

● MINERAL INFORMATION SERVICE

A PUBLICATION OF THE CALIFORNIA DIVISION OF MINES AND GEOLOGY

VOLUME 19 NUMBER 5
MAY 1966

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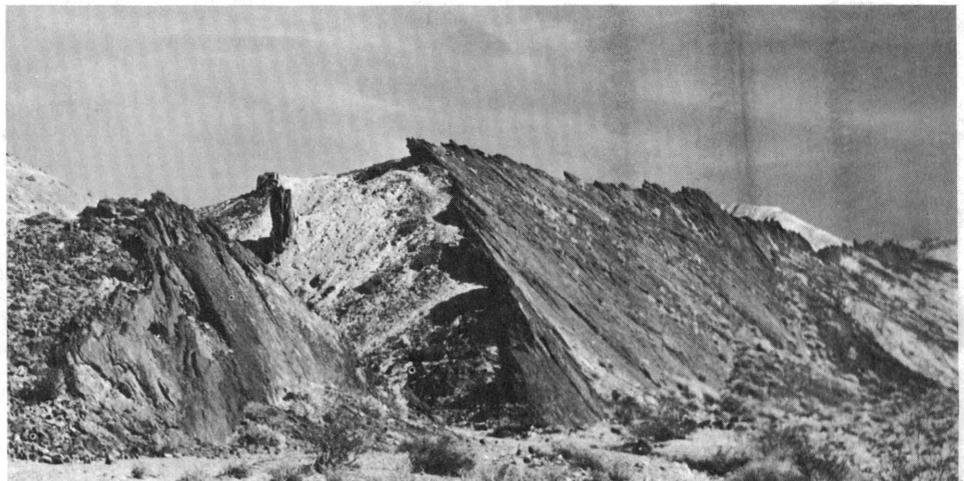
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Calico Mountains

MINERAL INFORMATION SERVICE

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MINERAL INFORMATION SERVICE is designed to report on the progress of earth science in California, and to inform the public of discoveries in geology and allied earth sciences of interest and concern to their lives and livelihood. It also serves as a news release on mineral discoveries, mining operations, statistics of the minerals industry, and new publications. It is issued monthly by the California Division of Mines and Geology. Subscription price, January through December, is \$1.00.

Other publications of the Division include the Annual Report of the State Geologist; the Bulletin, Special Report, Map Sheet, and County Report series; the Geologic Map of California; and other maps and publications. A list of the Division's available publications will be sent upon request. Communications to the Division of Mines and Geology, including orders for publications, should be addressed to the San Francisco office.

MARY R. HILL, *Editor*

THE HISTORY TRAIL

From Mr. Braeme E. Gigas comes good news concerning the name Mount Mary Austin. Writes he, "Happily, we need no longer put that phrase in quotes, because I have just received a letter from the Board of Geographic Names that the name has been approved." An enclosed letter from the Board adds, "This decision will be published in Decision List 6601 and the entry will read as follows:

Mary Austin, Mount: mountain, elevation over 13,040 ft., 1 mi. NE of Black Mountain and 8.5 mi. W of Independence; named for Mrs. Mary Austin, a prominent writer, natural historian, and long-time resident of the area; Inyo Co., Calif.; 36° 48' 57" N., 118° 21' 43" W."

THE HISTORY BOOKSHELF

Mines of the High Desert, by Ronald Dean Miller. 63 pages, 20 photos, maps, index, references. Price \$1.95.

History of the Dale mining district, in and about Joshua Tree-Twenty-nine Palms National Monument, is recounted by Mr. Miller, who was for years a naturalist at the Monument. The two dozen mines of the area—among them the Virginia Dale, Old Dale, New Dale, Supply, OK, Zulu Queen, Gold Coin, Snowcloud, Lost Horse, Hexie, Anaconda, and Desert Queen—were "small, almost do-it-yourself" turn-of-the-century ventures, but their story contributes an interesting and picturesque page to desert lore.

Mines of the High Desert is the fifth booklet in Walt Wheelock's La Siesta Press desert series . . . its predecessors *Freeman's, A Stage Stop on the Mojave*, by E. I. Edwards (price \$1.95); *Exploring Joshua Tree*, by Roger Mitchell (price \$1.00); *Baja California Overland*, by L. Burr Belden (price \$1.95); and *Desert Peaks Guide, Part I*, by Walt Wheelock (price \$1.00). They may be obtained from La Siesta Press, Box 406, Glendale, California, 91209.



Dedicated to keeping the gold mining industry from becoming an irrevocable page from history is the monthly paper *American Gold News*, the official publication of the American Gold Association and the Mineral Association of Northern California. Those who wish to keep a finger on the pulse of the ailing industry can do so with a subscription, price \$3.00 per year (foreign \$4.00 per year) or \$5.00 for two years. Address P.O. Box 427, San Andreas, CA 95249.



The Rock Paintings of the Chumash, by Campbell Grant. 163 pp., 120 figs., 30 colored plates and frontis. University of California Press, Berkeley and Los Angeles. 1965. Price \$10.00.

Our thanks to reader "C.S.", Librarian at Santa Barbara Museum of Natural History, for his complaint that we had not reviewed *Rock Paintings of the Chumash*. We are much in his debt for calling to attention this unusually beautiful volume, typified by a clear, understandable text and some of the most finely reproduced Indian paintings it has been our pleasure to view. Campbell Grant, author and artist, has copied many of the original paintings, on the spot; his copies are printed in color, along with a few color photos of the originals for comparison.

The book explores the territory of the Chumash, their history, and their culture, and the text is supplemented by numerous black and white illustrations. The material presented is authentic, yet its rendition is not hampered—for the layman—by the language barrier common to many scientific works.

Mr. Grant has included a short section entitled "Erosion and Vandalism" in which he concludes that "Damage through vandalism is a far greater threat to the existence of these pictographs than erosion". Fortunately their locations are not too well known, nor are they too accessible (what a sad comment to have to make!); but even so, many of them have been seriously damaged by vandals.

Rock Paintings may be ordered from University of California Press, Berkeley, California 94720. It is not distributed by the Division of Mines and Geology.

SILVER MINING IN OLD CALICO

By F. Harold Weber, Jr.



Early Calico, view north; in background are mine workings of Wall Street Canyon area to left and King Mountain area to right. Mine dumps on King Mountain are principally from Silver King and Oriental mines. Date of photograph not determined, perhaps about 1890. Collection of The Huntington Library, San Marino.

Seven miles north of Daggett is the much talked of city of Calico. One narrow and serpentine street is the only thoroughfare. The place is built on a narrow ridge; the back end of lots on each side of the street end on or over a bluff. Small, hastily-built houses are the order of buildings, only a few two-story houses gracing the camp. Saloons are more than numerous. Business generally is overdone, and the number of black-legs and tin-horn gamblers that infest the place is remarked by a newcomer. The only water supply is that hauled two miles from Evans' well, and costs from 3 to 5 cents per gallon. Wood is \$10 per cord. Board, \$7 to \$8 a week. The Occidental and Whitfield House are the only hotels, and they are pushed to their utmost capacity to accommodate the travel that is arriving daily. The camp is a good one, but at present is overestimated and overcrowded by men out of money and work. Capital, development and a chance is all this camp needs to be a second edition to the Comstock at no great distant date.

These words, written by a correspondent of the *Mining and Scientific Press*, were published in the issue of March 14, 1885. The "bonanza" Calico district then was in its fourth year of productivity, and near its zenith; within a few years it would begin to wane, becoming a near "ghost" by the very early 1900's. During this period of roughly 20 years, the 50-odd mines of the Calico district and surrounding region—the Silver King, Oriental, Waterloo, Bismarck, Garfield, Odessa, Occidental, Waterman, and others—yielded an estimated \$13 to \$20 million in silver. This production is small in comparison with \$225 million taken from the great Comstock Lode at Virginia City, Nevada, but very significant in terms of metal mining in southern California. Since 1900, silver mining operations in the Calico district have been mostly small and intermittent; but great interest shown in the district by the mining industry since 1963 suggests that once again it may become the site of important silver mining operations.

The little "ghost" town of Calico lies at the southern edge of the Calico Mountains, about 10 miles northeast of Barstow in the central part of the Mojave Desert of southern California, and about 100 miles northeast of Los Angeles. It is commercialized now, and hardly a ghost: parking lots often are filled with modern automobiles, whose brash, shiny colors seem out of place in an old mining camp. Genteel tourists poke curiously along the town street, perusing relics of former mining days, and wander among the dusty graves of the cemetery. Loudspeakers blare inducements to concessions, and the whistle from a sight-seeing train echos hauntingly back into the mountains, to the north, where lie the old mine workings of the district. These workings consist both of extensive, professionally engineered adits and shafts, and of widespread, crude gopher-like surface diggings. Altogether, the mine workings have yielded perhaps 15 to 20 million ounces of silver, plus small amounts of barite, gold, lead, and copper. In addition, the region has yielded \$9 million worth of borax minerals, mined from 1884 to 1907.

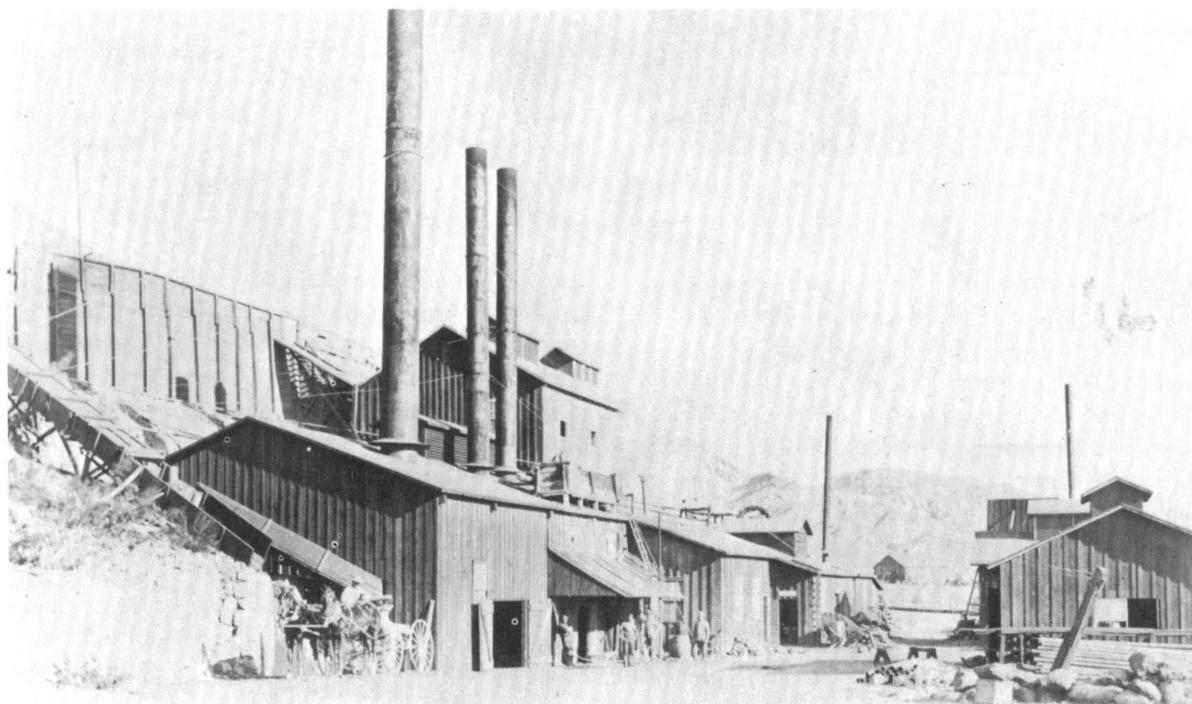
Prospecting for silver in the Calico Mountains and surrounding region apparently was begun seriously during 1880-81, although the first discoveries may

have been made earlier, perhaps in 1875. Some prospectors must have searched the Mojave Desert soon after development began of the gold mines in the Mother Lode region, but because the desert region was desolate, poorly accessible, and largely unexplored, mineral discoveries were few. The real spark to prospecting in the eastern mountain and desert region of California, and in Nevada, probably was ignited by discovery of the Comstock Lode at Virginia City in 1859, about 300 miles north-northwest of Calico, and its spectacular development during the 1860's. From this focal point, prospectors spread out widely over the west, and began to discover other great districts, including Eureka, Tintic, and Pioche. Prospecting also was sparked by completion of the transcontinental railroads, beginning with the Central Pacific in 1869, which enabled more men to come west to seek their wealth. In eastern California, during the 1860's and 1870's, Blind Spring Hill, Cerro Gordo, Panamint City, and Darwin were discovered; then Calico; following it, during the late 1890's and early 1900's, were developed the gold districts of Mojave and Randsburg, which eventually also yielded large amounts of silver.

The demand for silver that was the basis for prospecting was natural, as long through history silver had been considered a precious metal, and had been

used in coins and as a backing for wealth. The United States had adopted the silver dollar as its unit of monetary value in 1776; and ultimately adopted bimetallism for monetary purposes, whereby the dollar eventually became (in 1837) worth 23.22 grains of gold or 371.24 grains of silver (hence the expression "16 to 1"). But until the Comstock Lode was discovered, the country imported nearly all of its silver. Since that discovery, the U.S. has been a major producer of silver, and during most years from 1871 to 1915 was the world's leading producer. In 1964 the United States ranked third in world output, following Mexico and Peru, and ahead of Canada and USSR. In that year, the United States produced about 36 million ounces of silver, worth about \$47 million, principally as a by-product of base-metal mining operations, but partly from ore mined for gold or primarily for silver itself. About 52 million ounces of silver was imported during 1964.

One very important event that was gradually to blight the nation's young but growing silver mining industry occurred in 1873, when the United States went off bimetallism and onto the gold standard (though without basic change to the monetary policy). Soon afterward, the price of silver began to fall



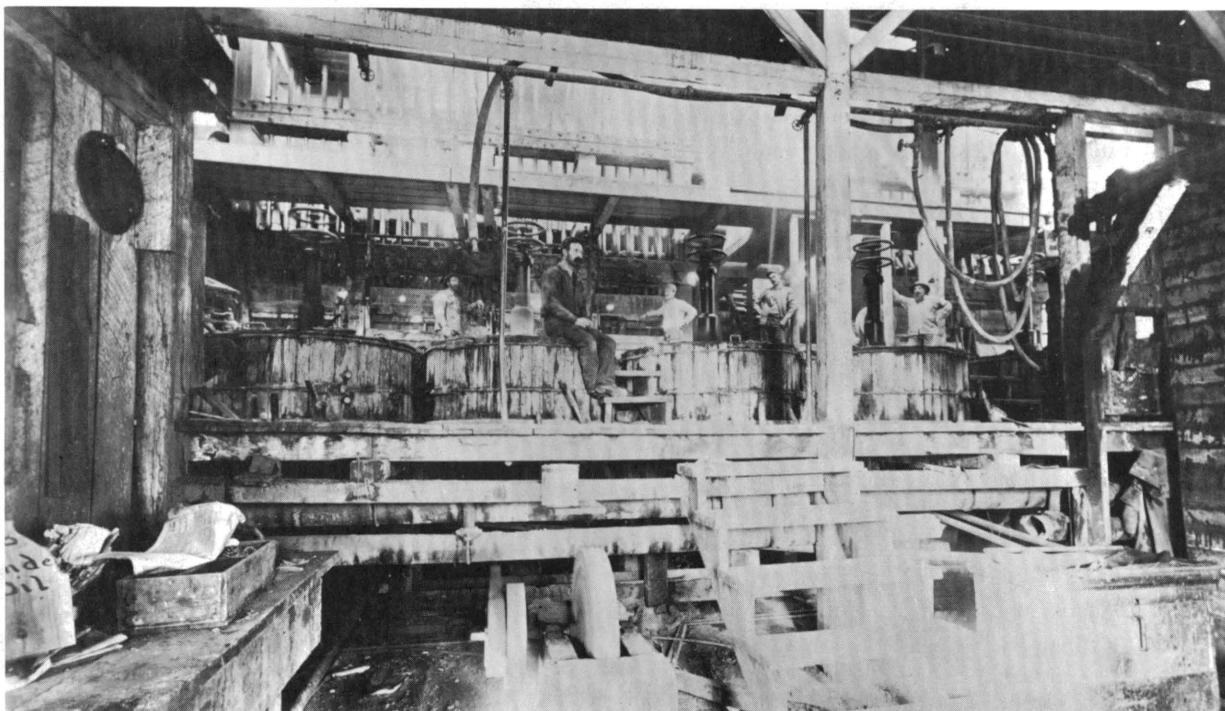
Mill of the Silver King Mining Company (also called Garfield mill). Photo taken perhaps about 1890. At that time ore from Occidental (including Garfield mine), Odessa, and Oriental groups was being processed here. Site of mill is on south side of hill between mouths of Wall Street and Odessa Canyons. Collection of The Huntington Library, San Marino.

irregularly from an average high during 1865-73 of about \$1.33 per troy ounce to roughly \$1.13 in 1881, when Calico was discovered, and to about 64¢ by 1894, when most of the larger operations in the Calico district had ceased or nearly ceased. The price continued to fall, though with fluctuations, to 51 cents in 1915, and to its ultimate low, about 25 cents, in 1932; even during this last period, however, developers and promoters were actively attempting to reopen and redevelop the mines of Calico.

In some respects it is ironic that the Calico district should lie so close to the new freeway of Interstate Highway 15, which links Los Angeles and Las Vegas, Nevada. For Los Angeles epitomizes the unbridled growth in population of the nation, which is reflected in the growth of the Nevada gambling industry that has evolved from the early days of silver mining. This growth in population has led basically, if indirectly, to the renewed demand for silver, and to the increase in its price from about 91 cents in 1961 to \$1.29 by 1963. This relatively high present price has stimulated hope in the mining industry for an even higher price, which, in effect, evokes a rebirth in interest in all inactive silver-bearing deposits and districts. Especially of interest are "bonanza" districts such as Calico, which have yielded relatively large amounts of silver

from near-surface workings in rich, shallow deposits, mined almost wholly for precious metals, because many such deposits in California commonly have not been thoroughly explored or studied either at depth or on the surface.

Development of the Calico district might be said to have begun earnestly on April 6, 1881 when S. C. Warden, Hues Thomas and John C. King and others located claims which they began to develop as the Silver King mine. Calico did not then grow with a great "rush", but by the spring of 1882 about 100 people were reported to be living in the town, and mining was underway. Activity was slowed during the summer, partly because of illness in the camp, and perhaps also because of the intense desert heat. But in the fall of 1882 mining in the region seemed to gather momentum: consolidation of smaller properties into larger ones led to more efficient development and mining, and more professional miners had arrived. In July, for example, the Silver King mine had been sold for \$300,000 to San Francisco interests. In addition, the Atlantic and Pacific Railroad was being constructed eastward from Mojave. By October 22, 1883 track had reached Waterman's, near present-day Barstow, and by the end of the year it had reached Ludlow, 130



Inside mill of Silver King Mining Company. Tanks shown were part of system of Boss (multiple pan) process which utilized chlorination and amalgamation to recover silver. Collection of The Huntington Library, San Marino.

miles to the east beyond Calico. The railroad, obviously, became a vital link for the district, essential to growth.

By the end of 1882, the district had taken shape geographically: immediately north of Calico camp, on the steep sides of Wall Street Canyon and on King Mountain were the Silver King, Oriental, Burning Moscow, Red Cloud, and other mines. To the north-east, in the vicinity of present-day named Odessa Canyon, were the mines of "East Calico", including the Garfield (opened December 1882), Odessa, Bismarck, Blackfoot, and others; and to the west and northwest lay "West Calico," with ultimate development of the Waterloo, Langtry, and other mines. About 5 miles west of Calico, in low hills beyond a broad valley, was developed the Lead Mountain mine; and about 10 miles to the west the Waterman mine had been developed (perhaps even before the first mines at Calico).

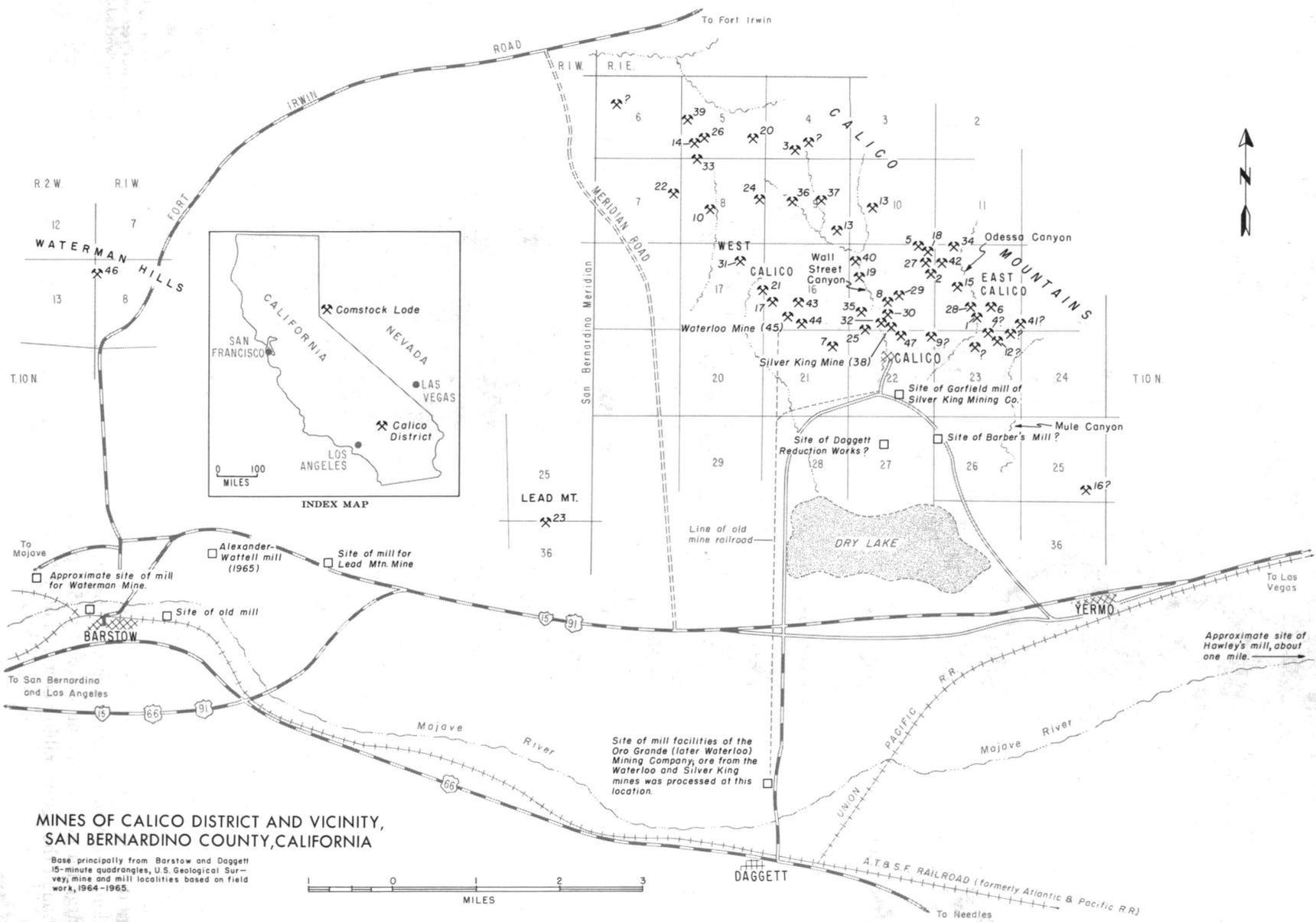
Along with development of the mines, mills for processing the ore and recovering the silver were constructed near Calico and along the Mojave River, several miles to the south, where water was plentiful. The ore was hauled to the mills in horsedrawn wagons, and the earliest ore from the Silver King mine was hauled 40 miles to a mill along the Mojave River at Oro Grande. The general silver recovery process used in the region was the so-called "continuous pan" (or Boss) process, in which ore pulverized in stamp mills flowed as pulp through a series of pans in which it first was chlorinated, then amalgamated for recovery of the silver. Such a process apparently handled the free-milling oxide ores of the Calico mines relatively efficiently, for it recovered as much as 95 percent of the silver from the purest chloride ores, and about 75 to 80 percent of the silver from deeper, sulfide-bearing ores. Salt for the chlorination came from south of Danby (100 miles east of Calico) and coal for fuel came from New Mexico.

The Silver King was the most prominent mine in the district, according to a report of the Director of the Mint for 1882; by the end of the year it had been developed to a depth of 250 feet, with about 500 feet of drifts and crosscuts. These developments were reported to have exposed "a ledge 20 feet wide, between well-developed walls, with rich streaks of from 2 to 3 feet on each wall. . . . Many car loads of partially selected ore from the mine have been sold in San Francisco, averaging \$300 per ton. . . ." The next in importance was the Oriental mine, under management of Judge James Walsh, a veteran miner, who said that Calico was "another Comstock". The 1882 mint re-

port went on to say that "the Burning Moscow, Red Jacket, and Sue and Fay, and several others have been sufficiently developed to be called mines. In all these mines the ore contains scarcely anything but silver in spar, and in the shape of chloride, bromide, verda plate (green silver), and horn silver." The report also stated that "The Cuba mine is another valuable location in East Calico, and is being developed with promising results. On looking over the Cuba location, almost the entire surface of the claim appears covered with a conglomerated mass of calcareous tufa and porphyry carrying chlorides and horn silver. Wherever the surface has been broken, ore is visible to the eye. . . . All the first class ore from the mine will work \$300 per ton, and the owners make it a point not to sack any that will not assay that much." (Silver was then worth about \$1.14 per ounce). No minable gold had been found.

MINES OF THE CALICO DISTRICT

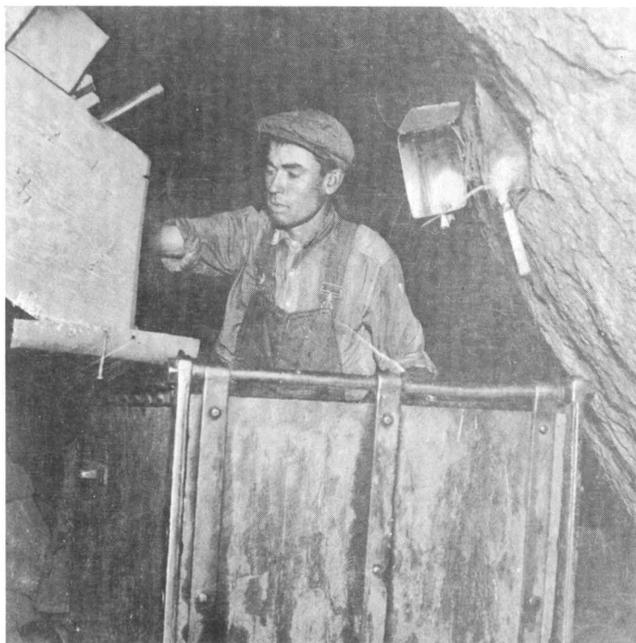
1. Alabama
2. Argentum
3. Backdoor No. 1 prospect
4. Baltic
5. Bismarck
6. Blackfoot
7. Burcham (Total Wreck) (Gold-lead)
8. Burning Moscow
9. Carbonate group
10. Cisco
11. Cuba (location undetermined)
12. Dietzman
13. Gale Group
14. Galena King
15. Garfield
16. Grandview
17. Grant
18. Humbug
19. Falls
20. Le Montain (Silver-lead-barite)
21. Lamar
22. Langtry
23. Lead Mt. (Silver-barite)
24. Leviathan
25. Lone Star group
26. Mulcahy group
27. Occidental
28. Odessa
29. Old Oriental
30. Oriental
31. Possibility group
32. Red Cloud
33. Revier
34. Runover
35. St. Louis Consolidated
36. Silver Bow (Silver-lead-barite)
37. Silver Tip (Silver-lead-barite)
38. Silver King
39. Silverado
40. Sioux
41. Snowbird
42. Thunderer
43. Union (Gold)
44. Voca (Washington)
45. Waterloo
46. Waterman
47. Zenda



**MINES OF CALICO DISTRICT AND VICINITY,
SAN BERNARDINO COUNTY, CALIFORNIA**

Base principally from Barstow and Daggett
15-minute quadrangles, U.S. Geological Survey,
mine and mill localities based on field
work, 1964-1965.





By the light of a candle and metal reflector, a Calico miner fills an ore car from a chute. Unidentified mine and date. O. A. Russell Collection.

As an example of how mining developed, the Garfield mine is reported to have been worked from December 1882 until April 1883 by only 2 men, who shipped 11 tons of selected, high grade ore which yielded \$5,885 in silver; but from November 1883 to January 1, 1885, 2,400 tons of ore was shipped from the mine, which yielded \$290,400 in silver (and a "large amount" of "unassorted" ore was worked locally at Barber's mill). By January 1883, the Waterman mine had yielded 9,000 tons of ore which yielded \$39.30 per ton, with the resultant tailings yielding about \$10 per ton (making a total of about \$440,000); and during 1883, the Silver King mine was reported to have yielded about \$426,000 in silver.

Smaller properties often were worked by so-called "chloriding" methods, whereby lessees operated mines individually or in small groups, paying one-quarter to one-fifth of the mill proceeds to the owners. This procedure was very inefficient, and hindered or prevented maximum possible development of the mines. For most such lessees cared only to mine expediently the richest possible ore, which was commonly composed of thin stringers and veinlets of silver chloride and associated minerals. Compounding the problem were the expensive charges to miners for hauling and milling: the charge for hauling from Calico mines to mills along the Mojave River was \$2.50 per ton; and the charge for custom-milling was \$11 to \$14 per ton, even though the actual milling cost was only \$3 to \$5.

Productivity in the district reached its peak during 1884-1885, when perhaps as many as 2,500 people lived in the district. By this time, the Silver King mine had been purchased by the Oro Grande Mining Company, owned principally by C. M. Sanger of Milwaukee. (Ultimately the Oro Grande Mining Company also was to gain control of the Waterloo mine, after settlement of a law suit.)

At the beginning of 1884 the Silver King mine had been worked to a depth of 500 feet, and was reported to "still show well at the bottom." From January 1884 to March 1885, the mine yielded about \$1 million worth of silver bullion, with the company mill at Daggett reportedly averaging \$40,000 to \$50,000 per month. Each ton of ore was reported to yield about \$30 to \$45 in silver (at about \$1.11 to \$1.06 per ounce), and to cost about \$18 total to mine, haul, and mill. Miners were paid about \$3.50 per day.

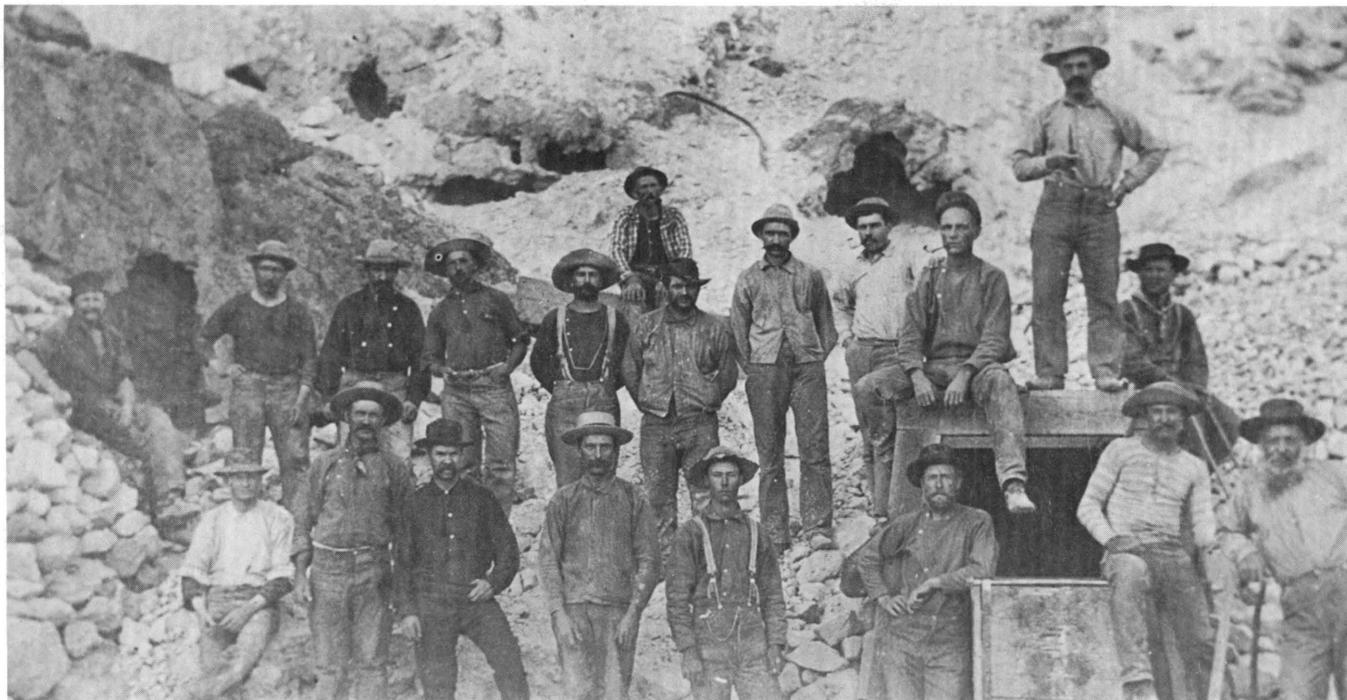
The Sue mine,* northwest of the Silver King, also was prominent; and Barber's mill, just south of Calico, was operating. In East Calico, 10 tons of ore mined daily at the Bismarck mine yielded \$100 per ton; and ore from the Cuba mine was processed at Hawley's mill. The Snowbird mine also was active, and the main adit of the Garfield mine had reached a length of 1,000 feet. In West Calico, the Waterloo mine was worked extensively underground, though it is said mostly for rich pockets.

Activity in the district began to decrease after 1884-1885, as the price of silver began to fluctuate downward more sharply from about \$1.10 in 1884 to 93



Molten silver is being poured from a melting pot into a bullion mold by J. Bert Osborne, 1924. Silver probably was recovered from ore taken from the Sioux mine, which was worked by Osborne at that time. O. A. Russell Collection.

* Probably same as mine later spelled "Sioux".



Early day miners at Occidental mine. Gopher-like workings, typical of most of East Calico, are in background. O. A. Russell Collection.

cents by 1889; in addition, once the richer deposits near the surface had been mined, operators were forced to mine deeper, leaner ore, which cost more to mine, as well as providing less revenue. Thus the Waterman mine ceased operations in 1886; and activity in the region probably became very light by the end of 1888, although the Oro Grande Company accelerated its operations (constructing a new 60-stamp mill in 1888). An event of note was the visit to the district in December 1886 of Waldemar Lindgren, a young mining engineer and geologist, later to become perhaps the most eminent in his field.

Two events then served to stimulate mining in the Calico district briefly: the first, late in 1888, was construction by the Waterloo Mining Company (successor to the Oro Grande Company) of a small railroad which extended from the Silver King and Waterloo mines to the company milling facilities at Daggett. This railroad reduced the cost of ore haul from about \$2.50 to 12 cents per ton. The second event was passage of two Congressional Acts: the Bland-Allison Act and the Sherman Purchase Act of 1890, which enabled the Government to purchase silver for monetary use. The consequent administration of these laws drove the price of silver upward significantly, even though the Acts were soon defeated by their opponents (as

was William Jennings Bryan, the famous proponent of "16 to 1" bimetallism.) Thus, during the period from 1889 to 1892, mining was revived: in September 1889 about 100 tons of ore from the Silver King mine and 50 tons from the Waterloo mine were reported being mined daily; in addition, it was reported that in December 1891 the Garfield mill was taking ore from the Odessa, Oriental, and Occidental groups. At one point during the period, it was reported that 700 men were employed in the district, 150 stamps were operating in mills, and about \$200,000 per month in bullion was being produced.

Soon, though, the price of silver dropped again, from about \$1.05 in 1890 to about 64 cents by 1894. The Waterloo was forced to close down in March 1892, with 130 men losing their jobs. In 1896 the Silver King Company apparently ceased hoping that the price would somehow rise again, for it shut down operations at its Occidental and Oriental groups. The Odessa mine also was closed.

The district remained nearly dormant from about 1900 to 1915, when the price of silver again began to rise. From a low of about 48 cents in 1915, the price rose briefly to about \$1.38 late in 1919, before it began to decrease. The rise was caused principally by industrial demand and international monetary needs (re-

sulting in the Pittman Act) caused by World War I. With this rise in price, the district became very active again, but the activity was not reflected in significant production of silver.

The period from 1915 to the mid-1920's did contain several relatively important events though: The Calico-Odesa Company was organized in 1915 by J. R. Lane, and subsequently explored and mined on a small scale in a wide area east of Wall Street Canyon; the Daggett Reduction Company and others treated some of the old mill tailings by cyanidation; and some ore mined in the district was sent to smelters.

In 1926 the total output of the district was reported as 157 tons of ore, which yielded 35 ounces of gold, 582 ounces of silver, 115 pounds of copper, and 190 pounds of lead. Also in 1926, the Zenda Company acquired the assets of the Waterloo Mining Company, and began an exploration and development program on the Silver King property, though the price of silver had dropped to about 62 cents. The company core-

drilled 2 holes, and subsequently sank 2 shafts, of 550 and 350 feet, to explore deeper parts of veins whose upper parts formerly had been so productive. A 50-ton shipment of ore from these workings to a smelter in 1930 is said to have averaged 67 ounces of silver and no gold per ton. But the price of silver continued to fall (to about 32 cents by late 1930), and operations ceased in November 1930, when 47 men were laid off.

From that time until the present (early 1966) the only metal mining operations in any of the Calico mines have been very small and intermittent. Mill tailings, discarded after treatment of earlier mined Calico ores, continued to be processed by cyanidation through the 1930's, even though recovery apparently averaged only about 1 ounce to 2 ounces of silver per ton (with the range of recovery about 1 ounce to 9 ounces per ton). These tailings could be processed economically by cyanidation mainly because less efficient processing methods had been used at Calico dur-



View west-northwest in 1951 shows old workings of Odessa silver mine, on west side of Odessa Canyon, East Calico, mined principally from 1882 to 1896. Rugged topography is cut in andesite. Ubiquitous, gopher-like workings resulted from expedient mining of near-surface, "bonanza" deposits. Photo by O. A. Russell, Yermo.

ing the early mining years (cyanidation was developed in the late 1880's, and not used in California until 1891). Through the 1930's and 1940's small mining operations continued at such mines as the Sioux (by J. B. Osborne), the Waterloo (by Morris Mulcahy), the Burcham (Gold-Lead, also by Mulcahy), and the Zenda (by Lawrence Coke).

During the 1950's ore mined from several properties was processed for recovery of silver, lead and barite: such operations took place at the Le Montain and Silverado mines (by R. C. Buch and associates) and at the Silver Bow mine (by W. S. Hubbard). From 1957 to 1961, Oil Base, Inc. mined and processed relatively large tonnages of low grade barite ore at the Leviathan silver mine. Barite recovered in the district has been used as a weighting material in oil well drilling fluids. During 1964-65, the Alexander-Wattell mill was constructed near Barstow for recovery principally of silver and gold.

Perhaps because there have been no large, significant silver mining operations in the Calico district since the 1890's, and no mining operations at all from 1962 to 1965, the Calico district might be considered to have very little or no potential as a future source of silver. A pamphlet, issued in August 1965 by the United States Bureau of Land Management, which describes the recently established "Calico resource conservation area," states that

"The Calico Mountain area, once rich in silver, which spawned the brawling, lusty mining town

of Calico, now a County recreation facility, is still an attraction to campers, hikers, and rock hounds."

Such a statement sounds almost like an epitaph for mining.

Actually, as the year of 1966 began, chances for renewed and significant silver mining in the Calico district seemed better than at any time since the 1890's, when the larger early day operations were closed down. These chances were in the form of very significant interest shown in the district by the mining industry since about 1963. This interest stemmed from an increase in the price of silver from about 91 cents an ounce in November 1961 to \$1.293 per ounce in June 1963. (In November 1961 the U.S. Treasury stopped sales of its silver at the price of 91 cents, and the free market price gradually rose to \$1.293 per ounce, the United States monetary value of silver). Because of the higher price, and the possibility for an even higher price accompanying anticipated increased United States and world industrial and monetary demand, interest in older districts with significant silver production, such as Calico, became very logical.

Especially of interest to large mining companies in the Calico and other districts are very large, very low grade deposits, measured in tens and possibly many scores of millions of tons of potential ore, and scores and possibly a hundred million ounces or more of silver. Such deposits can be mined by simple, low cost

Red Cloud mine, part of Oriental group. Early day work in west end of Mammoth stope, which was reported to be 60 feet wide. Highest of four miners seems to be carefully working part of steeply dipping vein that consists of highgrade ore. Middle of three lower miners may have handcobbled and sorted ore before carrying it from stope in wheelbarrow. O. A. Russell Collection.



methods (such as open pit), taking advantage of modern techniques and equipment (such as giant earth-moving equipment); and the ores processed with the most modern of metallurgical techniques: with barite, lead, copper, or gold also recovered as byproducts.

Indeed, the Calico district still remains an "attraction" to the mining industry, as well as "campers, hikers, and rock hounds". If the district could speak out, it might use Mark Twain's famous words:

"The reports of my death are greatly exaggerated."

A list of references will accompany the last article on the subject of Calico, to be published in a future issue of this magazine.

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CALICO

— Highlights of its history —

- 1881: April 6, claims are located for future Silver King mine.
- 1882: Spring; mining is underway; about 100 people live in Calico camp. Fall, mining gathers momentum, as smaller properties consolidated, and the part of Atlantic and Pacific Railroad nearby is completed. Price of silver, about \$1.14 per ounce.
- 1883: At beginning of year, active mines include Silver King, Oriental, Burning Moscow, Garfield, Odessa, Bismarck, Blackfoot and others; also Waterman mine, to west.
- 1884-1885: Productivity is at peak, with perhaps 2,500 people living in district. Beginning of 1884, Silver King mine is developed to a depth of 500 feet; January 1884 to March 1885, Sil-

ver King yields \$1 million in bullion. Price of silver about \$1.09.

1886-1889: Productivity decreases, as price of silver drops to 93 cents by 1889. In addition, deeper, more expensive mining is mostly in leaner ore. Many mines are shut down.

1889-1892: Mining stimulated briefly by (1) short-lived Congressional Acts which briefly raise silver price to \$1.05 in 1890, and (2) completion of narrow gauge railroad from Waterloo and Silver King mines to mill at Daggett.

1892-1896: In 1892, Waterloo mine is closed; by 1896 most other mines are inactive.

1915-1919: Activity in district is stimulated as price of silver rises from 48 cents in 1915 to \$1.38 in 1919, before beginning to fall. But the activity is not accompanied by important production of silver.

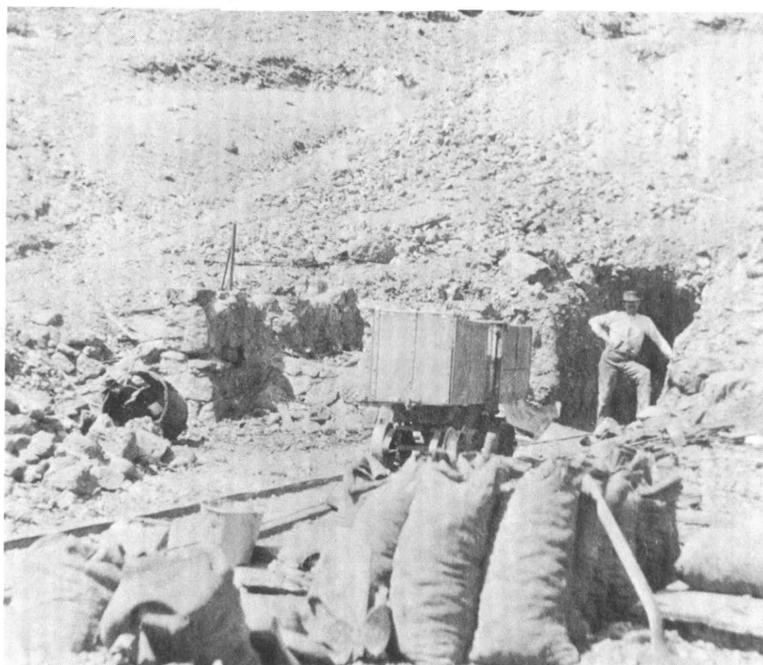
1926-1930: Zenda Company begins deep exploration program at Silver King mine in 1926 when price of silver is 62 cents an ounce. Program ceases in late 1930, as price falls to about 32 cents.

1930-1950: Small and intermittent mining operations for recovery of silver, as well as gold, lead and copper, take place. In addition, old mill tailings are processed for silver.

1957-1961: Oil Base, Inc. recovers barite from barite-jasper vein material.

1963-1966: As price of silver rises to \$1.29 per ounce, interest in district is greatly accelerated. Ironically, as "ghost" town tourist operation grows, chances also grow for important future silver mining operations.

Total production of silver: Estimated roughly at between \$13 and \$20 million; mined mostly between 1882 and 1896.



Portal of unidentified mine, showing sacks of hand-cobbed, presumably highgrade ore ready for shipment to mill. O. A. Russell Collection.



GEOLOGIC GUIDEBOOKS REPRINTED

GEOLOGIC GUIDEBOOK OF THE SAN FRANCISCO BAY COUNTIES

The book, issued as *Bulletin 154*, is now in its fourth printing in fifteen years. It deals with a region that has contributed greatly to the color and character of the West: not only to its tales and legends, its swashbuckling history, and its fabulous wealth, but also to its steady economic and cultural evolution to its present position as one of the nation's important centers.

The natural features and factors that helped the area attain its eminence are the subjects of the guidebook. Of the twelve counties treated, nine (Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano and Sonoma) border on the shores of San Francisco Bay, and three (Sacramento, San Joaquin, Yolo) are in the delta region of the San Joaquin and Sacramento Rivers, yet all twelve unite to form one large unit, naturally, historically, and industrially. Although a diversity of scenic beauty is found in the twelve counties, from the rugged relief of mountain ranges to the wide expanse of ocean waters, or the flat monotony of fertile delta lands, the story of each is bound to the other, and the complete story of the landscape not only tells the story of the background against which the human history of the San Francisco Bay area took place but also shows the natural reasons for the course of that history.

The perceptive reader and the earnest student will derive much enjoyment from the 32 authoritative articles that comprise the book. Each was prepared by a technical expert, yet they are written in an easily understood manner, and are grouped into seven logical parts, including, "Historical background," "History of the landscape," "Geologic history," "Prehistoric life," "Mineral industry," "Water," and "Places to go and routes to travel." The casual reader, too, will find the 28 authors have prepared for him a tale in words and pictures — nearly 300 illustrate the text — that will stir his interest and enthusiasm. Because the 392 text pages cannot present an exhaustive study of the natural history and resources, nearly all of the articles append a bibliography that will serve as a useful beginning for further research. Those who like to roam will find Part VII, "Places to go and routes to travel," an invaluable collection of motorlogs for short trips in the San Francisco Bay area; this section, together

with the seven colored strip maps of the 12 counties showing the geology and roads forms a handbook that will enhance their driving pleasure. Because it is necessary to introduce in the text some unfamiliar technical words, a convenient glossary has been included.

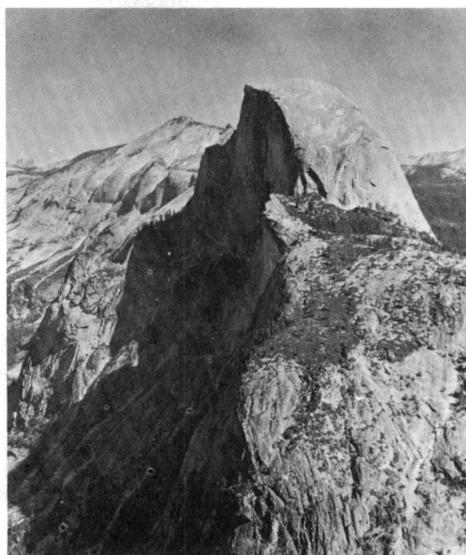
The book, containing 392 pages and more than 300 photographs, drawings, and maps, is bound in sturdy tan cloth. It may be purchased for \$2.50 plus tax.

GEOLOGIC GUIDE TO YOSEMITE VALLEY

Originally prepared for the annual meeting of the American Association of Petroleum Geologists held in California in 1962, *Geologic guide to the Merced Canyon and Yosemite Valley, California*, has been out of print recently, but is again available.

Issued as Bulletin 182, the book contains "Summary of the pre-Tertiary geology of the western Sierra Nevada metamorphic belt, California," by Lorin D. Clark; "Granitic rocks of the Yosemite Valley area, California," by Frank C. Calkins and Dallas L. Peck; "The geology, geomorphology, and soils of the San Joaquin Valley in the vicinity of the Merced River, California," by Rodney J. Arkley; "Geomorphology of the Yosemite Valley region, California," by Clyde Wahrhaftig. Included also are road logs for "do-it-yourself" geologic guiding.

Price of the bulletin, bound in paper, is \$1.50, plus 6¢ tax for California residents.



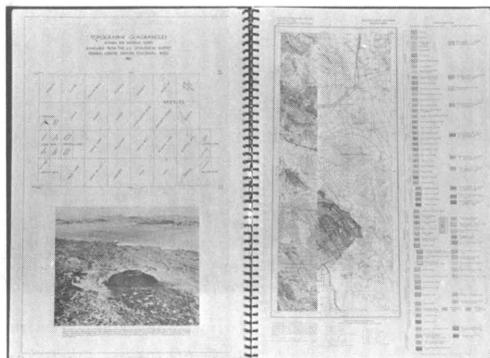
Half Dome from Glacier Point. Photo by U. S. National Park Service.

NOW AVAILABLE....

GEOLOGIC ATLAS

The geologic atlas of the State of California was prepared by the California Division of Mines and Geology to present an integrated summary of current knowledge of California geology. Preparation of these maps began in 1952, after the popular 1938 edition of the 1:500,000 scale state geologic map went out of print. This atlas, the first sheet of which was published in 1958, has been designated the "Olaf P. Jenkins Edition" in recognition of the stimulus Dr. Jenkins provided to geologic mapping in California during the 29 years he served as Chief Geologist and later as Chief of the Division of Mines, and in recognition of his personal direction of the atlas program at its inception.

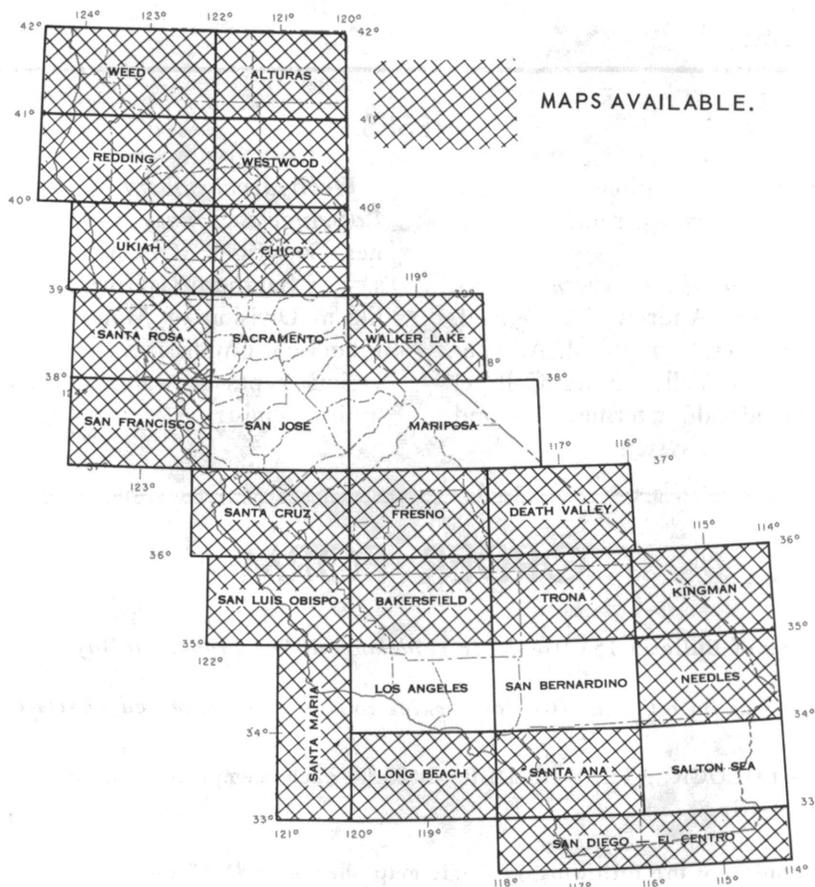
The atlas consists of 27 map sheets which show the regional distribution and interrelationships of the various rock units and the major geologic structures that are present in California. One hundred and twenty-four cartographic units representing plutonic, volcanic, marine sedimentary, and non-marine sedimentary rock types of different geologic ages are delineated in the atlas. The many hundreds of formational units recognized in California preclude the possibility of depicting each of these separately on the map sheets; therefore, the formational units have been grouped in "time-rock units" according to their generally accepted age assignments. Contact lines of two different weights are used on the maps, the lighter weight being used to represent depositional or intrusive contacts, and the heavier weight being used to represent faults.



ATLAS BINDER. A loose-leaf, library size binder (16-½ inches by 22-½ inches) in green cloth with gold lettering. Included with the binder are enough adhesive strips to accommodate all of the sheets of the geologic map and all of the data sheets, as well as a title page and instruction sheet. Price \$7.00, plus 28¢ tax.

OF CALIFORNIA

.... SPECIAL BINDER



Individual sheets of the geologic map may be purchased from the Division of Mines and Geology, Ferry Building, San Francisco, California, 94111. Each sheet is accompanied by a data sheet which explains more fully the map units, and also lists the sources of information used in preparation of the map. The price of each map and data sheet set is \$1.50, plus tax. Map sheets on which the geologic units are not colored are available for 50 cents.

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DEPARTMENT OF CONSERVATION

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THESES

The following theses and dissertations have been completed and are on file at the colleges and universities indicated:

The Dumont dune system of the northern Mojave Desert, California. By Angus Andrew MacDonald. 1966. 106 pp., 8 maps, 28 figures, 1 graph. M. A. Thesis. On file at San Fernando Valley State College, Northridge, California. Includes dune terminology and mechanics, migration of the dune system.

Geohydrochemistry of the San Gabriel Valley area, Los Angeles County, California. By Sanford L. Werner. Copyright, 1965. M. S. Thesis. On file at University of Southern California, Los Angeles. Abstract on file in Division of Mines and Geology Library, San Francisco. Emphasizes the use of chemical analyses of various types of water as a basic tool to show geohydrochemistry.



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