O. Box 274, San Jose. The plant is on Fruitvale avenue, and the property comprises 35 acres. The product is common red brick. The clay deposit consists of a 30-foot bed of red-brown plastic clay overlain by three to five feet of soil. The clay is mined with a Marion electric shovel which dumps the material into a car that is pulled by a Plymouth gasoline locomotive to the plant.

The clay is conveyed up over Hummar vibrating screens and then put in the dry pan and crushed by rollers. A bucket elevator carries the material through another Hummar screen from where the clay is conveyed by belt to the clay bin for storage. After the clay is conveyed from the hopper and through the pug-mill, it passes through an E. M. Freeze K-B brick machine, which has a capacity of 75,000 brick per day and is driven by a 150-h.p. electric motor. A wire cutting machine cuts the brick to the required length. An industrial car system is used in the drying and kiln yard. Drying in open racks requires from seven to eight days. One round down-draft kiln (oil burner) and two Hoffman down-draft continuous kilns are used for firing. Coal screenings are used as fuel in the latter. The firing schedule of the continuous kilns is as follows: three days water smoking, four days firing and ten days cooling. Fired at 2100° F. A brick crusher is also part of the equipment and is used to crush bricks for roofing purposes. The crushed roofing material is sold in 80-lb. sacks. Standard clinker and cherry red bricks are manufactured.

Bricks are made for only eight months during the year, but are burnt the year round. The plant has a capacity of 18 million bricks yearly. Fifty-five men are employed during the summer and twenty-five in the winter.

Bibl: State Div. Mines Bull. 99, p. 221.

S. & S. Tile Company. A. L. Solon and F. P. Schemmel, owners. Office and plant at 1881 South First street, San Jose. Local clay from Coyote Creek is used in conjunction with Lincoln clay and Ione sand.

The clay and sand are weighed, mixed and ground and then passed through a rotary screen and to the pug-mill. A Muller auger is used for shaping all plain tile, whereas fancy tile are hand-pressed in plaster molds. Tile is repressed with such designs as needed and dried in a specially designed waste-heat drier. Two oil-fired round kilns, 18 and 22 feet in diameter, respectively, are used to burn the tile. They are fired to 2100° F. for the first burn, then glazed, and again burned at the same temperature. Floor and wall tile are the principal products. About twenty men and eight women are employed.

Bibl: State Div. Mines Bull. 99, p. 221–222.

COPPER

Hooker Creek Mine. Dr. H. C. Adair, Flood Building, San Francisco, owner. Located 7 miles south of Los Gatos, above Aldercroft Heights, and one mile from the station of Eva on the main line of the Southern Pacific railroad. It is near the line between Santa Clara and Santa Cruz counties.

There are four tunnels, No. 1 about 20 feet, No. 2 about 235 feet, No. 3 about 85 feet and No. 4 about 500 feet in length. The present operators began working August 27, 1929. F. L. Schultheis, an

operator, prospected here in 1900. H. C. Homer, another one of the operators, states that an 85-foot highly mineralized zone, mostly chalcopyrite, in No. 2 tunnel was passed through. An assay by Smith Emery and Company on ore from No. 1 tunnel shows 18.13% copper, .82 oz. gold, and .60 oz. silver. The ore is chalcopyrite, azurite and malachite, and some of it is said to run very high in copper. Four men are working.

Bibl: State Mineralogist's Report XVII, p. 184.

DIATOMACEOUS EARTH

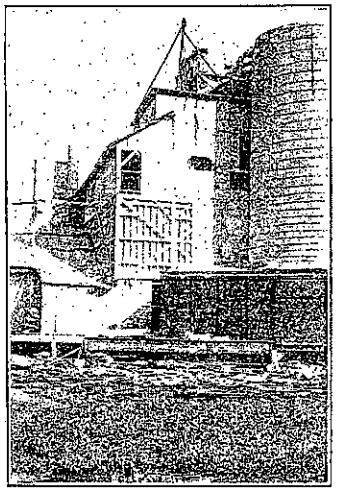
A. L. Atwater, 300 Broadway, San Francisco, reports diatomaceous earth on his property six miles southeast of Los Gatos in Sec. 13, T. 8 S., R. 1 W. Undeveloped.

LIMESTONE AND LIME

Limestone of good commercial grade occurs at several places in the mountains bordering the west side of the Santa Clara Valley, the most important deposits being those in the vicinity of Black Mountain, and in the range extending southeastward from Los Gatos to the Guadalupe mine. The Black Mountain deposits outcrop over a considerable area. The rock is a very high grade limestone, fine-grained and hard, varying in color from yellowish-blue to black.

Bay Shell Company. Home office: 519 California street, San Francisco. Plant located near Alviso. W. T. Monroe, plant superintendent.

This plant has been in operation over six years, pumping their oyster shells out of San Francisco Bay from boats with a rotary pump. The shells are unloaded from the boats to the stock pile by an overhead crane with a traveling clam shell bucket. The shells are later conveyed up to the plant hopper by the crane. After the shells are passed through a 40-foot rotary kiln, fired by oil, they go through a rotary screen, the finer material going to a Williams hammer mill, and the coarser grades through a set of rolls and through three screens, making a fine and medium shell product. The shells that passed through the hammer mill are taken through an air separator, where the fine lime is separated from the coarse and taken to the lime bin to be sacked by machine. Chicken shell, lime for fertilizer and mixed composts are manufactured. The shell runs about 98% $CaCO_3$. A spur line of the Southern Pacific railroad serves the plant. Electric power is used. Eight men are usually employed. Capacity of plant is 1000 tons monthly.



Bay Shell Company's plant at Alviso, Santa Clara County.

Bernal's California Marl Fertilizer Company. Pedro A. Bernal, Edenvale, owner. Property leased by *Consolidated Rock and Product Company* of Los Angeles. This company started operations here in 1921 and employed about eight men, until three years ago when work was discontinued.

This limestone quarry is located on the east slope of the Santa Teresa Mountains, three miles by road southwest of Edenvale. It is irregular in character, grading from a fine-grained hard bluish-gray limestone to a calcareous marl, containing an abundance of shells.

Most of the equipment on the property has been removed, but formerly an excavator, grizzly, screens, and mill for pulverizing the marl were used. The product was sacked at the quarry and hauled to Edenvale, from where it was shipped to consumers for fertilizer.

Bibl: State Mineralogist's Report XVII, pp. 185–186.

Bond Limestone Deposit. A. J. Bond, 564 Twenty-fifth street, Oakland, owner. Eighty acres of undeveloped lime rock is located ten miles by road from Los Altos, in Section 14, T. 7 S., R. 3 W., adjacent to the Winship properties. The following is an analysis as reported by the Cowell Portland Cement Company:

(Authority, advertising matter.)

Silica (SiO_2)		1.08%
Iron Oxide (Fe_2O_3)		0.64%
Calcium Oxide (CaO)		54.99%
Calcium Carbonate ($CaCO_3$)	98.20%	
Magnesium Oxide (MgO)		0.25%
Magnesium Carbonate ($MgCO_3$)	0.52%	
(SO_3)		0.02%
Loss on Ignition, (H_2O)		43.14%
		100.12%

Bibl: State Mineralogist's Reports VIII, pp. 543–546; X, p. 619; XII, p. 394; XIII, p. 630; XVII, pp. 184–185. Bull. 38, pp. 82–83.

W. B. Ortley Shell Company. Plant located at Alviso. The oyster shells are pumped out of San Francisco Bay by a rotary pump on a barge and brought to the unloading wharf at the plant by boat, and are left in the stock yard several days to dry. The shells are then elevated to the plant by means of a slip scraper (slusher). They are fed through a rotary kiln, fired by natural gas, and then elevated by a bucket conveyor and taken through the rotary screen where the shell is graded. The coarse shell is taken through the rolls for crushing and again conveyed up and through the rotary screen. The shell is sacked and sold for poultry feed. Electric power is used. Three men are employed.

Santa Clara Holding Company's Quarry, formerly known as the Alameda Sugar Company's Quarry. This limestone quarry is located nine miles by road from Mountain View, in Secs. 17 and 18, T. 7 S., R. 2 W. It has been idle for some time.

San Jose Cement Company, formerly known as the Guadalupe Portland Cement Company. Office: 919 Balboa Building, San Francisco. This company owns a deposit of 331 acres of undeveloped limestone about six miles south of Los Gatos, in Secs. 4 and 5, T. 9 S., R. 1 E., and in Sec. 32, T. 8 S., R. 1 E., M. D. B. & M. A gray-black limestone is

exposed here, assaying about 54% calcium oxide, which is equivalent to about 96% calcium carbonate. The estimated tonnage available is about 75 million tons. A volcanic slag is also found on the property.

Winship Properties. K. D. Winship Estate, 350 Post street, San Francisco, owners.

The following analysis is of an average sample of the limestone taken by W. W. Bradley of this division from croppings on the southwest flank of the mountain, in SW¼ Sec. 13, T. 7 S., R. 3 W.

(Analyst, Sidney A. Tibbetts, Berkeley.)

Silica (SiO_2)	1.56%
Aluminum oxide (Al_2O_3)	0.47%
Iron Oxide (Fe_2O_3)	0.22%
Manganese oxide (Mn_2O_4)	0.05%
Phosphoric oxide (P_2O_5)	0.06%
Calcium carbonate ($CaCO_3$)	97.20%
Magnesium carbonate ($MgCO_3$)	0.43%
Total	99.99%

These deposits suffer the disadvantage of being over 9 miles from the railroad, but they are accessible by wagon road. A railroad, however, could easily be built up the cañon of the South Fork of Permanente Creek to the foot of Black Mountain.

Bibl: State Mineralogist's Reports VIII, pp. 543–546; X, p. 619; XII, p. 394; XIII, p. 630; XVII, p. 185. Bull 38, pp. 82–83.

MAGNESITE

Magnesite deposits occur in the serpentine areas in the eastern portion of the county, the largest and best grade deposits thus far uncovered being those at Red Mountain in the northeastern corner of the county. These deposits have long been known and many attempts made to develop them, but their distance from the railroad, and the uncertainty of a market, long delayed their exploitation; and it is only within the last decade that they have been put upon a commercially producing basis.

A number of magnesite croppings occur at irregular intervals in a belt of soft impure serpentine along a low range of hills bordering the east side of the Santa Clara Valley, extending from east of Coyote Station to Gilroy. These croppings are small, and the magnesite is less pure than the Red Mountain deposits, being mixed to some extent into the serpentine, and varying in color from white to buff. Several of these deposits have been developed, and during 1916–1918 considerable crude magnesite was shipped out. They have the advantage of being within easy access of the railroad.

Maltby Magnesite Mines, formerly known as: *Western Magnesite Development Company, Standard Magnesite Company* and *Pacific Magnesite Company.* H. E. Stock, president; Herbert Erskine, secretary. C. S. Maltby, Humboldt Bank Building, San Francisco, has leased this property, located mainly in T. 6 S., R. 5 E., M. D. B. & M., along the summit of Red Mountain ridge which forms the boundary line between Santa Clara County and Stanislaus County, to the east, and operated it since 1919. W. T. Lewis is superintendent of the mines.

The magnesite outcrops in bold white ledges on the southern and western slopes of Red Mountain, 600 to 700 feet above the floor of the

valley. The magnesite is in general high grade, though towards the border of the large bodies it becomes mixed with the soft serpentine country rock, having a yellowish color, so that there is no well-defined boundary. A description of the geology is quoted from the report of Gale,[1] who made an examination of the deposits in September, 1912, in Bull. 79 of this division, page 83.

The earlier underground operations were due east from the furnaces, and some ore is still being drawn from that portion of the property. Later developments have been toward the north and southeast from the older workings. New orebodies are continually being developed. The most prolific producer up to the present time has been the White Diamond Group.

An aerial tramway at the north end has been installed in order to eliminate the long haul around the hill. A No. 4 tramway is being put on the southeast properties, known as the old Pacific Properties. The larger and heavier of the four tramways to the main south workings is 3000 feet long with a drop of 550 feet from ore bins to furnaces.

A total of 100–300 tons of ore per day is being delivered to the furnaces. Two new tunnels have been started on the southeast properties. Electric power has been installed and an Ingersoll-Rand, 2-stage compressor, capable of producing 1000 cu. ft. per min. Four upright kilns are used to burn the lump ore, and a rotary kiln, with a crushing plant, for calcining the fines. The burners used on the upright kilns have 2, 3 and 4 tips in order to spread the flame, while the rotary has a duplex burner of the company's own make which has been very satisfactory. The dismantling of the Scott furnace was begun in 1929 and large storage bins are being erected on its site. The ore as it comes from the mine is dumped on grizzlies set with 1¼-inch opening, and the through material passes over a ¾-inch screen. The plus ¾-inch material goes to the rotary kiln and the minus ¾-inch to the waste dump, as it contains mostly impurities. A Thwing electric pyrometer on the rotary kiln is used to maintain a constant temperature. The upright kilns are drawn every 2 hours, and their output totals 50 tons daily for the four. The burned lump ore is carried by a belt conveyor to a trommel with 1-inch apertures. The waste and off-colored magnesite are picked off the belt. The unburned cores after passing out of the trommel are hauled back to the main ore bin and reburned in the kilns. Air for atomizing the fuel oil is provided by a 27-h.p. G. E. blower, centrifugal type. Since the electrification of the plant in 1926 the boilers have been discarded except for heating purposes, etc. The Pacific Gas and Electric Company are considering the installation of natural gas lines to the property from their Kettleman Hills line which goes through Patterson Pass.

Fourteen motor trucks are in service, hauling the calcined magnesite to the railroad at Livermore, which is 33 miles by road northwest of the mines. On the return trip they bring in fuel oil in drums. About 90 men are employed. This company produces plastic, dead-burned and crude magnesite. Periclase, a new product in the magnesite industry, is being produced regularly and this new product should prove quite a factor in that industry.

[1] Gale, H. S., Magnesite Deposits in California and Nevada; U. S. Geol. Sur. Bull. 540 pp. 498-501, 1914.

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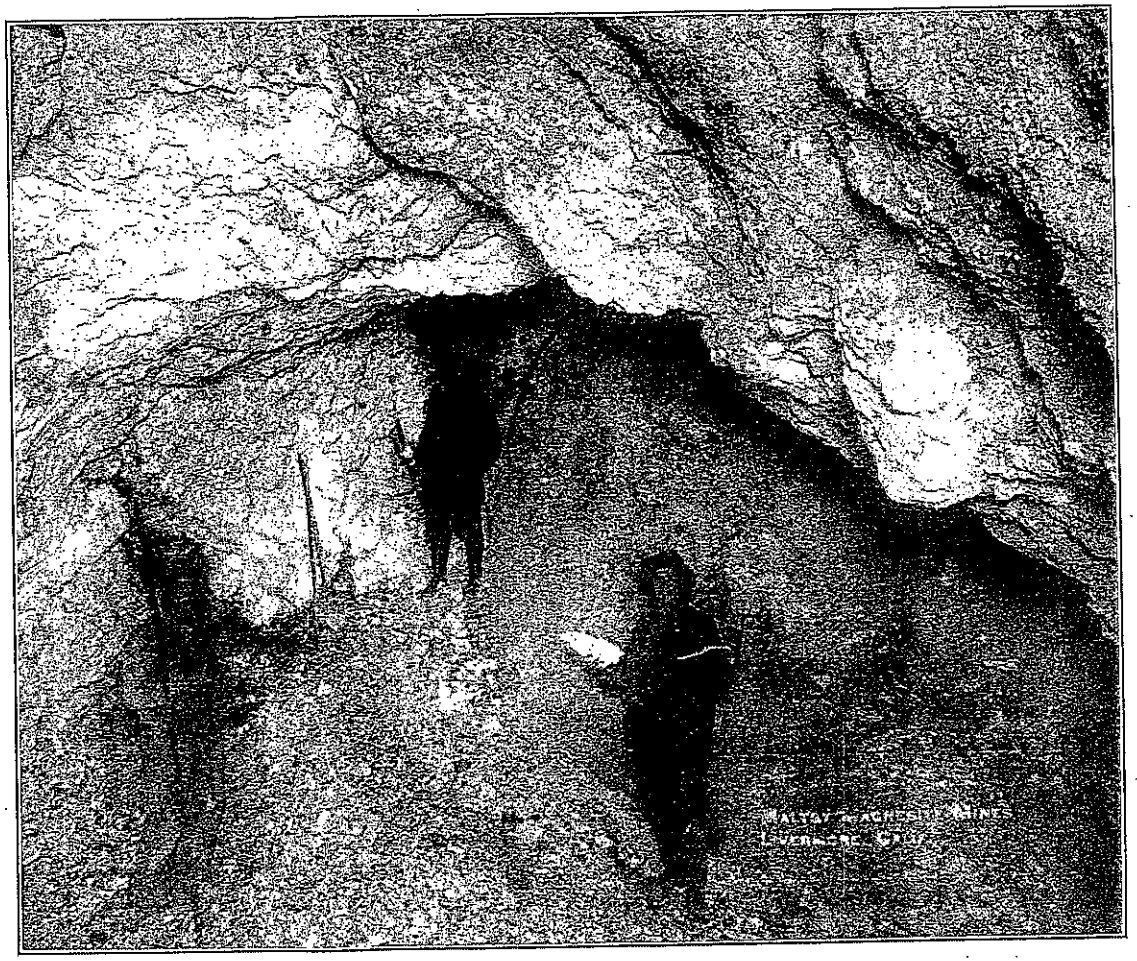


Underground workings in White Queen Group of Malthy Magnesite Mines. Photo by courtesy of C. S. Malthy.

O'Connell Bros. Ranch (formerly Weber Ranch). O'Connell Bros., Sixth and St. James, San Jose, owners. This ranch extends over an area of several square miles, and contains two groups of magnesite deposits which are designated the 'north' and 'south' groups, respectively.

The north group is located on an open ridge, about three miles in an air line northeast of Madrone. A few carloads were shipped by H. Sherlock during 1915 to Berkeley for the manufacture of carbon dioxide, and during 1916 some further development work was done by the Water Company under the management of H. L. Haehl of San Francisco, but the deposits found were too small to warrant exploitation, and work ceased. On the west slope of the hills near the top, a deposit was later developed under lease by H. C. Warwick of San Francisco, followed by a Mr. Madison. A large open cut shows a ledge of white to buff-colored magnesite. Several hundred tons have been produced from this deposit. An aerial tram conveyed the ore to a bunker at the foot of the hill, whence it was hauled by truck to the railroad at Madrone.

On the east slope considerable float has been found and several large cuts were made in the hope of striking the ore in place. The magnesite occurs here in bunch-like or kidney deposits, being evidently not deposited in a vein or lode, but as a general alteration of the serpentine with which it is closely associated. The slopes of the ridge are covered with an adobe soil, and the serpentine very much decomposed, but the development work indicates these deposits are in place. The kidneys or boulders are white and evidently quite pure.

The property has been idle since 1919. The formations uncovered in the several openings indicate that the magnesite occurs in small irregular veins, in part reticulated, and some irregular masses. In the upper workings near the top of the ridge the magnesite is more massive, but also irregular.

The magnesite in the south group of the deposits on the O'Connell ranch is distinctly different in character from that in the north group described above. It outcrops in large, rugged masses for at least a mile along the eastern side of a ridge which trends northward between Coyote Creek and the main Santa Clara Valley east of Madrone. It is three and one-half miles by road from Madrone. Idle.

Winship Properties. K. D. Winship Estate, 350 Post street, San Francisco, owner. Magnesite occurs on Secs. 1 and 2, T. 6 S., R 4 E., and on the SW¼ of Sec. 7, T. 6 S., R. 5 E., M. D. M.

Bibl: State Mineralogist's Reports XIII, p. 505; XVII, p. 188. Bull. 38, p. 331; Bull. 79, pp. 79 and 87. U. S. Geol. Surv. Bull. 355, p. 31.

There are numerous other magnesite deposits in this county, worked somewhat during the World War, but now idle, some of which are:

Bradford Ranch Deposit, 4 miles southeast of Edenvale, along the top of an open rolling ridge. Herbert S. Bradford, San Jose, owner.

Bibl: State Mineralogist's Report XVII, p. 187; Bull 79, p. 78.

Burnett Ranch Deposit. Near top of ridge one-quarter mile north of the Metcalf road, and three miles northeast of Coyote Station.

Bibl: State Mineralogist's Report XVII, p. 187; Bull. 79, pp. 78–79.

Cochrane Ranch Deposit (also known as the Jackson Ranch Deposit) is four and one-half miles east of Madrone Station, and one and one-half miles south of the junction of Coyote and San Felipe creeks.

Bibl: State Min. Bur. Bull. 79, p. 79.

MANGANESE

Manganese ores occur in the mountainous area in the extreme northeast corner of the county, bordering Alameda, San Joaquin, and Stanislaus counties. They occur in the form of oxides in the jasper lenses of the Franciscan formation. This formation, consisting of heavy bedded sandstone, shale and conglomerate, more or less metamorphosed, is intruded by many different igneous rocks. The manganese deposits are very irregular, varying in size from stains and small veins in the chert to comparatively large pockets. The ore varies from soft and powdery to hard and massive. In discussing the origin of these manganese deposits, E. C. Harder[1] writes as follows:

"The manganese ores in the Franciscan jaspers in their present form are clearly secondary concentrations, as is shown by their replacement of jasper and by the intimate association of manganese oxide and quartz veins, suggesting their contemporaneous deposition. That the jasper itself is the source of the ore is shown by the facts that it is invariably associated with the ore deposits throughout the Coast Ranges, and that ores do not occur in the sandstones and shales of the formation."

This theory, however, is now regarded by many as erroneous and the manganese beds are believed to have been deposited with the chert, and to have been altered, in place, from the carbonate or silicate to the oxide, by the action of water and other agents.

Comparatively little ore was shipped from the different deposits prior to 1916. The high price of this metal during the war period led to some renewed activity, but at present none of the properties are being developed.

Lopez Prospect. Alfred Lopez, Route 1, Morgan Hill, reports a manganese deposit, one mile west of Madrone Station on the Rainey Ranch. He expects to mine this deposit soon.

Some of the manganese properties that were active during the war period, but now idle, are: (For detailed information, see our Bulletin No. 76, pp. 75–80; State Mineralogist's Report XVII, pp. 192–197.)

Ala Mountain Mine, is twenty-six miles southeast of Livermore in Section 28, T. 5 S., R. 4 E., M. D. M.

Black Bear Mine, twenty-five miles southeast of Livermore, is in Section 34, T. 5 S., R. 4 E., M. D. M., near the summit of the west slope of the Arroyo Mocho Valley, at an elevation of 3100 feet.

Black Bird Prospect, is in the center of Section 28, T. 6 S., R. 5 E.

Black Wonder Properties, comprises the Jones Group in the NW¼ of NE¼ of Section 27; the Black Wonder in the SE¼ of SE¼ of Section 27; and the Mexican Prospect, in SW¼ of SE¼ of Section 27, T. 6 S., R. 5 E., near the Stanislaus County boundary.

Bibl: U. S. Geol. Survey Bull. 427, pp. 162–163.

Camp Bessie Mine. (See Fable Manganese Mine.)

[1] U. S. Geol. Survey Bull. 427, 1910.

Davenport Prospect, is on the Winship Properties near the center of the north line of Section 27, T. 5 S., R. 4 E., one-half mile east of the Arroyo Mocho Road and twenty-five and one-half miles from Livermore.

Davenport and Smith Prospect, is on the Winship Properties in the NE¼ of Section 27, T. 5 S., R. 4 E., one-half mile from the Arroyo Mocho Road and twenty-five miles from Livermore.

Doak Mine No. 2, is in the Red Mountain district twenty-five miles southeast of Livermore on the Camp Bessie Road, in Sections 22–27, T. 5 S., R. 4 E., M. D. M.

Fable Manganese Mine, in SW¼ of NE¼ of Section 34, T. 5 S., R. 4 E., in a small canyon tributary to the Arroyo Mocho, about twenty-six miles southeast of Livermore.

Bibl: State Min. Bur. Bull. 38, p. 337; U. S. Geol. Survey Bull. 427, p. 162.

Keller Brothers had a slightly developed prospect of manganese in Section 13, T. 6 S., R. 4 E., in San Antone Valley.

Mammoth Prospect, is in Section 13, T. 6 S., R. 4 E., three-quarters of a mile east of a point which is thirty-two miles from Livermore on the Arroyo Mocho Road.

Mineral Products Company formerly owned two unnamed prospects one-half mile east of the Black Bird Prospect, near the east line of Section 28, T. 6 S., R. 5 E.

Mateos Ranch Deposit, is in Section 8, T. 6 S., R. 2 E., eight miles by road east of Milpitas, in Alum Rock Canyon, about two miles beyond the park. John D. Mateos, 165 North Fifteenth street, San Jose, owner.

Newhall Mine (Great Expectations Claim), is in Section 36, T. 5 S., R. 4 E., on the headwater of Colorado Creek, a branch of Black Bird Valley, twenty-nine miles southeast of Livermore.

Pennsylvania Manganese Mine, is in SE¼ of Section 12, T. 7 S., R. 4 E., thirty-five miles southeast of Livermore via the Arroyo Mocho Road.

Wallace Ranch, is in Section 8, T. 6 S., R. 2 E., six and one-half miles by road east of Milpitas.

Winship Properties. K. D. Winship, 350 Post street, San Francisco, owner. In the northeast corner of Santa Clara County, in the upper part of the Arroyo Mocho, these properties include the following sections containing manganese prospects. Section 27 and Section 35, T. 5 S., R. 4 E., M. D. M.

In the SW¼ Sec. 27, on the west side of the Red Mountain-Livermore road, at a point well above and easily accessible to the road is a series of manganese veins covering a width of about 50 feet. These croppings are traceable for a distance at least a couple of hundred yards long, running west of north. It could probably be followed much farther, but the chamise brush is very thick at this point. A little work was done some years ago around these outcroppings, and it is stated a few tons of high-grade ore hauled out. Material from there could be easily handled by a gravity tram to a loading point on the Arroyo Mocho road.

On the NE¼ of this same Sec. 27, is a good prospect of manganese ore. Some work was done a few years ago, said to have been by the same parties who worked on the SW¼. A short tunnel, now caved, is stated to have cut through a 4-ft. vein of high-grade ore. The surface indications are that it is at least that wide. The strike is west of north. There are other exposures on this same lead, to the south for about 200 or 300 feet. This deposit is on the east side of the Arroyo Mocho road in an ideal location for a gravity tram to handle the ore to bunkers.

MINERAL WATER

The numerous mineral springs of Santa Clara County are not confined to any particular locality or zone, but occur in the mountain ranges along both sides of the valley. They are all easily accessible and attractively located, and at the more important ones, recreation parks or health resorts have been established, while at others the waters are bottled for medicinal and table uses.

Most of the springs are carbonated and of small flow; a few are essentially sulphur springs, but the best known is a hot spring of large flow, Gilroy Hot Springs, which has been famous as a health resort for many years.

Dr. Winslow Anderson in his valuable book 'Mineral Springs and Health Resorts of California' calls attention to the medicinal value of several of the springs, comparing them favorably to the famous waters of Europe, and in writing of the California springs, in general, states that "all that is needed to make them as serviceable in the restoration and maintenance of health as their famous sister springs in the east and in Europe is their further development, their chemical analysis and the scientific administration and application of their waters."

Alma Soda Spring. The San Jose Water Works own a small carbonated spring in Cavanaugh Gulch, about a mile from Alma Station. The water, containing principally magnesia, sulphur, soda and iron is bottled and distributed locally for table uses, by C. Wood, 1075 Luther street, San Jose.

Bibl.: State Mineralogist's Report XVII, p. 197.

Alum Rock Park Springs. A group of mineral springs issue from the banks along the sides of Alum Rock Canyon, seven miles northeast of San Jose. The country rock here is thin bedded sandstone and shales highly tilted and folded. The springs are all of small flow and slightly sulphureted. They vary greatly in their chemical characteristics, as will be seen by referring to the analyses below, extracted from U. S. Geol. Survey Water Supply Paper No. 338. Most of the springs have been improved by cement basins to form drinking pools, and water from several of them is piped to the baths.

This property, owned by the city of San Jose, is conducted as a recreation park and is equipped with a natatorium, cafe, and numerous concessions. The Peninsular Railway operates an electric line to the park.

Bibl: State Mineralogist's Reports XII, p. 345; XIII, p. 519; XVII, p. 200. U. S. Geol. Survey Water Supply Paper No. 338, pp. 208–210. Mineral Springs and Health Resorts of California, Anderson, Winslow, pp. 78–80.

Analyses of Water from Alum Rock Park Springs, Santa Clara County, California

(Constituents are in parts per million)

Constituents	1 By weight	1 Reacting value	2 By weight	2 Reacting value	3 By weight	3 Reacting values	4 By weight	4 Reacting value	5 By weight	5 Reacting value	6 By weight	6 Reacting values	7 By weight	7 Reacting values	8 By weight	8 Reacting value
Sodium (Na)	1,330	57.40	870	38.32	1,751	76.16	2,110	91.77	1,052	45.77	533	23.18	637	27.71	856	37.24
Potassium (K)	25	.64	24	.61	45	1.15	77	1.96	25	.64	16	.39	13	.33	15	.38
Lithium (Li)	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace
Ammonium (NH_4)																
Calcium (Ca)	142	7.11	101	5.02	433	21.10	164	8.16	127	6.33	198	9.86	161	8.02	152	7.60
Magnesium (Mg)	24	2.14	39	3.18	160	13.19	39	3.18	37	3.06	53	4.78	73	6.02	63	5.21
Iron (Fe)	5.9	.21	3.5	.13	6.9	.26	4.2	.15	.6	.02	1.9	.07	30	1.06	.4	.19
Aluminum (Al)																
Manganese (Mn)																
Sulphate (SO_4)	167	4.10	305	4.28	2,418	50.34	10	.21	15	.00	305	6.30	390	8.11	280	6.04
Nitrate (NO_3)									0	.00	0	.00	0	.00	0	.00
Chloride (Cl)	765	21.60	404	11.39	1,522	42.95	1,223	34.52	800	22.58	133	3.76	308	8.68	534	15.06
Bromide (Br)									Trace	Trace	0	.00	0	.00	0	.00
Iodide (I)									Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace
Carbonate (CO_3)	1,236	41.20	534	17.80	648	21.60	1,995	66.50	689	22.96	908	30.27	765	26.18	880	29.34
Bicarbonate (HCO_3)	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	0	.00	0	.00	0	.00
Arsenate (AsO_4)																
Phosphate (PO_4)	12	.39	10	.32	3.4	.11	22	1.01			0	.00	Trace	Trace	0	.00
Silica (SiO_2)	20	.66	22	.73	60	1.99	21	.70	31	1.03	26	.86	26	.87	25	.82
	3,746.9		2,621.5		6,926.8		5,775.2		3,379.6		2,237.9		2,443		2,320.4	
Carbon dioxide (CO_2)	1,483	67.41	838	38.00	192	8.73	1,835	83.41	1,092	49.66	16	.37	0	.00	447	20.34
Hydrogen sulphide (H_2S)	37	2.17	68	3.99					0	.00	10	.59	13	.77	13	.76

1. Blue Sulphur Spring. Analyst, William Ireland, Jr. Authority, advertising matter.
2. White Sulphur (Sulphur tunnel No. 1). Analyst, William Ireland, Jr. Authority, advertising matter.
3. Salt-Condiment Spring. Analyst, William Ireland, Jr. Authority, advertising matter.
4. Soda Spring. Analyst, William Ireland, Jr. Authority, advertising matter.
5. Soda Spring (On west side of creek, 100 yards north of bath). Analyst and authority, W. D. Forbes (1910). Possibly the same spring as that represented by the preceding analysis.
6. Sulphur Spring (75 yards northwest of tea garden). Analyst and authority, W. D. Forbes (1910).
7. Blacksmith Spring (west of tea garden). Analyst and authority, W. D. Forbes (1910).
8. Southernmost of three springs at Blacksmith Spring house. Analyst and authority, W. D. Forbes (1910).

Azule Mineral Spring [1] is situated in a ravine a mile northward across a divide from Congress Springs. It was first known as Mills Seltzer Spring, but the name was early changed to Azule, from the blue appearance of the mountains to the southwest. The water was formerly bottled for table use, but it has not been on the market since about 1890. The property has, however, been improved as a picnic resort.

The spring rises in a small concrete house, from a crevice in dark-colored sandstone. Water also issues beside the spring house, apparently from the same crevice as that within the house, and the combined flow of the two streams in perhaps a quarter of a gallon a minute. The water is strongly carbonated and also tastes slightly of hydrogen sulphide. A very small deposit of Epsom salt was noticed beside the spring, and the channel is iron stained for a few yards below it. There are small deposits of lime carbonate farther downstream.

Although the spring issues from sandstone, serpentine that appears to form a dike not much more than 10 yards thick is exposed on the slope immediately above it. This dike may determine the position of the spring at this point, and the considerable amount of magnesia in the water that is shown by the following analyses, tabulated with one from Congress Springs, is probably explained by the presence of the serpentine. The water may be classed as secondary alkaline and primary saline, but the unusually large content of magnesium is noteworthy.

Bibl: State Mineralogist's Reports XIII, p. 518; XVII, pp. 200, 201. Anderson, Winslow, op. cit.

Analyses of Water from Azule Mineral Spring and Congress Springs, Santa Clara County, California

(Constituents are in parts per million)

	1		2		3	
Temperature	16° C. (60° F.)				10° C. (50° F.)	
Properties of reaction:						
Primary salinity	39		42		42	
Secondary salinity						
Tertiary salinity						
Primary alkalinity	18		11		36	
Secondary alkalinity	48		47		21	
Tertiary alkalinity	140		136		42	
Constituents	By weight	Reacting values	By weight	Reacting values	By weight	Reacting values
Sodium (Na)	972	42.25	990	43.03	1,746	75.99
Potassium (K)	126	3.21	117	2.98	20	.51
Calcium (Ca)	69	3.44	62	3.08	181	9.05
Magnesium (Mg)	462	38.02	462	37.99	144	11.87
Iron (Fe)					115	4.10
Aluminum (Al)					41	4.52
Sulphate (SO_4)					378	7.87
Chloride (Cl)	1,212	34.17	1,280	36.10	1,201	33.88
Carbonate (CO_3)	1,582	52.76	1,526	50.86	1,790	59.67
Silica (SiO_2)	55	1.82			68	2.26
	4,478		4,437		5,684	
Carbon dioxide (CO_2)	2,632	119.64	2,606	118.45	756	34.36

1. Azule Mineral Spring. Analyst and authority, Winslow Anderson (1888).
2. Azule Mineral Spring (bottled water). Analyst, James Howden. Authority, U. S. Geological Survey, Bull. 32.
3. Upper Spring, Congress Springs. Analyst and authority, Winslow Anderson (1888).

[1] Waring, Gerald A., Springs of California, U. S. Geol. Survey Water Supply Paper 338, pp. 212-213.

Blodgett Magic Spring is located seven miles west of Gilroy in Bodfish Canyon.[2] "The water issues in a board-curbed and inclosed pool near camp grounds, at the base of the canyon side 25 yards east of the stream. It is not strongly mineralized, but tastes slightly saline and is mildly sulphureted and carbonated. * * * The analysis shows a primary and secondary alkaline water with notable tertiary alkalinity and primary salinity. In former years it was bottled and sold locally to a small extent. The water issues from soft white sandstone.

"A spring that is known as the Blodgett Mineral Spring, or Magnesia Spring, is situated on the hillside above a branch of Bodfish Creek and several miles north of Blodgett Magic Spring. It issues from serpentine and its water is piped from a small covered and rock-walled basin one mile eastward to a tank near a farmhouse. The following analysis of the water shows that besides containing a large proportion of magnesia, the water of the mineral spring is primary and secondary saline in character."

Bibl: State Mineralogist's Report XVII, pp. 201-202.

Analyses of Water from Blodgett Mineral Spring and Blodgett Magic Spring, Santa Clara County, California

(Analyst and authority, Winslow Anderson, 1889. Constituents are in parts per million)

	Mineral		Magic	
Properties of reaction:				
Primary salinity	45		28	
Secondary salinity	16			
Tertiary salinity				
Primary alkalinity			21	
Secondary alkalinity	39		51	
Tertiary alkalinity	57		50	
Constituents	By weight	Reacting values	By weight	Reacting values
Sodium (Na)	111	4.83	129	5.61
Potassium (K)	24	.88	4.7	.12
Calcium (Ca)	30	1.48	61	3.05
Magnesium (Mg)	68	5.62	37	3.08
Iron (Fe)	Trace	Trace	Trace	Trace
Aluminum (Al)	Trace	Trace	37	4.15
Sulphate (SO_4)	222	4.63	42	.88
Chloride (Cl)	112	3.16	85	2.40
Iodide (I)	Trace	Trace		
Carbonate (CO_3)	151	5.03	256	8.53
Metaborate (BO_2)	Trace	Trace	Trace	Trace
Silica (SiO_2)	93	3.08	70	2.33
	821		721.7	
Carbon dioxide (CO_2)	32	1.45	79	3.58
Hydrogen sulphide (H_2S)	48	2.81	Trace	Trace

Coes Spring. A carbonated spring rises in a creek bed on the east slope of Pine Mountain, 11 miles east of Madrone. It is not utilized commercially. An analysis of the water is given with that of Madrone Spring, following.

Bibl: State Mineralogist's Reports XIII, p. 518; XVII, p. 202. U. S. Geol. Survey Water Supply Paper 338, pp. 214-215.

[2] Waring, G. A., op. cit. pp. 273-274.

Calaveras Mountain Springs. J. Daniels, owner. Leased by Calaveras Water Company, G. W. Fieger, 354 E. Santa Clara street, San Jose. Calaveras Springs are located at an elevation of about one thousand feet, nine miles north of San Jose, up the Calaveras road three miles. The water is bottled and distributed locally. Analysis of water as made by H. Kleinhaus is as follows:

(Authority, advertising matter)

Temperature at Spring	52°F.
Calcium Carbide	4 grs.
Iron Carbonate	½ gr.
Chloride Sodium	1 gr.
Carbonate Soda	2½ grs.
Traces Magnesium with Silica, Alumina combined	3 grs.
Total Solids per Gallon	11 grs.

Congress Springs, formerly known as the Pacific Congress Springs, are in Campbell Creek Canyon, at the base of the Santa Cruz Mountains, 12 miles southwest of San Jose. A group of three springs, two of which are carbonated, flow from the bank of the creek. It is used for a recreation park and owned by the Peninsular Railroad Company, who operate an electric line to the park.

Bibl: State Mineralogist's Reports XII, p. 345; XIII, p. 519; XVII, p. 202. U. S. Geol. Survey Water Supply Paper 338, p. 212. Anderson, Winslow, op. cit., pp. 213–214.

Analysis of Water from Gilroy Hot Springs, Santa Clara County, California

(Analyst and authority, Winslow Anderson, 1888. Constituents are in parts per million)

Temperature	43° C. (110° F.)
Properties of reaction:	
Primary salinity	60
Secondary salinity	31
Tertiary salinity	0
Primary alkalinity	0
Secondary alkalinity	9
Tertiary alkalinity	62

Constituents	By weight	Reacting values
Sodium (Na)	228	9.93
Potassium (K)	17	.42
Calcium (Ca)	66	3.30
Magnesium (Mg)	43	3.57
Iron (Fe)	2.1	.075
Sulphate (SO_4)	185	3.85
Chloride (Cl)	422	11.91
Iodide (I)	Trace	Trace
Carbonate (CO_3)	46	1.53
Arsenate (AsO_4)	Trace	Trace
Silica (SiO_2)	57	1.88
	1,066.1	
Carbon dioxide (CO_2)	114	5.16
Hydrogen sulphide (H_2S)	61	3.58

Gilroy Hot Spring is situated 13 miles northeast of Gilroy on a hillside above Coyote Creek at an elevation of 1240 feet. There is one large mineralized spring here, which flows from a bank in a small ravine at a temperature of 112° F. It is housed in a bottomless concrete tank, from which the water is piped to tub baths and plunges. The flow is approximately 15 gallons per minute. The water is said to be efficacious

in the alleviation of rheumatism, kidney, liver, stomach, skin and blood diseases. Besides its uses for bathing, it is used for drinking, and it was formerly carbonated and bottled at Gilroy. The health resort established at this property in 1865 is one of the best known in California. There are hotel and cottage accommodations for 150 guests, but it is open only part of the year.

Bibl: State Mineralogist's Reports XIII, p. 518; XVII, p. 202. Water Supply Paper 338, pp. 81–82. Anderson, Winslow, op. cit., pp. 156–158.

Grant Spring is situated in Alum Rock Canyon, 5 miles above the park. It is a slightly mineralized spring of small flow, whose waters contain principally sodium and magnesium carbonates.

Bibl.: U. S. Geological Survey Water Supply Paper 338, p. 212. State Mineralogist's Report XVII, p. 203.

Hillydale Sulphur Spring.[1] A small sulphur spring is situated on property known as Hillydale, about four and one-half miles south of the former reduction works of the New Almaden quicksilver mine, or 20 miles by road southward from San Jose. The spring is on the western bank of a stream, 200 yards from the house on the place, and yields about one-half gallon a minute of moderately sulphureted water. The following analysis indicates a primary-saline, secondary-alkaline water whose total mineral content is small.

The water is used locally for drinking and is considered useful medicinally.

The spring is situated at the base of a basaltic slope, in an area of sedimentary rocks that may belong to the Franciscan formation. The rock near the spring contains much calcite and is stained with metallic sulphides, from which the sulphide constituents of the water are possibly derived.

Bibl: State Mineralogist's Report XVII, p. 203.

Analysis of Water from Hillydale Sulphur Spring, Santa Clara, California

(Analyst, F. R. Green, 1904. Authority, owner of spring. Constituents are in parts per million)

Properties of reaction:	
Primary salinity	57
Secondary salinity	0
Tertiary salinity	0
Primary alkalinity	6
Secondary alkalinity	37
Tertiary alkalinity	6

Constituents	By weight	Reacting values
Sodium (Na)	95	4.12
Calcium (Ca)	32	1.59
Magnesium (Mg)	0.5	.78
Iron (Fe)	1.0	.04
Aluminum (Al)		
Sulphate (SO_4)	39	.81
Chloride (Cl)	104	2.93
Carbonate (CO_3)	83	2.76
Silica (SiO_2)	11	.37
Hydrogen sulphide (H_2S)	374.5 Present	Present

[1] U. S. Geol. Survey Water Supply Paper, 338, pp. 271-272.

Madrone Spring is situated 14 miles east of Madrone Station, and about five miles north of Gilroy Hot Springs, on a tributary of Coyote Creek. The spring issues at edge of creek, and the water, which is strongly carbonated, is caught in a cement basin. It was formerly hauled in barrels to San Jose and bottled, but is now used only for drinking purposes about the place. There are several other springs which are only slightly mineralized on the property.

Bibl: State Mineralogist's Reports XIII, pp. 518–519; XVII, p. 204. U. S. Geol. Survey Water Supply Paper 338, p. 214. Anderson, Winslow, op. cit., p. 191.

Analyses of Water from Madrone and Coes Springs, Santa Clara County, California

(Constituents are in parts per million)

	1		2	
Properties of reaction:				
Primary salinity	1		8	
Secondary salinity				
Tertiary salinity				
Primary alkalinity	29		8	
Secondary alkalinity	70		89	
Tertiary alkalinity	12		18	
Constituents	By weight	Reacting values	By weight	Reacting values
Sodium (Na)	217	9.45	56	2.45
Potassium (K)	7.5	.19		
Lithium (Li)	Trace	Trace		
Barium (Ba)	1.2	.02		
Strontium (Sr)	Trace	Trace		
Calcium (Ca)	380	18.94	90	4.47
Magnesium (Mg)	37	3.04	182	14.94
Iron (Fe)	4.7	.17	21	.74
Aluminum (Al)			Trace	Trace
Manganese (Mn)	.8	.03		
Sulphate (SO_4)			27	.57
Chloride (Cl)	14	.40	6.4	.18
Carbonate (CO_3)	940	31.34	649	21.63
Metaborate (BO_2)	Trace	Trace		
Phosphate (PO_4)	3.2	.10	7.0	.22
Silica (SiO_2)	108	3.60	97	3.21
Carbon dioxide (CO_2)	1,713.3 Present	Present	1,135.4 Present	Present

1. Madrone Spring. Analyst, G. E. Colby.
2. Coes Spring. Analyst, M. E. Jaffa.

Santa Clara County Park Spring, usually known as Soda Rock on Stevens Creek. This spring is located five miles west of Cupertino and is owned by Santa Clara County. This park is used as an outing or recreation park.

The Santa Teresa Springs are located on the east slope of the Santa Teresa Mountains overlooking the Santa Clara Valley, 3 miles south of Edenvale. The water, which is very slightly mineralized, issues from seams in a formation of hard gray sandstone, flowing over 20 gallons per minute. It is caught in a large concrete reservoir, from which the water is piped to the ranch house below. P. A. Bernal of Edenvale is the owner.

Bibl: State Mineralogist's Report XVII, p. 205.

Analysis of the Santa Teresa Spring Water

(Constituents are in grains per gallon; analyst, Dr. H. Kleinhans; authority, advertising matter)

Silica	5
Aluminum and Iron Oxide	1
Calcium Carbonate	8
Magnesium Carbonate	3
Magnesium Sulphate	2
Sodium Sulphate	4
Sodium Chloride	1
Total solids	24

There are several sulphur springs along Bodfish Creek, none of which are utilized commercially. One, larger than the rest, situated about 7 miles west of Gilroy, close to the road.

NATURAL GAS AND PETROLEUM

Natural gas and petroleum have been produced in the county at two localities, namely: in Moody's Gulch, south of Alma Station, and on the Sargent Ranch, near the southern boundary of the county. Following is an extract from Bulletin No. 89, 'Petroleum Resources of California,' by Lawrence Vander Leck, 1921, with reference to this area:

"The topographic features of Santa Clara County consist of the Santa Clara Valley running north and south through the center of the county, with the Santa Cruz Mountains bordering it on the west and the Diablo Range on the east.

"The southwestern portion of the county has been mapped by the U. S. Geol. Survey.[1]

"The formations of the Diablo Range within this area consist mainly of Franciscan beds. On the western edge of the range, east of San Jose and the Mission San Jose, there are outcrops of Cretaceous and Tertiary which may underly the Santa Clara Valley at this point. The valley proper is covered with recent alluvium. On the western edge of the valley, the Santa Clara formation (upper Pliocene) consisting of sands and gravels and clays, is found outcropping. Beneath the Santa Clara and forming the core of the Santa Cruz Mountains at this point are beds of the Franciscan formation. Along the western edge of the county which is practically parallel to the top of the western slope of the Santa Cruz Range, is a long, narrow belt of Tertiary running the entire length of the county. The northern portion of this belt is made up of Oligocene, Vaqueros and Monterey beds. South of Loma Prieta, it consists mainly of Monterey shale, which continues as far south as the Pajaro River, where it turns east, crosses the range and finally dips under the Pliocene beds of the Santa Clara Valley at Sargent.

"Oil indications within the county are limited to the following areas: (1) Moody Gulch. (2) Los Gatos. (3) Sargent.

"(1) Moody Gulch is in a westerly branch of Los Gatos Creek about two miles south of Alma. The gulch may be entered from the main county road from Santa Cruz to Los Gatos. Fig. 1 shows the general structure of the region and the formations that outcrop. The oil probably formed in the diatomaceous shales of the Monterey and then by

[1] U. S. Geol. Survey. Santa Cruz folio 168. By J. C. Branner.

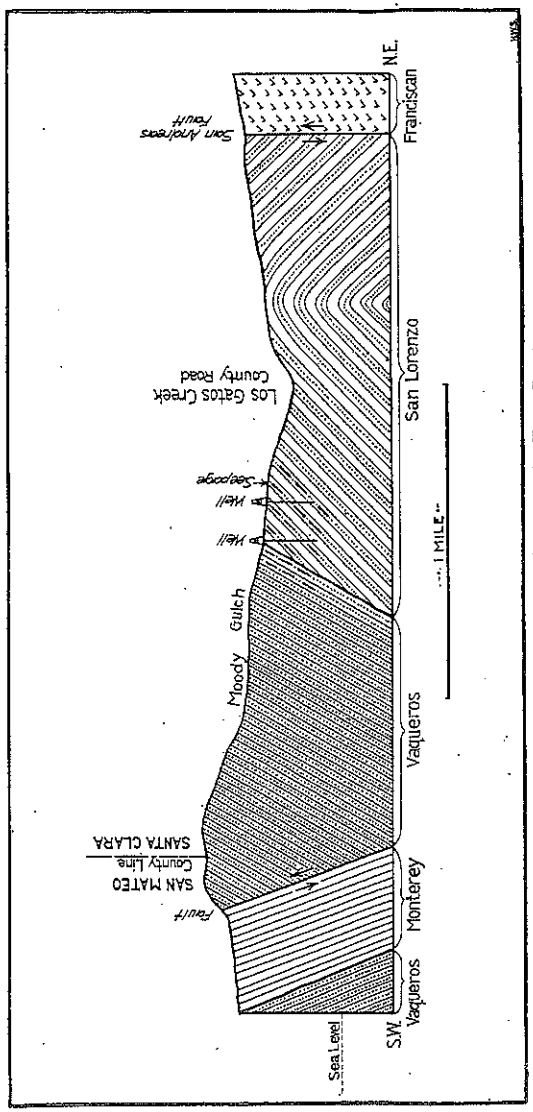


FIG. 1. Section up Moody Gulch, Santa Clara County.

reason of the fault contact has migrated into the porous sands of the Vaqueros and San Lorenzo formation. Drilling was first started here in 1880 and all together about 85,000 barrels of oil have been shipped from the gulch. The wells drilled number about 16, and the average depth is about 1200 feet. The gravity of the oil is 45° Baumé. The reported yield from the old wells varies from ten to forty barrels. Operations ceased about 1910, but recently the Trigonia Oil Co. has taken over the property containing the old Logan and Moody wells and is starting up operations again. The conditions that exist in the gulch probably extend for a mile or so both to the northwest and southeast. It is proable that with careful management the area around the gulch could be made to produce small wells of commercial value.

"(2) Los Gatos. Following is a report by C. A. Waring[1] of this region:

'The Santa Clara Valley region east of Los Gatos is covered with alluvial gravel, sand and soil so that the underlying formations are completely concealed. From wells drilled in the region it is evident that this land is underlain by rocks of the Monterey series which carry some oil.

'Drilling for oil has been carried on near the reservoir of the San Jose Water Company, on the San Jose road two miles northeast of Los Gatos. Oil indications were first noticed on the ranch of Mr. R. C. McPherson in an 85-foot well.

'Four wells have been drilled in the locality. At two of these the rigs are still standing but no operations are at present being carried on. In a 1600-foot well back of the barn on the property of Mrs. H. K. Main, gas may be seen bubbling through oil which fills the casing. Some oil is said to have been bailed from this well for use as fuel by the owners. A well on the south side of San Jose road is said to have been drilled 2530 feet deep, and to have pierced three oil strata.'

"In 1918 the Traders Oil Company drilled two wells, but failed to obtain a commercial production. Well No. 1 was drilled on the McGrath Ranch to a depth of 2000 feet and well No. 2 was located on the San Jose road near Walker avenue and reached a depth of 2675 feet.

"As stated above, it is probable that the region is underlaid by Monterey shale containing a little oil, but the presence of Franciscan rock on both sides of the valley restricts the shale to such a small area that production on a commercial scale is doubtful.

"(3) The Sargent Ranch field lies approximately in T. 11 S., R. 3 and 4 E., about three miles west of the railroad station of Sargent. The principal development has taken place along La Brea Creek. The formations outcropping are the Franciscan, Monterey sandstone and shale and Pliocene sands and clays. The oil originated in the diatomaceous shales of the Monterey and has collected in sandstone beds of the same formation. The Franciscan is found outcropping on the hills to the north of La Brea Creek and is overlaid by the Monterey formation which lies in the form of a crescent dipping at about 45° to the southeast. Westward the Monterey continues as far as a mile west of the Santa Clara-Santa Cruz County boundary, where it is truncated by the San Andreas fault. In its southward extension it is terminated by a fault along the Pajaro River. On the lower portion of La Brea Creek and in the hills just west of Sargent, the Monterey dips under the sandstones and shales of the Purisima. These later beds are dipping at an angle of 45° to the south. In the Lomas Muertas, south and east of Sargent, there are beds of sand and clay probably of upper Pliocene age. The axis of a small anticline runs southeast up the canyon just east of Sargent Station and finally flattens out into an east dip which is the general inclination of the strata in the Lomas Muertas.

[1]State Mining Bureau Bulletin 69, 1914, page 470.

There have been about twenty wells drilled along La Brea Creek. All obtained a showing of oil. Those which have produced on a commercial scale are located about two miles up the creek from the state highway. The average depth is about 1500 feet and the oil is obtained from sandstone beds on a monocline in the Monterey. The gravity averages about 18° Baumé.

"At the present time (1921) the Watsonville Oil Company is operating nine wells with a total production of 75 barrels per day, which is apparently the maximum yield of the field. On Pescadero Creek and near Chittenden, a number of shallow wells were drilled obtaining small showings of heavy oil. Due to the fault contacts on the west and south and the serpentine contact on the north, there is no hope of extending the field in those directions. On the east the oil-bearing sand of the Monterey dips so steeply under the Pliocene beds, that the chance that they would be within reach of the drill is doubtful. On the axis of the anticline just east of Sargent in the Lomas Muertas (San Benito County) there is a possibility that these beds may be reached by drilling. The Shell Company is at the present time (1921) drilling a prospect well here."

The Watsonville Oil Co., A. W. Cox, Gilroy, president, is now operating nine wells, producing about 35 barrels per day, in the Sargent Ranch field. The *Continental Oil Co.* drilled three wells in 1927 and 1928, in Section 31, T. 11 S., R. 4 E., and Section 1, T. 12 S., R. 3 E. in the Sargent field, but failed to obtain any commercial production. The *Strader Oil Company, Ltd.*, is drilling a well on Section 8, T. 9 S., R. 1 W., M. D. M., in the Moody Gulch area.

From January 1, 1922, to December 31, 1928, the following notices of intention to drill in Santa Clara County were filed with the Division of Oil and Gas, in addition to the above:

Year	Company	Location Sec., T., R.	Well No.
1922	Douglas S. Watson	5–12–4	
1923	Santa Clara Oil Co.	1–12–3	1
1926	R. H. Shannon	8– 9–1	New Moody 4
1926	Alfred Tinally	7– 8–1	1
1927	W. H. Lingenfelter	8– 9–1	1
1928	H. W. Covert	8– 9–1	6
1928	Carl Crossen	8– 8–1	1

PYRITE

F. V. Gaffey, R. D. 1, Box 274, Watsonville, reports a large pyrite deposit near the highway in Santa Clara County. Undeveloped.

QUICKSILVER [1]

The first known occurrence of quicksilver within the area of the United States was that found at the New Almaden mine in Santa Clara County in 1824 by Antonio Sunol and Louis Chaboya. Though some occurrences had apparently been earlier noted in Mexico, the New Almaden was the first producing quicksilver mine in North America. Sunol and Chaboya built a mill nearby and endeavored to extract silver from the cinnabar. Late in 1845 the ore was shown to

[1] Bull. No. 78, California State Mining Bureau, 'Quicksilver Resources of California,' by W. W. Bradley.

Andreas Castillero,[1] a Mexican officer, who identified it as cinnabar, and under whose direction development work was immediately begun. Gun barrels were utilized as their first retorts. The output was small, however, until after California became part of the United States, since which time more than a million flasks have been produced in this county, the greater portion of which came from the New Almaden mine.

The quicksilver deposits of Santa Clara County are confined, with one exception, to what is known as the New Almaden District. This district lies east of south from San Jose, extending from the northeasterly foothills of the Gabilan Range on the west to the low foothills that lie between Coyote and Dry creeks on the east. It also embraces the Santa Teresa Hills, a low spur ridge which lies between and in general parallel to the other two. The principal deposits are 8 to 13 miles from San Jose, on the ridge which forms the southwestern boundary of the Santa Clara Valley at this place, having a general NW.-SE. direction, and locally called the New Almaden Ridge.

The geology of this district and particularly of the New Almaden Ridge and its ore bodies has been described in considerable detail by various writers, especially by Becker [2] and by Forstner,[3] the latter of whom says:

"The three ridges in which the deposits occur are to a great extent formed by serpentine, especially the two first named. The serpentine is associated with metamorphic sandstone and jaspilites. Large bodies of croppings can be found in each of these ridges, having also a general northwestern trend, but not coinciding with the backbone of the ridges.

"In the New Almaden ridge the most extensive orebodies have been found in and close to Mine Hill, the highest peak of the ridge, lying in its southeastern part. From this point going northwestward the croppings, while not continuous, can be traced along the ridge into the territory of the Guadalupe mine, a distance of about three and one-half miles. At the surface the serpentine shows in large detached bodies surrounded by the sandstones and shales of the Franciscan series and having a general northwestern trend. This general direction of the serpentine exposures is important in connection with its occurrence underground, proven in the New Almaden mine. The line of ore croppings runs from Mine Hill to the American shaft, passing about 600 feet southwest of the Randol shaft. The underground workings in this territory have shown that the fissures wherein the orebodies have formed have invariably a serpentine footwall; hence the serpentine must be considered to occur underground in a continuous body through this entire territory and to be in places covered by overlying sandstones and shales. Southwest of Capitancillos Creek lies another parallel exposure of serpentine, contiguous to which the outcrops of the Costello mines are found. The Santa Teresa and Bernal mines are located in the serpentine of the Santa Teresa hills, and the North Almaden or Silver Creek mine close to those of the most northern ridge. In the latter a great part of the serpentine is very highly altered by silification, as is also the sandstones, a great portion of the rocks being jaspilites. The western slope of the adjoining Mount Diablo range is nearly exclusively formed of shales.

"In this district the occurrence of cinnabar-carrying orebodies is clearly closely allied to that of serpentine, and as the New Almaden was the first extensively worked quicksilver mine in California, this association explains the reason why, for a considerable lapse of time, cinnabar ores were, in the opinion of most quicksilver miners, considered related to this rock formation. The croppings consist of a more or less weathered material having usually an ochreous color from the oxidation products of the iron sulphides, and traversed by a network of quartz seams, from a knife blade to quarter of an inch wide. Overlying the orebodies is almost invariably found a body of clay, generally black, and containing more or less inclusions of a dark-gray sandstone. As this clay overlies the ore bodies it has received the name of 'alta' (Spanish for 'high' or 'upper'). At the surface of this 'alta' crops is a light-gray material, resembling disintegrated sandstone, traversed by a network of very thin, yellowish-brown seams, often very much like a bunch of very fine roots. In places the same material can be found in the New Almaden mine several hundred feet below the surface, forming part of the 'alta.' * * * The rocks of the Franciscan series in this region show a great amount of silification. The chert beds are, however, almost entirely unrepresented.

[1] Black's Supreme Court Reporter: The United States vs. Andreas Castillero, vol. 2, 1862. Also U. S. Geol. Survey, Mon. XIII, pp. 8-10, 1888.
[2] Becker, G. F., Geology of the quicksilver deposits of the Pacific Slope; U. S. Geol. Survey, Mon. XIII, pp. 310-330, 467, 1888.
[3] Forstner, Wm., Quicksilver resources of California; Cal. State Min. Bur. Bull. 27, pp. 168-171, 1903.

"To the west of the New Almaden ridge a belt of bedded sandstone is exposed. The beds are from three to five feet thick and interbedded with thinner beds of shale. * * * The country west of the New Almaden ridge and south of Capitancillos Creek, belonging to the Gabilan mountain system, consists, almost exclusively of the sandstones and shales of the Franciscan series with occasionally some jaspilites. * * * West of the serpentine belt which lies west of the New Almaden ridge, south of Costello's house, a small exposure of glaucophane schist was found. A body of rhyolite lies in the northern part of the New Almaden ridge, having a nearly east and west strike and being about two miles long."

The Alta, or so-called clay referred to above, is not a substance of definite composition, though it is usually a dark or black mass, readily distinguishable even in hand specimens from the country rock. It is simply an attrition product of the country rock and varies in composition with the material from which it has been produced. Its black color is in part due to the presence of manganese.

With reference to the age of the formations in the New Almaden District, Becker [1] summarizes his observations in the following:

"Upon highly metamorphosed rocks lie Miocene sandstones, which were sharply folded at the Post-Miocene upheaval. They are not conformable with the lower series and contain pebbles from these older beds. In the older rocks near New Almaden Mr. Gabb found Aucella, proving the presence of the Knoxville series.

"In this district is the only mass of rhyolite thus far found in the Coast Ranges. It forms a dike nearly parallel to the line connecting the New Almaden and the Guadalupe. It is almost continuous, and I have followed it for a distance of several miles. It is certainly Post-Miocene and probably Post-Pliocene.

"The New Almaden is a very extensive mine * * * The ore is cinnabar, with occasional traces of native quicksilver, accompanied by pyrite and marcasite, with rare crystals of chalcopyrite. The gangue is quartz, calcite, dolomite, and magnesite. These materials were deposited in shattered masses of pseudodiabase, pseudodiorite, serpentine, and sandstone. * * *

"The other mines of the district contain similar ores in similar rocks. The Guadalupe was the most productive. * * *

"All the deposits of the district appear to occur along a rather simple fissure system. The main fissure is nearly parallel to the rhyolite dike at the Guadalupe. It follows the direction of the hills, the axis of which curves gradually away from the dike for a certain distance. Passing through or near the San Antonio and Enriquita, it seems to break across the ridge at the America and enters the Almaden on the strike of its two great fissures. It is near this fissure that new orebodies are most likely to be found. The Washington seems to be on a branch of the main fissure.

"This was probably formed at the time of the rhyolite eruption, to which also I ascribe the genesis of the ore."

Also: [2]

"This dike not only proves the former existence of volcanic activity in this district, but emphasizes a fundamental structural axis. The character of the metamorphic rocks shows that the line along which compression and upheaval took place in the early Cretaceous was about west by north, east by south. The folding of the Tertiary rocks shows that compression was repeated in the same direction at the close of the Miocene. The position of the rhyolite dike proves that the dislocation which opened a passage for this lava again followed a similar course."

Also: [3]

"Ore deposition followed the eruption of lava. The minerals deposited and the manner of their deposition are such as in the more northerly quicksilver districts were induced by volcanic springs. Though there are now no indubitable remnants of the volcanic activity which certainly prevailed here since the beginning of the Pliocene, the analogies of the deposit, together with the presence of lava of approximately the same age as the ore, make any theory of deposition excepting from hot sulphur springs improbable."

There have been but two mines of consequence developed in this district, the New Almaden and Guadalupe, though there are a number of small properties which have at times produced a few flasks of quicksilver.

[1] Becker, G. F. Op. cit., p. 467.
[2] Becker, G. F. Op. cit., p. 314.
[3] Op. cit. p. 328.

Bernal Mine. Pedro A. Bernal, Edenvale, owner. It is 10 miles southeast of San Jose, on the east slope of the Santa Teresa hills, at an elevation of about 450 feet. A tunnel, over 200 ft. long, was driven along a clay gouge and serpentine contact, many years ago but failed to encounter any important orebody, so it was abandoned. No work has been done in recent years.

Bibl: Cal. State Min. Bur. Bull. 27, p. 171; Bull. 78, p. 157. State Mineralogist's Report XVII, p. 209.

California-Nevada Quicksilver Mining Co. Otto Taubert, president, 800 Carmel avenue, Berkeley. Incorporated under the laws of Nevada. This mine is located on the Tilton Ranch, 18 miles by road southeast of San Jose, below Coyote Station. Prospecting work has been done on the property by Taubert since September, 1929. Taubert reports a tunnel driven in about 160 ft., encountering a vein 18 inches wide, 60 ft. from the mouth, and another 10-ft. vein was struck 15 ft. further on, while the remaining distance penetrated was alta. Equipment includes air compressor, 20-h.p. Sampson gasoline engine, machine sharpener and drills.

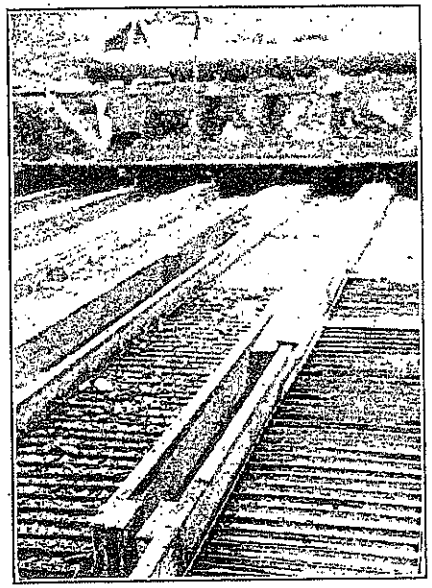
Guadalupe Mine. New Guadalupe Mining Co. J. S. Gregory, owner. Frank Golden, attorney, 582 Market street, San Francisco. This property, covering a territory of 2500 acres, is situated 10 miles south of San Jose on the west slope of New Almaden Ridge, and adjoins the land of the New Almaden Company on the northwest. The mine was discovered in the early 50's and is said to have produced 20,000 flasks of quicksilver up to 1875, when it became the property of the Guadalupe Mining Company. This company erected furnaces and made many surface improvements. In 1886 the mine was shut down due to litigation, remaining idle until 1900, when H. C. Davey organized the Century Mining Company. The old furnaces were remodeled, the mine unwatered, and operations resumed, since which time it was an important and continuous producer until recently. Idle.

The property has been described by so many writers that the reader should refer to the reports cited below for data on the geology, mine workings and past work.

Bibl: State Mineralogist's Reports VIII, p. 542; XIII, p. 600; XVII, p. 213. Bull. 27, p. 173; Bull. 78, pp. 157–160. Mineral Resources West of Rocky Mountains, 1875, p. 13; 1876, p. 20. U. S. Geol. Survey, Mon. XIII, p. 326.

New Almaden Mine (originally Chaboya; then Santa Clara). New Almaden Mines, Inc., owners. Mary L. Sexton, president; Knight, Boland and Christin, attorneys, Balfour Building, San Francisco. This property, covering over 8000 acres, lies from 8 to 13 miles east of south from San Jose along the New Almaden Ridge, and was at one time second only in production to the famous Almaden mine in Spain, after

which it was named. This property is the oldest known quicksilver mine in the United States, being first worked in 1824 by Antonio Sunol and Louis Chaboya. In 1845, Andreas Castillero, a Mexican army officer, 'denounced' (located) it under the name of Santa Clara. After the admission of California into the Union, Castillero and associates leased the mine to Barron, Forbes and Company, who changed the name to New Almaden.



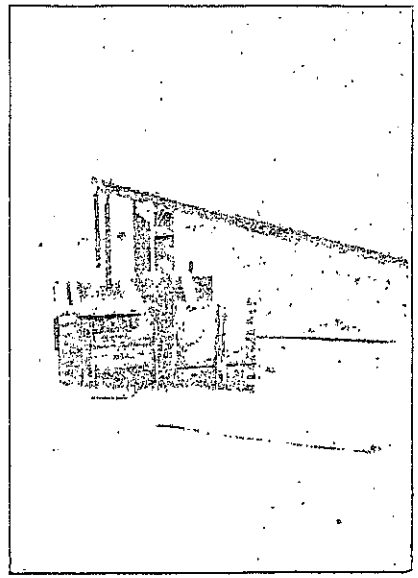
Sluices used to wash cinnabar ore at New Almaden Dumps, Santa Clara County.

The greatest surface improvements were made after it became the property of The Quicksilver Mining Company in 1864. Many important practices and appliances in the metallurgy of quicksilver had their beginning here, including the development of the Huttner-Scott fine-ore furnace in 1875–1876. The mine had been worked continuously from 1845 to 1926, but is now idle.

The property has been described by so many writers that the reader should refer to the reports cited below for data on the geology, mine workings and past work.

Retorts at New Almaden Dumps, showing heads with special "U" pipe fittings, Santa Clara County.

New Almaden Mine Dumps. - E. T. Haun, Almaden, lessee. The old dumps from the furnaces, which cover approximately five acres, are being mined by the use of a power shovel. Dump trucks unload the ore down a wooden slide, where it is washed through a grizzly by water power, segregating the coarse ore. The ore is then washed down over a sluice. The sluice is arranged with heavy close-set wire riffles at the head, separating the finer ore first and the coarser later with wider-set wire grates. The ore that is washed over the riffles is collected and taken to the jig tank. The jig machine is operated by hand, separating the heavier from lighter material in the screen by agitation in water.



Jig tank, used to wash ore at New Almaden Dumps, Santa Clara County.

A 4-tube retort, erected by Haun in 1928, is used. A 70% recovery is claimed, as a special trap device is added on the tube heads. (See photo.) Three street L's are connected and the pipe screwed in each head at the bottom of the tube, so that the mercury flows up through the U-shaped pipe into the bucket below. Coal is used for fuel. When visited by the writer in January, 1930, the plant was idle as the property was in litigation.

Bibl: Note—The New Almaden mine and plant have been described by so many writers that only the principal references are here given. Others will be found in the Bibliography in Part III of Bulletin 78. State Mineralogist's Reports I, pp. 26, 27; IV, pp. 336 et al.; VIII, pp. 541–542; X, pp. 604–606; XI, pp. 374–375; XII, pp. 367–370; XIII, pp. 600–601; XVII, p. 224. Bull. 27, pp. 174–186; Bull. 78, pp. 160 et al. U. S. G. S. Mon. XIII, pp. 8, 310–330, 467. Min. Res. 1883–1915, inc. Mining Resources West of Rocky Mountains. 1867, pp. 170–178; 1874, pp. 33, 380, 540; 1875, p. 13; 1876, pp. 4–18, 20. Min. and Sci. Press, vol. 84, pp. 393–404, 1902; vol. 87, p. 201, 1903; vol. 100, pp. 15–16, 446–447; Feb. 16, 1916, pp. 282–284. Eng. and Min. Jour., vol. 34, pp. 185–186, 334, 1882; vol. 91, p. 85, 1911; vol. 102, p. 630, 1916. Geol. Surv. of Cal., Geol. vol. I, p. 68; vol. II, pp. 91–110, 122.

Santa Clara Quicksilver Corp. Formerly known as the Piercy property, just above the old Miller mine workings. Fred Murphy of San Jose in charge of operations. This property is located nine miles by road southeast of San Jose, just off the Forde road. This company started operations in November, 1928, securing the mineral rights from the Miller heirs. It is reported that 1400 ft. had been worked

in the old Miller tunnel, 300 ft. below the surface outcroppings, which is now partially caved in, as work was discontinued there in 1906.

Sandstone and jasper outcroppings are found on top of the ridge. A tunnel has been driven in near the surface outcroppings on top of the hill to about 100 ft. and a track has been laid. A jaw crusher, driven by a 2½-h.p. gasoline engine, crushes the ore. A 12-tube retort is in operation day and night, natural gas being used for fuel. Four men are employed.

Silver Creek Mine (North Almaden). A. R. Bradford et al., San Jose, owners. This property, formerly known as the North Almaden mine, is 12 miles by road southeast of San Jose, on the east side of Silver Creek. A large body of serpentine containing cinnabar was found in Silver Creek gulch, overlying Knoxville gravels. This detached body was evidently due to a great landslide which is plainly visible about the works. It was approximately 1000 ft. in length, 300 ft. wide, 60 ft. in thickness, and was exhausted in a few years, producing about $60,000 worth of quicksilver. It is reported that Mr. Slator had been prospecting here last fall. The property is equipped with a 20-ton Scott furnace, partly demolished, and a pipe retort.

Bibl: State Mineralogist's Reports XII, p. 367; XIII, p. 600; XVII, p. 225. Bull. 27, pp. 187, 235, 238; Bull. 78, p. 168.

Numerous other quicksilver prospects now idle and owners unknown to the author are:

Bowie Prospect, New Almaden District.

Bibl: State Mineralogist's Report XVII, p. 209. Cal. State Min. Bur. Bull. 78, p. 157.

Brainard Prospect, situated south of the Guadalupe mine, and west of the northern end of the New Almaden lands.

Bibl: State Mineralogist's Report XVII, p. 209. Cal. State Min. Bur. Bull. 78, p. 157.

Comstock Mine, located in the extreme southeastern corner of Santa Clara County, in Sec. 19, T. 11 S., R. 7 E., M. D. M., and in the Stayton district, most of which lies in San Benito County.

Bibl: State Mineralogist's Report XII, p. 367 XVII, p. 210. Bull. 27, p. 172; Bull. 78, p. 157. Mineral Resources West of Rocky Mountains, 1875, p. 14.

Costello Mine is about one and one-half miles by road southeast of the Guadalupe mine, on the hillside above Los Capitancillos Creek at an elevation of about 1000 ft.

Bibl: State Mineralogist's Report XVII, p. 210. Cal. State Min. Bur. Bull. 27, p. 172; Bull. 78, p. 157.

Hillsdale or *San Juan Bautista Mine* (one time called Chapman, also Chaboya), is about 2 miles southeast of San Jose on the east slope of the San Juan Bautista Hills, and within one-half mile of a street car line.

Bibl: State Mineralogist's Reports XIII, p. 600; XVII, p. 213; Bull. 27, p. 174; Bull. 78, p. 160. Geol. Surv. of Cal. Geol., vol. 2, pp. 112–113.

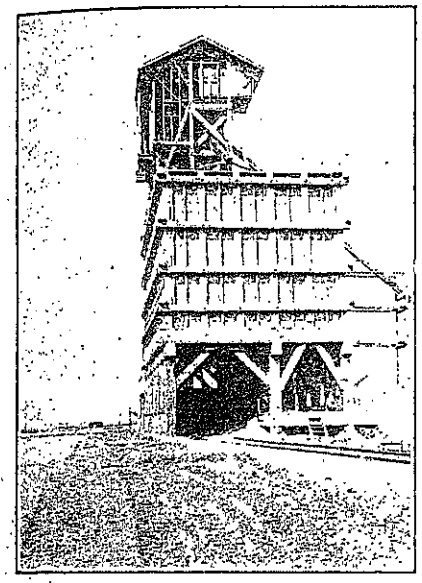
Santa Teresa Mine is eight miles southeast of San Jose on the east slope of the Santa Teresa hills.

Bibl: State Mineralogist's Report XVII, pp. 224–225; Bull. 27, p. 186; Bull. 78, pp. 167–168.

Wright Mine is three miles south of the New Almaden Hacienda, on Llagas Creek.

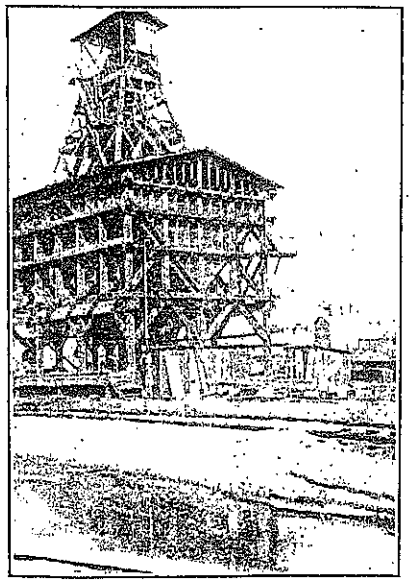
Bibl: State Mineralogist's Reports XII, p. 370; XIII, p. 600; XVII, p. 225; Bull. 27, p. 187.

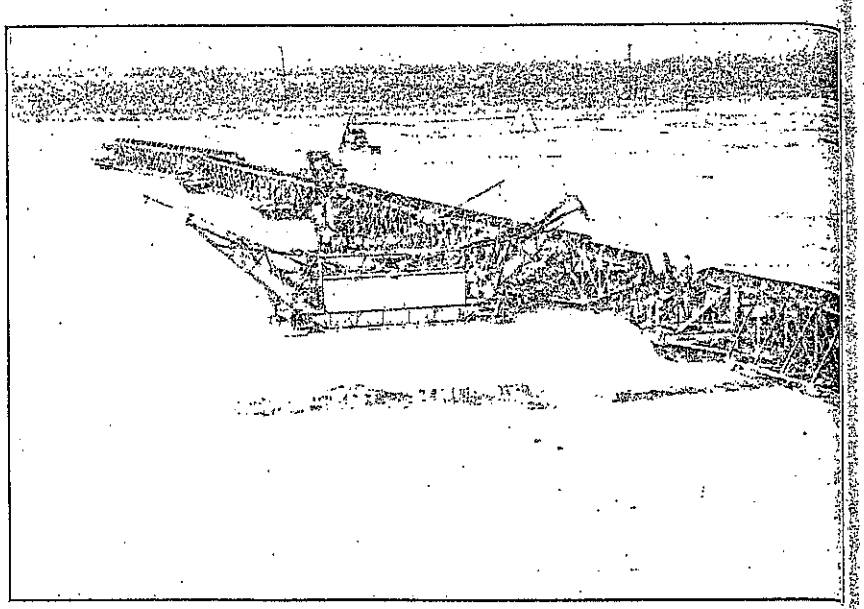
SALT



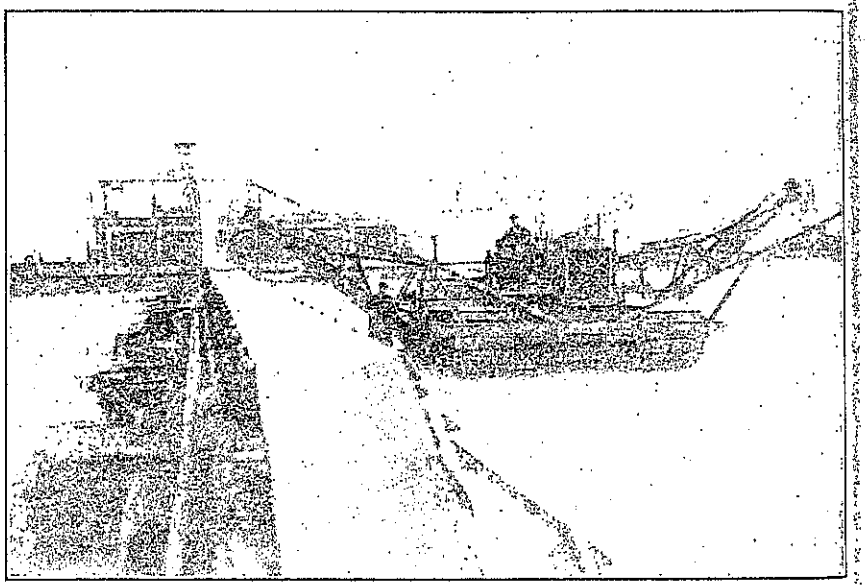
Washer at Alviso Salt Company's plant, Santa Clara County.

Alviso Salt Co.. V. S. Hardy, president; W. H. Makaffy, secretary. Home office, Russ Building, San Francisco. H. W. Bartlett, plant superintendent. The construction of this plant, at Alviso, began in 1923. The brine is pumped into a series of large outer ponds, 1000 ft. by 6000 ft., where it is concentrated by solar evaporation. The concentrated brine at the point of saturation is then thrown into the crystallizing ponds, where the evaporation is completed to dryness. Water is drained off the ponds once each year, usually between July and December. A harvester, run by a 60-h.p. Best tractor, scoops up the salt and conveys it onto a belt conveyor which loads it on a barge, that carries the salt up to the plant at Alviso. The conveyor belt is operated by one tractor, while each conveyor section is mounted on two caterpillars, operated by electric motor, so that the conveyors may be moved from pond to pond. The harvester first loosens the salt and then scoops it up, making a 16-ft. swath. Two men handle the entire harvesting operation. The plant at Alviso consists of a washer and a rewasher. Over 4000 acres are leased along the bay from Alviso to Mayfield. The potential ca-





Salt harvester loading salt on conveyor belt. Photo by courtesy of Alviso Salt Company, Santa Clara County.



Harvester, operated by a 60-h.p. Best tractor, placing salt on conveyor belts which load it on barge. Photo by courtesy of the Alviso Salt Company, Santa Clara County.

SANDSTONE

An extensive body of hard buff-colored sandstone, which is deposited in beds varying from a few inches to several feet in thickness, occurs at Graystone Station, 9 miles south of San Jose, on the Almaden branch of the Southern Pacific Railroad. This stone was formerly quarried for building purposes in San Francisco, San Jose and other towns, and it was used for the construction of the buildings of Stanford University. There has been no stone cut from this deposit for several years, and the only sandstone quarries now operated in the county are those producing crushed rock described under the heading, 'Stone Industry.'

Bibl: State Mineralogist's Reports VIII, p. 547; X, p. 618; XII, p. 399; XIII, p. 637; XVII, p. 225. Bull. 38, pp. 133–138.

STONE INDUSTRY (CRUSHED ROCK, SAND AND GRAVEL)

Anderson Quarry. G. H. Anderson of Mountain View has a rock quarry located three miles southwest of Los Altos. A dragline is used to work the material.

Bright Gravel Company. W. H. Bright and Earl W. Heple, owners. Office: 494 Delmas avenue, San Jose. Plant is located on Coyote Creek south of San Jose. The sand and gravel are mined by the use of a steam shovel and a dragline scraper. The material is fed into a hopper, then conveyed by belts to be crushed, screened and washed. Five men are employed.

California Concrete Products Co., formerly known as Merritt Concrete Products Co. Fred Holthouse, president; J. Demichelli, secretary. The plant is located at 1700 Monterey road, San Jose. All of the sand and gravel is purchased from Felton, Watsonville and from along Coyote Creek. After the sand and gravel are graded, they are mixed with water and cement by a paddle mixer and then the material is fed into a McCracken packer head pipe machine. The pipe is cured and placed in the yards to dry. Cement irrigation pipes and sewer pipes are the principal products. Electric power is used. About twelve men are employed.

Carroll Gravel Pit. W. A. Dunlap, owner. Operated by R. D. Carroll, 950 South Sixth street, San Jose. Plant is three miles south of San Jose on Coyote Creek. The deposit is worked by the use of team and fresno scraper. The sand and gravel is washed and screened.

Concrete Pressure Pipe and Construction Co., Inc. H. C. Scholten, president; L. Scholten, secretary. Plant at Gilroy, California. Sand and gravel is obtained from Logan, Olympia and Niles. Equipment includes screens, building-block machine and a pipe machine. Electric power is used. From five to twenty men are employed. Sewer and irrigation concrete pipe besides other concrete products are manufactured.

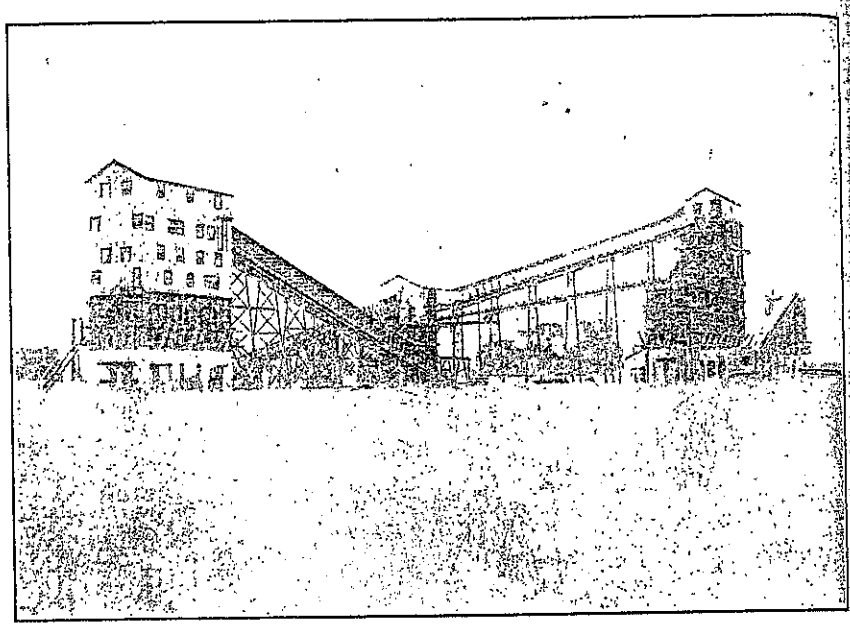
Kelley's Rock Quarry. A. M. Kelley quarries a serpentine rock used for road work, located north of Morgan Hill.

J. W. Lovejoy. This quarry is located about 4½ miles southwest of Mountain View, near the Los Altos Country Club's property. The

equipment consists of dragline, crusher, elevator, tractor and compressor.

Los Gatos Sand and Gravel Co. W. R. Burchell, Box 185, Los Gatos, owner. Pit located about 1½ miles north of Los Gatos, on Los Gatos Creek. Equipment includes Bearcat excavator, grizzlies, Allis-Chalmers crushers, screens, 26-h.p. gasoline engine, etc. Three grades of crushed gravel are produced.

Martin Bros. Sand and Gravel Co. This plant, owned by M. P. Martin and B. C. Martin, Route 2, Box 205A, San Jose, was erected in 1927 and operations began in March, 1928. It is located on Coyote Creek, north of San Jose, on the Milpitas-San Jose highway. The gravel beds cover approximately twenty acres, with an overburden from



Associated Gravel Company's plant, Coyote, Santa Clara County.
Photo by courtesy of Pacific Coast Aggregates, Inc., owners.

a foot to six feet, which is sold for fill. The deposit is worked by the use of a dragline and a General excavator, equipped with an Erst clam-shell hoist, and hauled to the plant by trucks. The plant, equipped with link-belt machinery, crusher, trommels, elevators, washing vats, scalping screens, etc., has a daily capacity of 100 yards, and is operated by electric power. The water is pumped from their own well. Five men are employed. A clay, suitable as an oil-well drilling mud, has been used from this property.

Oar Quarry. Jim Oar, Mayfield, owner. Quarry located 4 miles south of Mayfield.

Pacific Coast Stone Co. Pratini and Cantu, Monterey road, San Jose, owners. Cast stone and cement are manufactured. Sand is obtained from the Olympia Sand and Gravel Co., Felton.

Pacific Coast Aggregates, Inc. Norman B. Livermore, president; C. C. Roller, secretary. Home office, Wells Fargo Building, Second and Mission Sts., San Francisco. This company recently took over the plants of the Associated Gravel Co., Bay Development Co., and Santa Clara Gravel Co.

Associated Gravel Plant. This plant, located 12 miles southeast of San Jose, on Coyote Creek, was constructed in 1927. There are over 400 acres of sand and gravel on this property along the former Coyote Creek bed. It is mined by a Bucyrus excavator and hauled to the plant on cars by a gasoline locomotive. This plant is equipped with link-belt machinery, gyratory crusher, trommels, elevators, washing vats, etc.; producing fourteen grades of sand, gravel and crushed rock. Electric power is used. Five men are employed. Mr. Bishop is plant superintendent.

Bay Development Plant. This plant adjoins that of the Associated Gravel Co. and is to be discontinued, as the new company can develop the remaining deposits from the Associated's plant.

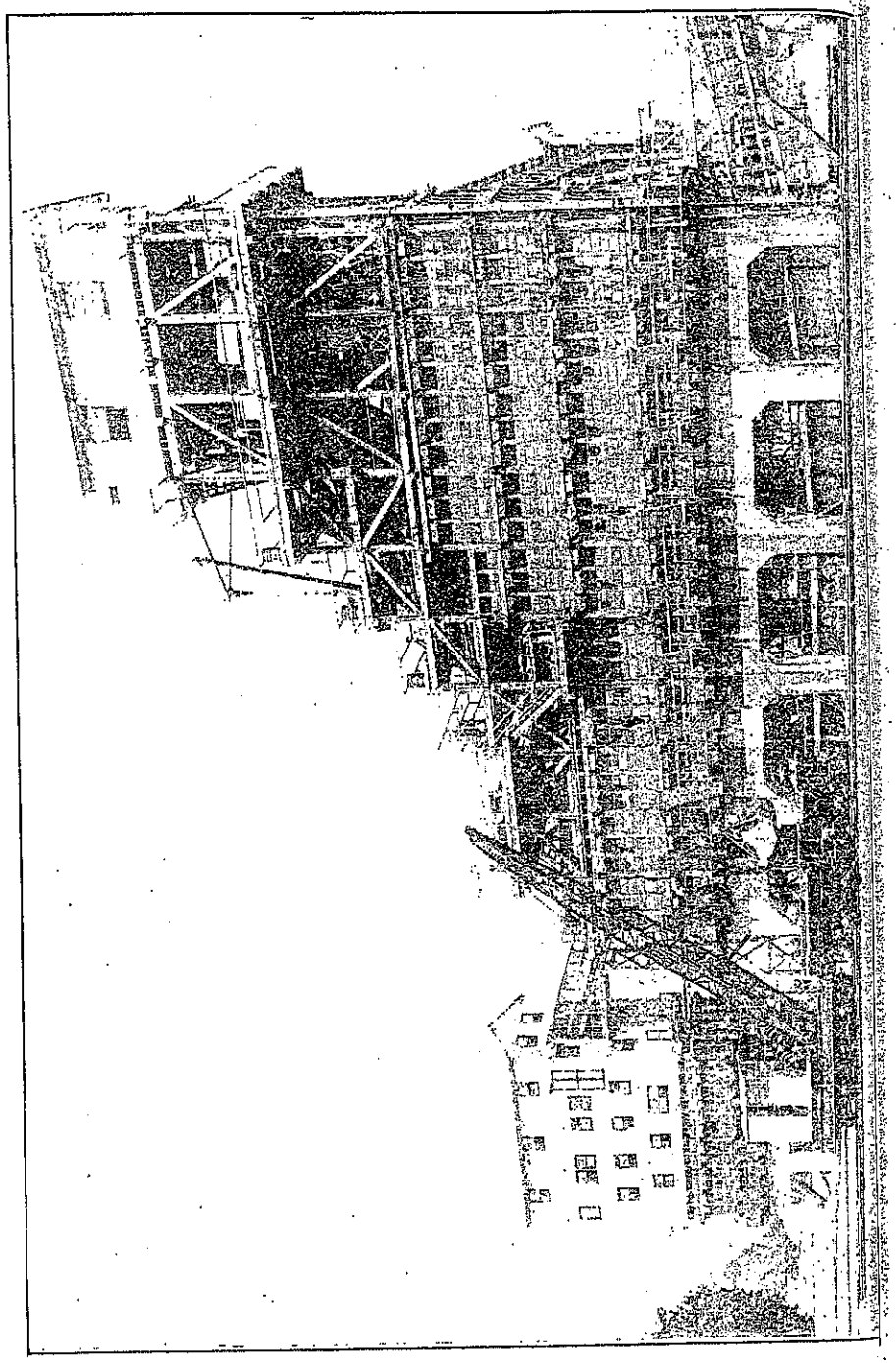
Santa Clara Gravel Plant. Located 1½ miles south of Campbell. R. Helstrom, Box 116, Campbell, foreman. This gravel bed along Los Gatos creek covers approximately 62 acres. A Link-Belt dragline excavator mines the beds. A gasoline locomotive and cars take the material to the plant, where it is scalped, crushed, washed and graded. Equipment includes a Bodinson screen and two Link-Belt screens. Electric power is used. Four men are employed.

Prentiss Paving Co., formerly known as Raymond H. Crummey, Inc. Chas. E. Prentiss, president; D. L. Morrison, secretary. The plant and office is located at Fifth and Keys streets, San Jose. About 10 acres of a gravel deposit are leased by this company 6 miles southeast of San Jose, opposite the Swickard Ranch, but are worked only 6 months during the year. Two draglines and two dry rotary screening machines are used. Three men are employed.

Raggio Cement Pipe Co. This plant is owned by George J. Raggio, and is located at 674 Stockton avenue, San Jose. The fine sand is obtained from Coyote Creek, while the remainder of the sand comes from Niles and Felton. Crushed rock is bought at Logan. The equipment consists of a Heer pipe machine and two mixers. The plant employs from 8 to 20 men, but operates only about 8 months during the year.

San Jose Concrete Pipe Co. This plant is located at 590 Stockton avenue, San Jose, and is owned by H. L. Ferguson and P. M. Matich. Sand is obtained from Olympia, Santa Cruz County, while some rock and gravel is secured from Coyote Creek. Among the equipment is a Heer pipe machine and two crushers. The plant is operated for about 9 months during the year, and employs about 9 men.

Santa Clara County Quarry, also known as Saratoga Rock Quarry, and formerly known as Stanfield and Knowles Quarry and Quality Sand and Rock Co. The county of Santa Clara is the owner of this quarry, situated 1 mile west of Saratoga, just below Congress Springs. The property is located in Section 11, T. 8 S., R. 2 W., M. D. M., and covers approximately 63 acres. The rock is a hard, gray, metapor-



phosed sandstone, which is mined with the use of a dragline and taken to the plant, which is equipped with 3 crushers. Electric power is used. Eight men are employed.

Bibl: State Mineralogist's Report XVII, pp. 226–227.

Santa Clara County Gravel Deposit. The county owns a small gravel deposit, 7 miles east of San Jose on the Mt. Hamilton road. This deposit is a cemented gravel and is shoveled on trucks by hand.

Stanford Quarry. Hutchinson Co., Inc. 1706 Broadway, Oakland, owners. N. F. Patterson, superintendent of the quarry. This quarry is located 1½ miles southwest of Mayfield on the Page-Mill road. The blue basalt rock is mined by means of a dragline. Plant equipment includes two Telsmith gyratory crushers (a No. 5 and No. 2), trommel, bucket elevators, etc. Electric power is used. Seven grades of crushed rock and three grades of base rock are produced.

J. H. Swickard, Route 4, Box 376, San Jose, has ornamental rock available for building purposes.

Taaffe Construction Co. Taaffe Bros., Los Altos, owners. Rock quarry located 3 miles west of Los Altos. Three men are usually employed the year round.

Thermotite Construction, Inc. F. O. Bohnett, president; L. D. Bohnett, secretary. Plant located at 580 Stockton avenue, San Jose. Concrete blocks used in building residences and commercial buildings are manufactured. Some sand and gravel is obtained from Coyote Creek, but the greater part is shipped in from Campbell and Felton. Pumice in its natural lump state is used. The pumice, sand and gravel are mixed with cement, semi-dry, and tamped with a patented Thermotite tamping unit. The concrete blocks are cured in moist air for ten days before being put on the market. Electric power is used. From five to 40 men are employed.

Union Paving Co. J. A. Dowling, president; R. W. Telfer, secretary. Office, Call Building San Francisco. This company uses sand and gravel obtained from the Granite Rock Company and the Pacific Coast Aggregates, Inc. A plant is located at Gilroy and Santa Clara.

Numerous other sand and gravel pits operated along Coyote Creek near San Jose are:

Beasworrick Gravel Pit, using team and fresno; W. A. Dunlap; A. G. John; Jas. A. Lemieux; M. Montoya Gravel Pit, using team and fresno; Ralph Richmond; Henry Sands, using dragline scraper, Fordson hoist and screens; and A. S. Cardozo.

LOS ANGELES FIELD DIVISION

W. B. Tucker, and R. J. Sampson, Mining Engineers

On account of unfinished field work there is no report from the Los Angeles Field Division in this issue.