191

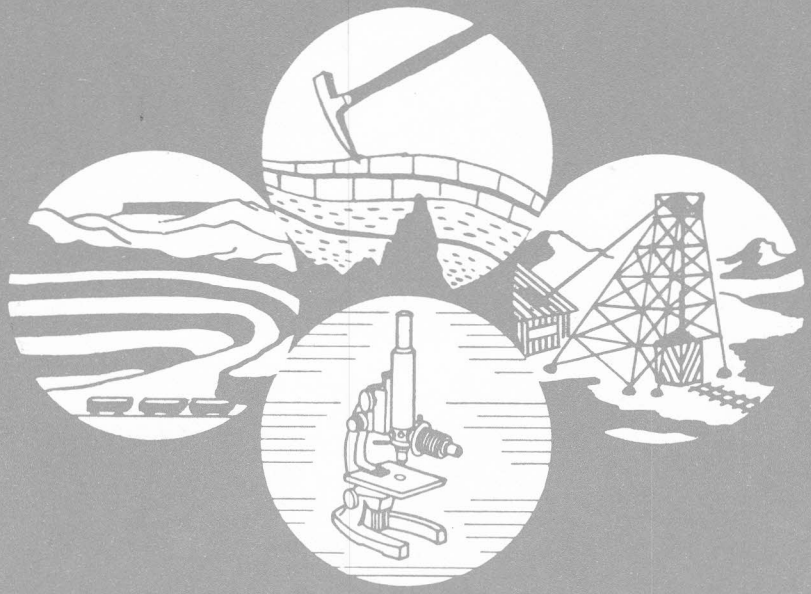
# INDEX OF MINING PROPERTIES IN SANTA CRUZ COUNTY, ARIZONA

by
Stanton B. Keith
Geologist

APPROVED

## THE ARIZONA BUREAU OF MINES

Bulletin 191
1975



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# INTRODUCTION

"Index of Mining Properties in Santa Cruz County, Arizona" is the third of the series covering the counties of the State. The first two, covering Cochise and Pima Counties, were published as Arizona Bureau of Mines Bulletins 187 (1973) and 189 (1974) respectively. Arizona's important and large mineral output has come from numerous major operations and small mines or prospects for some 300 years, from the time of the early Spanish prospecting in what is now Santa Cruz County. The records of the mining activities are scattered in historical documents and records, publications of individuals and Federal and State agencies, articles in technical journals, public and private reports, and newspaper clippings. Many such sources are not readily available to those seeking such information and thus these indices are designed to provide, in a concise form, a summary of information on the mining properties and the more important sources of the information.

No attempt has been made to name and describe every mining property or prospect that may have been located or worked. The total number would be in the hundreds of thousands. The selection has been made on the basis of notable production records, special geologic or mineralogic character, or the importance in relation to overall mineral resources that might become available and economic to mine. The index also is useful in land use planning by indicating areas of high mineral potential. Comments, suggestions, or corrections regarding the indices are always welcome.

Many individuals have provided assistance in the collection of the included data and their help is gratefully acknowl-

edged. Special thanks are due Mr. Robert Lenon of Patagonia and Mr. Vernon Dale of the Arizona Department of Mineral Resources for their assistance in specific mining districts. The preparation of the format and maps is the work of Bureau personnel, especially Messrs. J. L. LaVoie and D. B. Dwyer.

## HISTORY

Santa Cruz County was created out of the southeastern corner of Pima County by the Arizona Territorial Legislature in March, 1899. It is the smallest county in the State, embracing only some 1,229 square miles and is only about fifty miles long and thirty miles wide at its greatest extent. A large part of the area is covered by National Forest land and several old Spanish land grants. Nogales, on the border with Mexico, is the county seat and the only sizeable settlement. The names "Papago" and "Grant" were originally proposed for the county before the present name "Santa Cruz" was adopted. This appropriate Spanish name comes from the river that heads up in the eastern part of the county, flows south into and then westward through northern Mexico before turning northward through the center of the county. It was named by the early Jesuit missionaries, the first Europeans to settle in the area.

Mining has played an important role in the history and development of Santa Cruz County. The local Indians, Papago and Pima, were agriculturists and had no interest in minerals except for stone implements and colorful pigments. In the 1600's Spanish expeditions and prospectors may have searched for precious metals but outside of some minor gold placering and surface prospecting, no mining was done. Jesuit Fathers, led by Father Eusebio Francisco Kino, started establishing missions in Santa Cruz County in the late 1600's and using indian converts, started prospecting and shallow mining of the enriched, oxidized outcrops of lead-silver deposits found in the surrounding mountains. With the establishments of the missions, small military outposts, settlements, and ranches were located along the rivers and tributary streams from which small scale mining and placer operations were initiated. The Salero and other deposits in the southern Santa Rita Moun-

tains, the Mowry and Washington Camp area deposits, and the gold and silver deposits and placers in the Oro Blanco area were found and worked. The early Americans in these districts found the remains of numerous crude adobe furnaces and slag piles from the Spanish operations. Sporadic Apache Indian raids, Indian revolts, and frontier difficulties hampered mining activities but small scale operations continued up to the time of the Mexican Revolution of 1810-1812. In these early days, Santa Cruz County was a part of the District of Arizonac, State of Sonora. Around 1736, the discovery of the "Bolas de Plata", a rich accumulation of native silver of unknown origin, just south of the present Mexican border, stimulated an intensive search for other bonanza deposits in the general area. The names and exact location of many of the workings of that time have been lost or are unidentifiable but many were renamed and reworked later. The total metal output of the early period is not recorded but was probably relatively small although of high value.

Spanish military protection was withdrawn in the Mexican Revolution and the subsequent Apache Indian uprising and outlaw depredations resulted in the destruction or abandonment of most of the missions, mines, and settlements. At the time of the Gadsden Purchase of the Santa Cruz County area in 1853 there was no mining activity. With the United States acquisition, Arizona became a part of Dona Ana County of the Territory of New Mexico. Few Americans had visited this area prior to the 1850's or the time of the joint United States and Mexico Boundary Commission survey in 1854. The survey brought with it the reestablishment of some military protection, allowing men connected with or closely following the survey parties to take up claims on numerous deserted workings and prospects. The first descriptions of the geology and mineral resources of the area were contained in the report by Hall, Parry and Schott of the U. S. and Mexican Boundary Survey (1857). In 1856 and 1857, exploration parties and companies, such as the Sonora Mining & Exploration Co. and the Arizona Mining Co. examined, purchased, and developed the old deserted mines. The Santa Rita Mining Co., under the direction of Charles D. Poston, in 1858, established headquarters at the ruins of the old Spanish settlement at Tubac and reopened the old Salero and other deposits along the southeastern flank of

the Santa Rita Mountains. About the same time, the old Patagonia mine (later taken over by Col. Sylvester Mowry and renamed after himself), the Montezuma (adjoining or renamed the Empire), the Trench, the Compahgre, and other old Spanish or Mexican deposits were reopened or worked. Crude adobe smelters were built locally to reduce the oxidized lead-silver ore to high grade bullion. Only high grade, oxidized deposits could be economically mined and treated. Although Indian and Mexican labor was relatively cheap, it was unreliable and transportation of supplies and bullion, mainly through Mexican Pacific ports, using animal transport, was difficult and expensive. Regular stage coach lines through Arizona to California and eastern United States did not start until 1857 and even then did not provide the bulk transportation needs.

In spite of the difficulties, mining activity in the Santa Cruz area was just beginning to advance rapidly at the start of the Civil War in 1861. The Federal troops who had kept the Apache and outlaw depredations to a minor nuisance level, were withdrawn and without the military protection, Apache Indian raids ravaged the area, closing all mining activity except for the Mowry mine which became an armed stronghold. Mowry (1864), Pumpelly (1870), and others have provided vivid accounts of this period. Arizona became a separate territory in 1863 and some military protection was gradually reestablished during and after the Civil War but mining activity in the Santa Cruz area remained nearly dormant until the 1870's when freedom from Apache attacks was reasonable assured. Numerous old mines in the Harshaw, Tyndall, Patagonia, and Oro Blanco mining districts were reopened or relocated. Unfortunately many of the old mines were given new names and records of the older locations are not available. Actual production still remained limited until the Southern Pacific Railroad extended its line into central Arizona in the late 1870's. The establishment of a smelter at Benson on the main railway line in 1882 and the completion of the Mexico and Arizona Railroad through the Sonoita Creek valley in 1884 provided a needed incentive for increased mining activity in the Santa Cruz County area. Local smelting of the ores mined was never very successful or economical and even the Benson smelter closed down in 1886. Some rich ore shipments continued to be sent to smelters in Texas and New Mexico from several mines in

the Santa Rita and Patagonia Mountains but the demonetization of silver in 1893 closed up most of these silver-lead mines. In the Oro Blanco district, mining continued up to 1887 with several recovery mills treating the high grade gold ores found. After a period of inactivity, the mills were again reactivated in 1894 with several small mines producing gold and some sulfide ore having high gold and silver values.

In the late 1890's, the increased demand for copper directed the search for copper-bearing deposits. In the Washington Camp area of the Patagonia mining district, the oxidized zone contained rich argentiferous lead carbonate but in depth the ore showed increasing amounts of zinc and copper. However, the deeper ore also was complex with partially oxidized zinc, lead, copper, and iron sulfides in a heavy gangue of garnet and other pyrometamorphic minerals as well as quartz and calcite. Such mineralization would not respond satisfactorily to known direct smelting methods. A. R. Wilfley, inventor of the Wilfley concentrating table, purchased the Pride of the West mine at Washington Camp in the late 1890's and through concentration processes successfully produced copper, lead, and zinc concentrates which he shipped to smelters handling such products. The Washington Camp area also attracted George Westinghouse, founder of the Westinghouse Electric Company. As early as the late 1880's, he started acquiring mining properties in the same area and worked the high grade carbonate ore down to where sulfides were encountered. In the early 1900's, the Westinghouse holdings were transferred to the Duquesne Mining and Reduction Co., financed by the Westinghouse Electric Co., and the new company embarked on a major development and ore testing program. In 1906, the company acquired the Pride of the West plant. Major production was started in 1913 by which time they controlled most of the mines in the Washington Camp and Duquesne area. The operations closed down in 1918 and the equipment and facilities were sold. Other notable mines in the Patagonia, Harshaw, Oro Blanco, Palmetto, and Tyndall mining districts have had intermittent periods of major production in the 1900's, mostly coinciding with war years or periods of premium prices. However, no single mine in Santa Cruz County has produced as much as one million tons of ore although the Montana mine group in the Oro Blanco district, the Flux and Trench

mine groups in the Harshaw district, the Duquesne-Washington Camp and Mowry mines in the Patagonia district, and the Three-R mine in the Palmetto district, have had periods of important output. In recent years there has been little or no ore production from any of the mining districts in the County.

A reasonably accurate record of the production of base and precious metals from Santa Cruz County is known only since 1901 when the U. S. Geological Survey, and later, the U. S. Bureau of Mines, collected annual statistics from mineral producers, ore buyers, and smelters. The summary results were published in "Mineral Resources of the United States", through 1931, and in "Minerals Yearbook", from 1932 to the present. However, for other mineral products, few detail statistics by properties have been made available. For the period prior to 1901, and for other mineral products, the production figures must be largely estimated from fragmentary Federal and State reports, articles in technical publications, and newspaper articles. Some such sources may be erroneous or of questionable character but the independent estimates included here are believed to be close approximations. The index does not cover the production of sand and gravel, nor of common stone. The accumulative tonnage and value of such material produced in Santa Cruz County would be appreciable but the lack of reliable data makes any estimate on them impractical.

Table I is a summary of the known and estimated production of base and precious metals by mining districts in Santa Cruz County, through 1972. From a total of over 3.1 million tons of ore mined, some 30.2 thousand tons of copper, 134.2 thousand tons of lead, 142.4 thousand tons of zinc, 141 thousand ounces of gold, and about 17.8 million ounces of silver were recovered, for a total value of some 78.4 million dollars. Estimates of other metallic mineral products produced in the County would include some 18 thousand long tons of manganese ore, 8 thousand pounds of tungsten concentrates, and 200 tons of molybdenum ore. Excluding sand, gravel, and common stone, the total value of the mineral production would be close to 80 million dollars.

Santa Cruz County exhibits a wide range of geologic formations, structures, and types of mineralization. The exposed bed rocks include Precambrian intrusives and metamorphics; Paleozoic sediments; Mesozoic sediments, vol-

canics, and intrusives; Tertiary sediments, volcanics, and intrusives; and Quaternary sediments. Most bedded formations have been folded, domed, faulted, and intruded along a general northwest striking direction in several orogenic periods, most obviously during the mid-Mesozoic and the Laramide orogenies. The latter extended from late Mesozoic into the mid-Tertiary. Strong erosion has stripped off a large part of the volcanics and sediment along the domed intrusion core of the southern Santa Rita and Patagonia Mountains. The general geology of the mining districts in the Santa Rita and Patagonia Mountain areas has been well mapped and described, originally by the classic work of Schrader (1915) and more recently by Drewes (1971a, 1971b, 1972a, and 1972b) and Simons (1971, 1974). Numerous theses have been written on some of the mining districts in those mountain areas. In the western area of the County, the detail geologic information is more limited to local areas through the theses of Knight (1970) and Nelson (1963); articles by Fowler (1938, 1951) and Wilson (1934, Rev. 1967; 1961), reconnaissance mapping by the Arizona Bureau of Mines; and special reports by the U. S. Geological Survey and the U. S. Atomic Energy Commission.

The predominant metalliferous mineralization found and mined in Santa Cruz County has been argentiferous lead, zinc, and copper. In the southern Santa Rita Mountains, Patagonia Mountains, and locally in the Oro Blanco Mountains, such mineralization occurs irregularly along faults and fissures, in breccia zones, along swarms of quartz or quartz-barite veins, or in replacement or pyrometasomatic deposits. The vein-like occurrences are often associated with quartz vein swarms or strong fault zones cutting intrusives or metamorphosed sediments and volcanics. The replacement and pyrometasomatic deposits are found in folded, faulted, and altered Paleozoic limestone blocks. In the oxidized zone, the major mineralization is argentiferous lead carbonate which in depth gives way to zinc and lead sulfides. Locally copper sulfides increase in depth. Very locally molybdenum has been found associated with copper. Some noncommercial tungsten mineralization is present in the pyrometasomatic deposits and also has been mined in two small areas. Manganese is often an important gangue mineral in some deposits. The presence of a porphyry-type copper deposit has been discovered under the northwest

slope of Red Mountain in the northeast corner of the Harshaw district. This occurrence is deeply buried under a thick cover of Mesozoic and Tertiary volcanic and sedimentary formations and its full extent and grade has not been disclosed. The discovery, however, does suggest that other possible deeply buried orebodies may exist in the surrounding area. In the Oro Blanco area, relatively small, irregular, and shallow gold-silver deposits with weak base metal sulfides occur in fracture and breccia zones associated with strong silicification and pyritization. The gold itself often has a high silver content equal to or exceeding the gold content. In the County as a whole, gold is usually a minor constituent in the ores and, in any valuable amount, is concentrated only in the oxidized and weathered near-surface zone. The overall silver to gold ratio from production is usually greater than 100 to 1 and in the Harshaw district, the largest ore producer in the County, the ratio has been greater than 2,000 to 1. Some hydrothermal alteration is associated with most mineralization and locally is intense such as in the pyrometasomatic deposits and the areas of strong alunitic, sericitic, kaolinitic, and pyrophyllitic alteration found in the northern part of the Patagonia Mountains and around Red Mountain.

There appears to be strong structural control of intrusives and mineralization with a dominant northwest striking direction. Although there was a strong orogenic period in the middle Mesozoic, little or no economic mineralization seems to have been associated with it and that orogeny is masked by the strong deformation associated with the Laramide period. The thrusting, faulting, and doming now seen resulted mainly in this later period and on into the Tertiary. Although mineralization is widely spread, zoning patterns are evident. One center of intense mineralization in the Harshaw district may well be under the general area of Red Mountain where copper appears to be the major metal while radiating out from this center along major fault zones to the south and northwest, zinc and lead are more prominent. Other areas of strong hydrothermal alteration may suggest other centers of more intense mineralization. Drewes (1967, 1973) gives some indication of this situation in the southern Santa Rita Mountains but more detail investigations are required there and in the Patagonia Mountains. In other districts to the west, any zoning pattern is less

clear although Knight (1970) suggests that there may be hydrothermal zoning in the Oro Blanco area. Mining activity in Santa Cruz County has been more or less dormant in recent years but the announced discovery under Red Mountain is certain to revive interest in the possible discovery of additional deep, hidden orebodies in this well mineralized and geologically favorable area.

## EXPLANATION OF TABLES AND MAPS

Four tables, a set of mining district maps, and a reference bibliography are included in this index. Table I is a production summary, partly estimated, of base and precious metal ore from the mining districts of Santa Cruz County through 1972. Table II lists property names alphabetically with the mining districts in which they are located. Table III lists alphabetically the names of mining property owners and/or operators with the associated mining properties and districts. The lists in Tables II and III are not all inclusive but includes those believed to be most important. Unfortunately names of mines, owners, or operators have changed frequently which complicates the task of properly identifying the correct associations.

Table IV is the main index, giving briefly, detailed information on the mining properties, listed alphabetically by mining districts. The locations are given by surveyed or protracted township, range, and section, and as closely as possible to the position in the section. Mineral products are listed by chemical symbols or by name, generally in the order of their production importance in the deposit. Minor or trace elements that have been identified are shown in parantheses. The general geology is very briefly summarized, based largely on the reports listed in the references. The type of operation is noted and the production figures are based on reported and estimated data. The references cited are listed in the bibliography and are not all inclusive. They are believed to give the most informative data available.

The small scale maps show the location of the mining districts in Santa Cruz County and the location of the mining properties within the districts. The numbered locations are keyed to the respective numbers shown in Table IV. Major geographic features; surveyed or protracted township, range, and section lines; and the generalized geology also

are shown. The bibliography at the back of the bulletin includes all references cited in the text or in Table IV.

## NOTES ON INDIVIDUAL MINING DISTRICTS

### GREATERVILLE MINING DISTRICT

The Greaterville mining district, named after an early settler, covers parts of both Pima and Santa Cruz Counties with only a small section within the latter. (see Index of Mining Properties in Pima County, Arizona; Arizona Bureau of Mines Bulletin 189, 1974 for the part in Pima County.) From the county border it extends southward to a ridge just to the south of Gardner Canyon and eastward from the crest of the Santa Rita Mountains to the alluvium of Cienega Creek valley. Mt. Wrightson, a 9,432 foot peak, marks the southwest corner. The topography is marked by several deep canyons of east flowing perennial and intermittent streams separated by rough and ragged mountain spurs and ridges.

The rock formations consist of complexly folded and faulted sedimentary, volcanic, and intrusive formations ranging in age from Precambrian to Cenozoic. A small area of thrust-and block-faulted Paleozoic limestone, dolomite, shale, sandstone, and quartzite occurs in the northeast corner but the predominant formations of the district are the thick series of Triassic through Cretaceous rhyolitic and andesitic volcanics with interbedded arkose, sandstone, and minor limestone that were deposited in a continental basin before the Laramide orogenic period. The exposed intrusives are a possible Late Triassic quartz diorite dike or plug and a Late Tertiary rhyolite pluton with associated dikes and dike swarms. The geology of the district has been shown and described by Schrader (1915) and in some detail by Drewes (1971a, 1971b, 1972a, 1972b).

The metalliferous mineralization of the part of the district that is within Santa Cruz County consists of a few scattered, irregular, and generally weak, veinlike deposits of copper and silver with minor lead, zinc, and gold in a quartz or quartz-barite gangue. The deposits occur along fault zones or interformational contacts. They appear to represent a weak outer fringe of the stronger mineralization found to the north and south. The geochemical reconnaissance by

Drewes (1973) indicates the weak character of the mineralization in this area. A small amount of onyx marble was quarried in the past from one small cave deposit.

This part of the Greaterville district was prospected in the late 1800's but there is no indication of any production prior to the 1900's. The latter came from spotty, largely oxidized, and slightly enriched, near-surface concentrations. The total metal production from this part of the district, through 1972, would not exceed some 2,000 tons of ore containing about 20 tons of copper, 6,300 ounces of silver, 12 ounces of gold, and minor lead and zinc for a total value of some $14,000.

It would not appear that the part of the Greaterville district within Santa Cruz County offers favorable possibilities for major economic mineral deposits.

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**HARSHAW MINING DISTRICT**

The Harshaw mining district lies at the northeast end of the Patagonia Mountains, bounded on the north by Sonoita Creek, on the east by Harshaw Creek and Meadow Valley, on the south by an irregular and arbitrary line through American Peak, and on the west by the general crest of the Patagonia Mountains. The district was named after David Tecumsch Harshaw, an early pioneer rancher and prospector who, in 1875, settled at the site of the later mining camp of Harshaw, located at the junction of Harshaw and Hermosa creeks. It also has been known as Durazno (Spanish for peach) from the occurrence of peach trees probably planted by some early Spanish Father. The settlement of Patagonia on Sonoita Creek has been the main population and supply center for the surrounding districts, particularly when the Mexico and Arizona Railroad, later a section of the Southern Pacific, was in operation.

The topography of the district is rough and rugged with irregular, steep-walled hills and mountains and meandering, deeply incised washes and canyons. Elevations range from about 4,000 to over 6,000 feet. The geology and mineral deposits were described by Schrader (1915) and more detail mapping and descriptions of the geology have been provided by Simons (1971, 1974). The oldest exposed rocks

are folded and faulted blocks of Paleozoic limestone, dolomite, sandstone, and quartzite along the southern border of the district but most of the surface is covered by a thick accumulation of Mesozoic through Middle Tertiary rhyolitic and andesitic volcanics containing irregular lenses of arkose, sandstone, conglomerate, and limestone. The volcanics have been intruded by small plutons and necks of Laramide rhyolite which may rise from an extensive deep and hidden granitic intrusive mass. Strong northwest-striking thrust and normal faulting have tilted and deformed the volcanic formations.

Production records indicate that zinc and argentiferous lead have predominated in the metalliferous deposits found but considerable copper also has been recovered, particularly from the deeper levels. Much of the argentiferous lead was mined prior to 1900, coming from oxidized and enriched near-surface deposits. Zinc was not recovered to any large extent until 1939 when a selective flotation mill was put into operation at the Trench Camp. Gold was never a very important by-product, averaging only about 0.003 ounces per ton for the district except near the surface in a few deposits where it had been slightly enriched by weathering. Silver, on the other hand, has been a major constituent, averaging over 7 ounces per ton. Some apparently disseminated silver values are found in the wall rocks around some deposits and needs to be investigated further in the district. Manganese ore has been produced from some mines. Originally it was produced as an argentiferous manganese smelter flux and later, during war years, shipped to government stockpiles. The mineralogy of the ore produced consisted of the more common base and precious metal sulfides and their oxidation products plus relatively common argentiferous tetrahedrite, argentite, and pearcite. The gangue minerals have been mainly quartz, calcite, and manganese carbonate, sulfide, and oxide.

Most of the minerlaization found in the district occurred in veins or in breccia along fault and fracture zones, usually in lensing orebodies seldom exceeding a few hundred feet in length or depth. The wall rocks, for the most part, are altered Mesozoic or Laramide volcanics. Locally strong silicification, sericitization, kaolinization, and alunitization is present. The recently announced discovery of a porphyry-type copper deposit through deep drilling at Red

Mountain suggests other deep, hidden orebodies may be present in the Harshaw district.

The rich superficial, oxidized silver and argentiferous lead deposits in the district were found by the early Spanish and Mexican prospectors and several such deposits were mined prior to 1800 as evidenced by the remains of old adobe furnaces and the ancient slag piles. The deposits at Trench Camp and at the Flux and Hermosa mine were being worked as early as the 1850's. Estimates have been made that over one million dollars in silver bullion had been shipped out by the early 1880's but that figure can not be verified. Ore from the Flux, Hardshell, and Blue Nose was smelted at Benson between 1882 and 1886, mainly after the completion of the Mexico and Arizona Railroad in 1884. Local smelting was attempted without success and the Benson smelter closed down in 1886. Some sporadic production from the World's Fair, Flux, Hardshell, and Trench-Josephine properties continued into the late 1930's but the demonetization of silver in 1893 brought about a sharp drop in production from the district to not more than 1,000 tons of ore per year. By 1939, the American Smelting & Refining Company had gained control of the Trench, Flux, and January-Norton properties and constructed a 200 ton per day flotation mill at the Trench Camp. Production increased to some 50 to 60 thousand tons per year of zinc, lead, and copper ore containing high silver values. In the late 1950's, the major deposits were becoming depleted of economic ore and the total output of the district declined. Since 1965 there has been little or no production.

The Harshaw district has been the major ore producer in Santa Cruz County. Through 1972, the total estimated and recorded production of base and precious metals would be some 1.3 million tons of ore containing about 86 thousand tons of zinc, 72 thousand tons of lead, 3 thousand tons of copper, 9.2 million ounces of silver and only 4.3 thousand ounces of gold for a total value of some 41.5 million dollars. About 10,000 long tons of manganese ore of variable grade, including the argentiferous manganese smelter flux, also came from the district. A relatively minor amount of placer gold came from the terrace deposits at the junction of Alum Canyon and Sonoita Creek.

The Harshaw district is well mineralized as well as having many favorable geologic indications for still undiscovered metalliferous deposits. A detail study needs to be

made of the strong hydrothermal alterations, structural features, and zoning patterns for clues to the loci of deep and hidden economic mineralization similar to that recently found at Red Mountain.

**NOGALES [GOLD HILL] MINING DISTRICT**

The Nogales mining district, also called the Gold Hill district, covers an ill-defined area north of the border town of Nogales with its main physical feature being Mt. Benedict, an isolated 4,565 foot peak between the Santa Cruz River to the east and Nogales Wash and Potrero Creek to the west. Mt. Benedict was originally called Gold Hill from placer gold found on its slopes and acquired its present name from a local rancher and prospector.

The topography of the mountain area is moderately rough with incised dry washes radiating out from the summit in all directions. The original geologic description of the district was given by Schrader (1915). The central core is a quartz monzonite intrusive originally mapped as Precambrian but more recently assigned to the Jurassic by Simons (1974) who considers it to be an uplifted fault block. The intrusive exhibits strong sheeting, contains numerous inclusions of older rocks and is cut by swarms of northwest-striking lamprophyre and aplite dikes and northeast-striking rhyolite or quartz latite dikes. Outside the mountain area, Tertiary and later sediments and alluvium cover the balance of the district.

Mineralization in the Nogales district is spotty and weak. Irregular fissure veins, usually associated with altered dikes, carry lensing quartz, pyrite, cerrusite, galena, and minor copper carbonates and sulfides. Some very spotty quartz-wulframite mineralization with minor scheelite occurs in fissures closely associate with dikes at the north end of the exposed intrusive. Reportedly some placer gold was found and worked in various washes.

The Nogales district was prospected by the early Spaniards and Mexicans for gold and silver in the small, narrow oxidized outcrops but little ore was produced. The tungsten occurrences were exploited in a small way in the early 1900's and late 1930's. Sporadic attempts have been made to mine the vein-like deposits during the 1900's but

except for some shallow enrichment, the amount of economic ore was very limited. The total estimated and recorded production from the district through 1972, of base and precious metals, probably would not exceed some 1,000 tons of ore containing about 95 tons of lead, 9 tons of copper, 14.2 thousand ounces of silver, and 1,019 ounces of gold for a total value of $54,000. Possibly some 1,500 pounds of carefully selective tungsten concentrates have been produced.

The unfavorable geologic character and weak and spotty known mineralization in the Nogales district does not indicate possibilities for major economic deposits.

## OLD BALDY MINING DISTRICT

The Old Baldy mining district straddles the boundary between Santa Cruz and Pima Counties with only a small section in the former. It covers the drainage basin of Madera Canyon on the west side of the Santa Rita Mountains with Mount Hopkins, 8,585 feet, and Mt. Wrightson, 9,453 feet, marking the southern border. Old Baldy was the name given to Mount Wrightson at one time.

The topography of this small district is very rough and rugged, carved out by erosion from a series of Late Cretaceous dioritic to granitic intrusives that invaded and domed a thick series of Triassic volcanics and sediments. The geology has been mapped and described by Schrader (1915), Drewes (1971a, 1971b, 1972a, 1972b), and in a thesis by Whitacre (1964). The known mineralization is weak and spotty with partially oxidized base and precious metals occurring along narrow quartz veins or in breccia zones in the intrusives and volcanics.

The district has been prospected at various times in the past as evidenced by numerous, scattered, small and shallow prospects and mines but there is no record of any economic production. The geologic setting and known mineralization do not indicate possibilities for major economic mineralization.

## ORO BLANCO MINING DISTRICT

The Oro Blanco mining district covers the southeastern part of Santa Cruz County lying west of the Atascosas and

Tumacacori Mountains. The name means white gold and comes from the Spanish for the color of the gold found, being a light color due to its high silver content.

The topography of the district is very rugged with rough, steep-walled, and narrow ridges and low mountains dissected irregularly by canyons and washes. Locally the geology has been mapped by Knight (1970) and Fowler (1938, (1951) but much of the district has been covered only by reconnaissance type geologic investigations. Most of the district appears to be covered by a succession of Mesozoic rhyolite and quartz latite ash flows, tuffs, and interbedded arkose overlain by Late Cretaceous terrestial sediments. Intrusive into the flows and tuffs are widely scattered, stock-like masses of Middle Mesozoic quartz monzonite and granodiorite. In the Laramide orogenic period, diorite intrusions in the form of a large sill and numerous dikes invaded the Mesozoic formations. In the Tertiary, dike swarms and plugs of quartz monzonite and rhyolite were widely emplaced generally aligned in a northwest striking direction. Deformation in the form of normal faults, tilting, and minor doming occurred in Laramide time. The prominent structures have northwest and northeast striking alignments and have broken the formations into slightly tilted structural blocks.

The mineralization in the district occurs in three general types of deposits. The most important and productive are the quartz-sulfide veins, such as the Montana-Rough and Ready and the Idaho, from which the bulk of the tonnage of base and precious metals ore has been mined. The mineralization occurs as lensing fracture filling and partial replacement of Mesozoic volcanic and sediment wall rock by quartz, pyrite, sphalerite, chalcopyrite, galena, tetrahedrite, and calcite along faults and shear zones and in fault intersections. Bordering and crosscutting diorite dikes and a large diorite sill are closely associated with the mineralization. Supergene enrichment produced chalcocite, covellite, native silver, silver halides, and high gold values in the near-surface oxidized zone. Except for the Montana mine, this type of deposit is usually limited in strike and dip.

The second type of mineralization is the gold and silver deposits in flat-dipping, shallow, and often faulted silicified zones. Quartz veinlets and stringers fill fractures and partially replace the wall rock, usually a Mesozoic tuff. Pyrite

is common but only very minor amounts of chalcopyrite, sphalerite, galena, and tetrahedrite are present. The gold and silver values are associated with the strongly silicified and pyritized areas, often where cut by quartz monzonite dikes. The third type is the steeply dipping, tabular zones of kaolinized and bleached, brecciated and sheared tuff and conglomerate containing a quartz cement gangue, iron and manganese oxides, and spotty native gold and silver. The zones are highly irregular and usually have a limited extent in strike and dip. Traces of uranium have been found in the district but appear to have little economic significance. One small manganese deposit has produced a minor amount of ore. Several gold placers have been worked in the district which in the past produced a considerable amount of flour gold and small nuggets, mostly prior to 1900.

The Oro Blanco gold deposits and placers were found and worked in a small way by the early Spaniards and Mexicans prior to the Gadsden Purchase. The first American locations were made in the late 1860's and early 1870's. The enriched, oxidized, surface ore was treated in arrastres but when sulfides were encountered, the ore was roasted in crude adobe furnaces to liberate the precious metals. In the 1880's and 1890's, several small mills were operating to recover the values from numerous small mines. Amalgamation and cyanidation was introduced in the early 1900's but the shortage of adequate water limited operations. By 1914 mining activity had almost ceased in the district.

The major mining operations of the district have been in the Montana group near Ruby. The gold-silver near-surface ore was worked at an early date and the deeper base metal sulphide ore was worked in a small way in 1917-1918 and 1928-1930. The period of major production occurred between 1934 and 1940 when operated by the Eagle-Picher Mining and Smelting Company. Numerous small gold and silver deposits were worked intermittently during the depression years from 1932 through 1942 but few produced over 100 tons of ore in any one year. From 1942 up to 1968, there has been some minor sporadic mining in the district.

The total estimated and recorded production of base and precious metals from the Oro Blanco district through 1972 would amount to some 909 thousand tons of ore containing about 126.5 thousand ounces of gold, 4.6 million ounces of

silver, 31 thousand tons of lead, 26 thousand tons of zinc, and 2.6 thousand tons of copper for a total value of some 12.9 million dollars. About 45 long tons of manganese ore were produced from one mine in the district.

Most of the mineralization in the Oro Blanco district has been found to be superficial and of limited extent. There appears to be a lack of favorable geologic characteristics for large economic mineralization outside of the Montana mine group but detail geologic investigations have not been made and should be made prior to considering the area as completely negative.

**PAJARITO MINING DISTRICT**

The Pajarito mining district lies in southern Santa Cruz County, on the north slope of the Pajarito Mountains along the border with Mexico, a few miles west of Nogales. The name comes from the Spanish for "little bird".

The topography of the district is very rough and rugged with irregular craggy ridges and hills and incised canyons and valleys. The geology of the area has been described by Webb and Coryell (1954) and Nelson (1963, 1968). A complex of volcanic and interbedded sedimentary rocks, ranging from Cretaceous to Recent cover the area. The oldest rocks exposed are quartz latite lavas of Cretaceous age exposed in the Pajarito Mountains in the southern half of the district. To the northwest they are covered by Late Cretaceous andesite agglomerates, breccias, and tuffs mixed with ash layers and flows. To the northeast they are covered by Quaternary bedded conglomerates containing interbedded tuff and basalt. The only intrusives are relatively small dikes and sills. Some local faulting and fracturing cut the Cretaceous rocks.

Known mineralization is confined to a small area on the north slope of the Pajarito Mountains and within the quartz latite lavas. Shallow workings have opened up narrow, lensing fracture veins containing pockets of argentiferous lead, marcasite, and pyrite with minor sphalerite, argentite, and chalcopyrite. Locally there are traces of cinnabar, arsenopyrite, wulfenite, vanadinite, and pitchblende. Some secondary uranium minerals also have been found. The gangue consists of quartz and calcite with occassional fluorite.

Near the surface, anglesite, cerussite, and native silver occur.

Reportedly, considerable native silver was mined from the outcrops of the veins at any early date and sporadic mining has been attempted since 1885. The total estimated and recorded production from the district through 1972 would not exceed some 1,000 tons of precious and base metal ore. The yield was about 159 tons of lead, 41.4 thousand ounces of silver, 2.5 tons of copper, 216 ounces of gold, and a few hundred pounds of zinc for a total value of some 68 thousand dollars. A few tons of uranium ore was shipped for test purposes from the White Oak property.

The geologic setting and the mineralization found does not favorably indicate major economic mineralization in the Pajarito district.

## PALMETTO MINING DISTRICT

The Palmetto mining district lies on the west side of the northern flank of the Patagonia Mountains, extending southward from Sonoita Creek to Paloma Canyon. Originally it extended to the Mexican border but the southern section became part of the Patagonia district. Palmetto is Spanish for a palm tree.

The topography of the eastern part of the district is rough with a deeply scored, rock slope extending westward from the crest of the Patagonia Mountains to a dissected and ragged pediment and the alluvial plains of the Santa Cruz River valley. The rocks underlying the district are, for the most part, a complex mass of intrusive and metamorphic rocks considered in the past as Precambrian but more recently classed by Simons (1974) as a Mesozoic granite intruded into Precambrian intrusive and metamorphic rocks. Some large included blocks of Mesozoic sediments have been found in the granite. Along the eastern side of the district, the Mesozoic intrusive is invaded by Laramide granodiorite. Strong northwest and northeast faulting as well as local fracturing and brecciation are prominent structural features. The general geology of the district has been mapped by Simons (1974).

The mineralized structures of the district consist of narrow, lensing quartz-fissure veins of argentiferous lead with minor copper and zinc; an irregular, tabular orebody of

disseminated oxidized cupriferous pyrite and copper minerals along a fault zone; and disseminated, oxidized iron and copper mineralization in shear zones. The mineralization occurs in the intrusive-metamorphic complex. Several areas show strong hydrothermal alteration to alunite, sericite, kaolinite, and pyrophyllite. The gold content of the ore is very low and only one small and low grade placer deposit has been found.

Some of the enriched, oxidized outcrops of the argentiferous lead veins were worked by Mexicans prior to 1880 and opened up further by Americans in the 1880's and 1890's. However, production from the area was relatively minor until the copper deposit at the Three-R mine became a major producer. In 1929-1930 and from 1937 through 1940 this mine accounted for most of the mineral output of the district. Few other mines have produced more than 100 tons per year and since 1969 there has been no recorded production from the district. The total estimated and recorded production of base and precious metals from the Palmetto district through 1972 would be some 132,000 tons of ore containing 5.5 thousand tons of copper, 225 tons of lead, 75 thousand ounces of silver, 242 ounces of gold and one ton of zinc for a total value of some 2.1 million dollars.

Except for the unusual and local copper deposit at the Three-R mine, the exposed metalliferous mineralization in the Palmetto district has been of minor importance. The Mesozoic granite appears to be a poor host rock for economic deposits. However, the strong local alunite and pyrophyllite alteration, abundant disseminated low grade pyrite and chalcopyrite, and the presence of breccia pipes suggest the presence of underlying Laramide intrusive and the possibility of porphyry copper in depth along the eastern part of the district.

## PATAGONIA MINING DISTRICT

The Patagonia mining district covers the southern part of the Patagonia Mountains from the Harshaw and Palmetto districts south to the Mexican border. It is one of the oldest mining districts in Arizona. The source or origin of the name is unknown but may have come from the original name of the Mowry mine, one of the first worked by Americans.

The rough and rugged Patagonia Mountains, with elevations up to over 7,000 feet dominate the topography of the district. The higher elevations of the northern part are broader than the sharp narrow ridges and peaks in the lower part to the south. Drainage canyons drain to east and west over dissected pediments and out onto the alluvial plains of the San Rafael and Santa Cruz valleys respectively.

The general geology of the district has been mapped by Simons (1974) and in part by Moger (1969) and Baker (1961). The exposed rocks of the eastern sector of the district consist of a northwest-striking zone of jumbled fault blocks containing folded and tilted Precambrian through Laramide sediments, intrusives, and volcanics. The central core of the mountains to the west exhibits a large, northwest-striking, elongated, late Laramide granodiorite intrusive. On the western flank of the mountains, Mesozoic granitic intrusive is exposed, intruded into Precambrian to Mesozoic sediments, intrusive, and metamorphics. Strong northwest and northeast striking faults are common and break the district into structural blocks.

The strongest exposed mineralization is in the pyrometasomatic deposits of the Washington Camp-Duquesne area and the replacement deposits of the Mowry area, both in or associated with Paleozoic limestone formations. In these deposits, irregular bodies of base metal sulfides, mainly argentiferous lead, much zinc, and some copper mineralization is usually controlled by strong faults or shear zones, and in the Washington Camp-Duquesne area, is associated with strong skarn development, largely garnet, and marmorization of the limestone. In the intrusive to the west, copper mineralization with minor lead and zinc, and locally molybdenum, occurs in lensing quartz fissure veins or zones and patches of quartz stringers and strong silicification. Locally, irregular replacement bodies, pods, seams, and narrow veinlets of manganese oxides, often argentiferous and mixed with iron oxides and minor amounts of base metal mineralization, has been found along faults and fracture zones or as replacements in limestone and volcanics. The skarn zones contain weak and spotty tungsten mineralization and tungsten also has been mined from a shear zone in Mesozoic granite in the southern part of the district. A few small gold placers have been worked but in general the

gold content of the mineralization of the district is relatively low.

Exploitation of the mineralization in the Patagonia district started as early as the late 1600's when Jesuit Fathers used Indian labor to recover silver from the oxidized outcrops of the argentiferous lead deposits. Spanish and Mexican miners worked the Mowry, Montezuma, and other deposits prior to 1828 as indicated by the old workings and slag dumps found by the early Americans. No record has been found of the production of that period but due to the crude mining and recovery methods then available, the tonnage extracted was minor although rich in value. At the time of the Gadsden Purchase in 1853 there had been no mining done since the Mexican Revolution because of the lack of protection from Apache raids. Americans connected with or closely following the boundary survey parties of 1858 noted the old workings and exposed deposits. New claims were established and some development work done. Lieut. Sylvester Mowry bought up the old Patagonia mine in 1859, renamed it after himself, and produced lead-silver bullion until 1862. The old Spanish and Mexican Montezuma mine in the Washington Camp area was relocated by Gardner and Hopkins at about the same time but little could be done before abandonment at the outbreak of the Civil War and the subsequent Indian raids. Some military protection was reestablished by 1872 and again mining activity began to increase at old and new deposits found. The rich Hermosa silver deposit was discovered in 1877. When the Benson smelter was operating from 1882 to 1886, considerable rich, oxidized lead-silver ore was shipped to it from the Mowry, Pride of the West, and other deposits in the Patagonia district. The completion of the Mexico and Arizona Railroad through Sonoita Creek valley made large scale shipment of ore possible. Local smelting attempts were unsuccessful. The demonetization of silver in 1893 greatly reduced mining operations although some limited and intermittent operations continue in some mines.

A revival of interest in the area came in the late 1890's with the increased demand for copper for the growing electrical developments. George Westinghouse, founder of the Westinghouse Electric Company, became interested in the Washington Camp deposits in the late 1880's and began

acquiring and developing the oxidized ores at several mines. However, the deeper base metal sulfides associated with the skarn could not be economically treated under the metallurgical methods practiced at that time. In 1899, C. R. Wilfley, who had developed the concentrating table, acquired the Washington or Pride of the West mine, built a concentrating plant, and successfully produced acceptable lead, copper, and zinc concentrates for about three years. Meanwhile by 1906 the Duquesne Mining & Reduction Company, formed and financed by the Westinghouse Electric Company, had taken over the Westinghouse holdings and acquired most of the other claims in the Washington Camp-Duquesne area. It also bought the Pride of the West mill and after considerable mine development and ore testing, started major production in 1913. Their operations continued until about the end of 1918 when the mines were closed and the plant sold. Since then the various deposits have been worked intermittently by various companies and lessees, notably the Callahan Zinc Lead Company from 1940 into mid-1944 and Nash Mines in the early 1950's. Other mines such as the Mowry, Morning Glory, Gladstone-Proto groups, and Santo Nino have had sporadic periods of major production up to the middle 1950's. Since then the ore output has declined and in recent years there has been only minor mining activity.

The total estimated and recorded production of base and precious metals from the Patagonia district through 1972 would be some 691 thousand tons of ore containing about 27 thousand tons of zinc, 22 thousand tons of lead, 18 thousand tons of copper, 3.3 million ounces of silver, and 7.3 thousand ounces of gold for a total value of some 17.9 million dollars. Other metallic products produced from the district would consist of about 8,000 long tons of manganese ore, 200 tons of molybdenum ore, and 650 pounds of tungsten concentrates.

The eastern section of the Patagonia district still presents favorable possibilities for hidden orebodies. The Laramide granitic intrusion may underlie much of the strongly faulted zone of Paleozoic sedimentaries and Mesozoic volcanics, presenting favorable loci for porphyry copper deposits in depth. Possible zoning patterns deserve careful geologic study.

## RED ROCK MINING DISTRICT

The Red Rock mining district lies to the east and northeast of the Harshaw district, bounded on the north by Sonoita Creek, on the east by an arbitrary line along the Canelo Hills, and on the south by Meadow Valley Flat. The name probably came from the red color of the oxidized volcanics that cover much of the district.

The topography, carved out of the Laramide andesite and rhyolite volcanics, is very rough and partly rugged. Irregular mountains and hills are separated by wandering canyons and washes. In the Canelo Hills, fault blocks and slices of Paleozoic sediments, Mesozoic volcanics, and Laramide sediments occur in a northwest-striking belt. Known base and precious metal mineralization is restricted to small, shallow, and weak occurrences of oxidized copper, lead, and zinc in or along fault and fracture zones in Laramide volcanics. A small amount of manganese occurs in fractured and brecciated Mesozoic welded tuff in the Canelo Hills area.

Several mineral occurrences were prospected and worked in the 1880's and sporadically in the 1900's. Several pockets of high grade silver and minor lead, copper, zinc and gold were opened up by shallow shafts, adits, and open cuts. The total estimated and recorded production of base and precious metals from the Red Rock district would be little more than 530 tons of ore containing about 56 hundred ounces of silver, 20 tons each of lead and copper, 2 tons of zinc and 4 ounces of gold for a total value of about 15 thousand dollars. A few tens of long tons of hand-picked manganese ore came from one deposit at times of premium prices.

Only weak and spotty mineralization has been found in the district but a careful examination for alteration zones in the volcanics, particularly in the rhyolite to the east of Red Mountain should be made for indications of hidden mineralization. Some disseminated pyrite and oxidized copper mineralization has been found bordering the Harshaw district.

## SAN CAYETANO MINING DISTRICT

The San Cayetano mining district is a small, elliptical-shaped area covering the San Cayetano Mountains, an outlying foothill range to the west of the southern Santa Rita

Mountains. The name was given to the mountains by the Spaniards. The rough topography results from the erosion of the Late Mesozoic tuffaceous and sandy sediments and volcanic tuffs intruded by Laramide quartz diorite and quartz monzonite and Tertiary granodiorite. Swarms of Late Tertiary rhyodacite porphyry dikes cut across the range. The district was first described by Schrader (1915) and mapped and described by Drewes (1971a, 1971b, 1972a, 1972b).

Scattered quartz-calcite veins and veinlets containing weak and spotty argentiferous copper, lead, and zinc mineralization ore are found in the Laramide intrusive and along a strong fault zone at the east side of the range. The mineralization was prospected by the early Spaniards and Mexicans and by Americans in the early 1900's. Considerable development has been done locally but only a few tons of silver-enriched copper ore was ever shipped.

The geologic setting and mineralization does not suggest the presence of economic mineralization in the district.

**TYNDALL MINING DISTRICT**

The Tyndall mining district covers a large area along the west flank of the southern Santa Rita Mountains, extending from the border with Pima County and the Old Baldy district to the north to Sonoita Creek to the south. The eastern boundary with the Wrightson district is along the general crest of the mountains and the western edge is an arbitrary line along the base of the western foothills, including the Governor Hills. The southern part of the district was at one time called the Aztec district from an early mine of that name. The origin of the name Tyndall is unknown but the district was organized in November 17, 1876 when the Tyndall Mining Company was operating the Abercon mine (location unknown).

The topography of the northern part of the district and the east side is mostly very rough with steep rocky slopes, sharp ridges, and deep canyons. The high peaks of Mt. Hopkins and Mt. Wrightson are at the northeast corner. To the south the topography is more subdued and rolling but locally rough. The western slope is broken into irregular bench-like foothills separated by numerous canyons.

The geology of the district has been mapped and studied

in some detail by Drewes (1971a, 1971b, 1972a, 1972b) and locally by university students. Some erosional exposures of Precambrian gneiss occur at the base of the western foothills and thrust-faulted blocks and strips of Paleozoic sediments occur in the northwestern section. Most of the district is underlain by Mesozoic and Tertiary volcanics and continental sediments that have been domed up and partly eroded away over a central core of Laramide quartz diorite to quartz monzonite intrusives. An intricate pattern of strong northwest and north striking thrust and block faults and swarms of quartz latite and rhyolite dikes cut across the district. Similarly swarms of irregular, lensing quartz veins locally occupy eastwest to northwest striking fissure or fracture zones. The strong major fault structures appear to be deep-seated and to have been active over a long geologic period, possibly extending back into the Mesozoic and thus were guiding controls on igneous intrusion and mineralization.

Two general types of mineralization occur in the district. Most prevalent are the irregular and lensing quartz fissure veins containing spotty argentiferous lead, zinc, and copper minerals with some pyrite, barite, and calcite. These veins, often in swarms, cut the Mesozoic volcanics, interbedded arkose, and the granitic intrusions in a westerly to northwesterly direction. The second and more localized type of mineralization is the largely oxidized replacement deposits of argentiferous lead, zinc, and minor copper in the strongly faulted and folded blocks of Paleozoic limestone in the northwest part of the district. Oxidation has produced rich silver values in the upper parts of both types. The gold content is very low.

Mining in the Tyndall district dates back to the arrival of the Jesuit Fathers in the Santa Cruz valley in the 1680's. With Indian labor they discovered and mined numerous vein outcrops for oxidized and enriched argentiferous lead. The ore was smelted and the silver recovered in crude adobe furnaces near the missions. Several deposits in the Salero and Alto areas continued to be worked up to the time of the Mexican Revolution. At the time of the Gadsden Purchase in 1853 they had long been abandoned due to unrestricted Apache raids. By 1856, Americans prospectors and exploration companys moved in, taking over the old mines and looking for additional deposits. Most prominent were the

Sonora Mining & Exploration Co., the Arizona Mining Co., and the Santa Rita Mining Co. The early account by Pumpelly (1870) gives a vivid account of the difficulties of mining operations in those early years. With the start of the Civil War and the withdrawal of military protection, the mines were forced to close down due to renewed Apache attacks. In the early 1870's it was again possible to start up mining activities in the district and considerable shallow, oxidized, and enriched lead-silver ore was extracted. In the Salero and Alto areas, lengthy litigation over the title to the claims with the owners of the Luis Maria Baca Land Grant No. 3 interrupted or delayed many operations. The Grant had been incorrectly surveyed in 1866 and final settlement was not reached for many years. Mining operations at any one property has been intermittent with few years when more than a few hundred tons of ore were shipped. The most productive years on record for the vein mines were in 1913-1914, 1923 through 1928, 1942, and 1948 when the Jefferson mine in the Alto area was the major operation. In 1952 through 1959, 1965-1966, and in 1972, the Glove mine, operating on the oxidized replacement deposits in limestone, produced from one thousand to over five thousand tons of ore per year. There has been little or no recent production from other mines in the district.

The total estimated and recorded production of base and precious metals from the Tyndall district through 1972 would be some 56 thousand tons of ore containing about 9.4 thousand tons of lead, 2.8 thousand tons of zinc, 480 thousand ounces of silver, 1,260 ounces of gold, and 500 tons of copper for a total value of some 3.6 million dollars.

The more obvious surface indications of economic mineralization in the Tyndall district have been prospected or worked over many years. What may remain in the vein-type deposits is of doubtful economic value and the replacement deposits in Paleozoic limestone appear to be limited. However, the strong northwestward alignment of faults and quartz vein swarms extend outward from Red Mountain which appears to be a center for more intense copper mineralization and suggests that a careful geologic study of this structural zone might indicate favorable loci for deeper economic deposits. Drewes (1973) has shown geochemical anomalous areas in the district which should be further investigated.

**WRIGHTSON MINING DISTRICT**

The Wrightson mining district lies on the southeastern slope of the southern Santa Rita Mountains, extending south from the Greaterville district to Sonoita Creek and eastward from the general crest of the mountain range and the boundary with the Tyndall district. The name comes from the Wrightson brothers who were early Americans in the mines of the area. Their name also was given to the mountain peak at the northwest corner of the district, sometimes called Old Baldy in the past.

The topography of the district is generally rough and rugged with ragged, irregular ridges and hills and southwestward draining gulches and canyons. The geology has been mapped and described by Drewes (1971a, 1971b, 1972a, 1972b) and locally by Rohrbacker (1964). The exposed rocks include a series of Triassic rhyolite, dacite, and latite volcanics with interbedded sediments which were intruded by Jurassic granite and quartz monzonite along the central core of the mountain range. In late Mesozoic time, a second thick series of rhyolite, dacite, latite, and andesite flows with interbedded arkosic sediments were deposited. During Laramide orogeny, diorite was intruded along the upfolded mountain range axis and quartz latite dikes and pods were injected into the older formations. Tertiary volcanics, dikes and swarms of quartz veins followed. Subsequent strong erosion has exposed the uplifted and domed central intrusive core and the series of eastward dipping volcanics on the eastern flank.

The ore mineralization in the district occurs in irregular groups, or roughly parallel bands or swarms, of lensing quartz fissure veins containing spotty base metal sulfides, mainly argentiferous galena, pyrite, tetrahedrite, chalcopyrite, bornite, and sphalerite. Barite and calcite are common gangue minerals. Locally in one area, the fissure veins contain fine grained free gold. There appears to be no particular wall rock preference. Most deposits are oxidized and enriched near the surface.

The mineralization in the district was first prospected in the late 1870's and has been mined sporadically up into the late 1950's. Production has not exceeded a few hundred tons of ore per year and for most years has been less than one hundred tons. The total estimated and recorded production of base and precious metals from the Wrightson

district through 1972 would be some 4 thousand tons of ore containing about 475 tons of lead, 51 thousand ounces of silver, 386 ounces of gold and 119 tons of copper for a total value of some 138 thousand dollars.

The economic mineralization found in the Wrightson district has been spotty and sparse and appears to be on the fringe of stronger mineralized areas. However, there has been little geologic study made in the southern area for possible deep economic mineralization extending northward from Red Mountain. Drewes (1967, 1973), through geochemical sampling, has indicated metal anomalies and alteration zones that need to be further investigated.

# TABLE 1
## PRODUCTION SUMMARY OF BASE AND PRECIOUS METALS THROUGH 1972
### ( Including estimates for years data not available )

| MINING DISTRICT | Short Tons Ore (1,000's) | Pounds Copper (1,000's) | Pounds Lead (1,000's) | Pounds Zinc (1,000's) | Ounces Gold | Ounces Silver (100's) | Total Value (1,000's) |
|---|---|---|---|---|---|---|---|
| Greaterville | 2 | 40 | (570 lbs) | — | 12 | 63 | 14 |
| Harshaw | 1,312 | 6,286 | 143,609 | 172,720 | 4,347 | 91,993 | 41,536 |
| Nogales | 1 | 17 | 191 | — | 1,019 | 142 | 54 |
| Oro Blanco | 909 | 5,113 | 60,987 | 52,723 | 126,450 | 46,218 | 12,944 |
| Pajarito | 1 | 5 | 317 | (420 lbs) | 216 | 414 | 68 |
| Palmetto | 132 | 11,004 | 449 | 2 | 242 | 750 | 2,103 |
| Patagonia | 691 | 36,665 | 43,025 | 53,771 | 7,267 | 32,635 | 17,862 |
| Red Rock | (530 tons) | 41 | 42 | 4 | 4 | 56 | 15 |
| Tyndall | 56 | 1,036 | 18,782 | 5,513 | 1,261 | 4,766 | 3,645 |
| Wrightson | 4 | 237 | 951 | — | 386 | 508 | 138 |
| Miscellaneous | (100 tons) | 3 | 1 | — | 38 | 16 | 2 |
| Total | 3,109 | 60,447 (30,224 tons) | 268,355 (134,178 tons) | 284,733 (142,367 tons) | 141,242 | 177,561 | 78,381 |

TABLE 2
INDEX OF MINING PROPERTY NAMES

| NAME | DISTRICT |
|---|---|
| Abe Lincoln mine (see Blue Nose mine) | Harshaw |
| Alamo gold placer | Oro Blanco |
| Alta mine | Harshaw |
| Alto mine group | Tyndall |
| Amado mine (see Montosa mine group) | Tyndall |
| American mine | Harshaw |
| American Boy mine group | Wrightson |
| Anaconda mine group | Wrightson |
| Andes group (see Aztec mine group) | Harshaw |
| Annie mine | Patagonia |
| Annie Laurie prospect | Oro Blanco |
| Apache mine | Tyndall |
| Apex mine (see Frisco Fair mine group) | Red Rock |
| Arizona group (see Idaho mine group) | Oro Blanco |
| Arizona mine (see Gladstone mine group) | Patagonia |
| Arizona-Pittsburg mine | Tyndall |
| Augusta mine | Patagonia |
| Augusta mine (see Hosey mine group) | Wrightson |
| Austerlitz mine group | Oro Blanco |
| Aztec mine group | Harshaw |
| B and R mine (see Alto mine group) | Tyndall |
| Basin mine group | Harshaw |
| Belmont mine | Patagonia |
| Bender mine | Harshaw |
| Big Chief mine (see Blue Nose mine) | Harshaw |
| Big Jim mine (see Blue Nose mine) | Harshaw |
| Big Steve mine (see White Oaks and Big Steve mines) | Pajarito |
| Black Ace mine (see La Plata mine) | Red Rock |
| Black Cap mine (see Mansfield mine group) | Wrightson |
| Black Diamond mine (see Montosa mine group) | Tyndall |
| Black Eagle mine | Harshaw |
| Black Hills mine (see Arizona-Pittsburg mine) | Tyndall |
| Black Peak mine group | Oro Blanco |
| Blaine Ledge mine (see Old Glory mine group) | Oro Blanco |
| Bland mine | Tyndall |
| Blue Bird mine | Red Rock |
| Blue Eagle mine | Harshaw |
| Blue Flag and Red Bird mines (see January and Norton mine group) | Harshaw |

Table 2, Cont.

| NAME | DISTRICT |
|---|---|
| Blue Lead mine | Tyndall |
| Blue Nose mine | Harshaw |
| Blue Nose Extension mine (see Blue Nose mine) | Harshaw |
| Blue Ribbon mine (see Gold Hill and Blue Ribbon mine group) | Oro Blanco |
| Blue Wing mine (see Brown Bird mine group) | Oro Blanco |
| Bonanza mine | Patagonia |
| Bonanza mine | Tyndall |
| Bowling Green mine | Tyndall |
| Bradford mine | Tyndall |
| Brick mine | Oro Blanco |
| Brown Bird mine group | Oro Blanco |
| Brownee mine (see Domino mine group) | Palmetto |
| Buena Vista group (see European mine group) | Palmetto |
| Buena Vista mine | Patagonia |
| Buffalo mine group | Harshaw |
| Bull Springs mine | Tyndall |
| Bullion mine (see Jarillas mine group) | Palmetto |
| Bullwhacker mine (see Golden Gate mine) | Patagonia |
| California mine | Harshaw |
| California-Grasshopper mine group | Patagonia |
| California Gulch placers | Oro Blanco |
| Castle Butte mine | Wrightson |
| Cave Hill deposit | Greaterville |
| Choctaw mine | Oro Blanco |
| Christmas Gift or Horseshoe mine | Harshaw |
| Clipper mine (see Happy Jack mine) | Wrightson |
| Collicello and Luray mine groups | Palmetto |
| Columbia mine group | Nogales |
| Constitution mine (see Salero mine) | Tyndall |
| Commodore mine | Oro Blanco |
| Compadre mine group | Tyndall |
| Connecticut mine | Tyndall |
| Copper Mountain or Amada mine (see Anaconda mine group) | Wrightson |
| Cramer mine | Oro Blanco |
| Darwin mine (see Salero mine) | Tyndall |
| Dave Allen mine | Patagonia |
| Devil's Cash Box group (see Bonanza mine) | Tyndall |
| Dewey mine (see Basin mine group) | Harshaw |
| Dixie mine | Wrightson |
| Domino mine group | Palmetto |

Table 2, Cont.

| NAME | DISTRICT |
|---|---|
| Dona Maria Elena mine (see New Hope mine group) | Palmetto |
| Dos Amigos mine | Oro Blanco |
| Double Header mine (see Anaconda mine group) | Wrightson |
| Double Standard mine | Patagonia |
| Dudley-Standard mine (see Double Standard mine) | Patagonia |
| Duquesne mine | Patagonia |
| Duquesne-Washington group mines (also see Annie, Belmont, Bonanza, California-Grasshopper, Dave Allen, Double Standard, Duquesne, Empire, Estelle and Louise, Holland, Illinois, Indiana, Indianapolis, Kansas, Maine, Manzanita, Mary Jane, New York, San Antonio, Silver Bell, and Smuggler and Texas) | Patagonia |
| Dura mine group | Nogales |
| Durham Copper claims | Red Rock |
| Eclipse mine (see Happy Jack mine) | Wrightson |
| Edna mine group | Patagonia |
| Elephant Head mine group | Tyndall |
| Ella mine (see Maine mine) | Patagonia |
| El Plomo mine (see Alto mine group) | Tyndall |
| Empire mine | Patagonia |
| Endless Chain mine | Patagonia |
| Enterprise mine (see Mowry mine) | Patagonia |
| Erin mine (see National mine) | Patagonia |
| Esperanza mine (see Old Glory mine group) | Oro Blanco |
| Estelle and Louise mine | Patagonia |
| Eureka mine (see Gladstone mine group) | Patagonia |
| Eureka mine (see Elephant Head mine group) | Tyndall |
| Eureka-Marble mine group | Tyndall |
| European mine group | Palmetto |
| Exposed Reef mine (see Hosey mine group) | Wrightson |
| Fernando mine (see Bender mine) | Harshaw |
| Florida mine | Tyndall |
| Flux mine | Harshaw |
| Four Metals mine | Patagonia |
| Francis group (see Gringo mine group) | Wrightson |
| Frisco Fair mine group | Red Rock |
| Gladstone mine group | Patagonia |
| Glove mine group | Tyndall |
| Gold Bar placers (see California Gulch placers) | Oro Blanco |

Table 2, Cont.

| NAME | DISTRICT |
|---|---|
| Gold Base mine (see Smuggler Gulch mine group) | Oro Blanco |
| Gold Hill mine | Nogales |
| Gold Hill and Blue Ribbon mine group | Oro Blanco |
| Gold Tree mine (see Alto mine group) | Tyndall |
| Golden Eagle mine (see Margarita mine group) | Oro Blanco |
| Golden Gate mine | Patagonia |
| Golden Rose mine (see Buffalo mine group) | Harshaw |
| Good Luck mine | Tyndall |
| Goodview mine (see Buena Vista mine) | Patagonia |
| Goshen mine (see Flux mine) | Harshaw |
| Great Silver mine (see Basin mine group) | Harshaw |
| Gringo mine group | Wrightson |
| Grubstake mine | Oro Blanco |
| Guajolote lode (see Four Metals mine) | Patagonia |
| Guajolote mine | Patagonia |
| Half and Half mine (see Lucky Shot mine group) | Oro Blanco |
| Happy Jack mine | Wrightson |
| Happy Thoughts mine | Patagonia |
| Hardscrabble mine (see Uncle Sam mine) | Nogales |
| Hardshell mine | Harshaw |
| Hassayampa mine (see Tres de Mayo mine group) | Palmetto |
| Hermosa mine | Harshaw |
| Hidden Tunnel mine (see Red Berry and Hidden Tunnel mines) | Greaterville |
| Highside mine (see Eureka-Marble mine group) | Tyndall |
| Holland mine | Patagonia |
| Hollywood mine (see Tres dey Mayo mine group) | Palmetto |
| Horseshoe mine (see Christmas Gift or Horseshoe mine) | Harshaw |
| Horseshoe mine (see Sunnyside and Volcano mines) | Harshaw |
| Hosey mine group | Wrightson |
| Humboldt mine | Harshaw |
| Hummer mine (see Frisco Fair mine group) | Red Rock |
| Idaho mine group | Oro Blanco |
| Illinois mine | Patagonia |
| Independencia mine (see Gladstone mine group) | Patagonia |
| Indian mine group | Oro Blanco |
| Indiana mine | Patagonia |
| Indianapolis mine | Patagonia |
| Indio mine (see Indian mine group) | Oro Blanco |

Table 2, Cont.

| NAME | DISTRICT |
|---|---|
| International mine (see Dura mine group) | Nogales |
| Isabella mine (see Montosa mine group) | Tyndall |
| Ivanhoe mine | Tyndall |
| January and Norton mine group | Harshaw |
| Jarillas mine group | Palmetto |
| Jefferson group (see Buffalo mine group) | Harshaw |
| Jefferson mine | Tyndall |
| Jesuit mine | Tyndall |
| Joplin mine | Tyndall |
| Josephine mine (see Trench mine) | Harshaw |
| Kansas mine | Patagonia |
| La Palma mine (see Tres de Mayo mine group) | Palmetto |
| La Paz mine (see Montezuma and La Paz mines) | Tyndall |
| La Plata mine | Red Rock |
| Last Chance mine | Wrightson |
| Lead King mine | Wrightson |
| Lead Queen mine (see Buffalo mine group) | Harshaw |
| Lee mine | Tyndall |
| Lee mine (see Mansfield mine group) | Wrightson |
| Le Roy mine (see Compadre mine group) | Tyndall |
| Little Joker mine (see Anaconda mine group) | Wrightson |
| Loma de Manganese | Oro Blanco |
| Long Contact mine (see Alto mine group) | Tyndall |
| Lucky Shot mine group | Oro Blanco |
| Lucky Spur group (see Bowling Green mine) | Tyndall |
| Maine mine | Patagonia |
| Mansfield mine group | Wrightson |
| Manzanita mine | Patagonia |
| Margaret mine (see Frisco Fair mine group) | Red Rock |
| Margarita mine group | Oro Blanco |
| Martha Washington mine (see Edna mine group) | Patagonia |
| Mary mine (see Compadre mine group) | Tyndall |
| Mary Jane mine | Patagonia |
| Mina Prieta (see Bender mine) | Harshaw |
| Mohawk mine | Tyndall |
| Monarch mine | Oro Blanco |
| Monster mine (see Smuggler Gulch mine group) | Oro Blanco |
| Montana mine group | Oro Blanco |
| Montezuma and La Paz mines | Tyndall |
| Montosa mine | Tyndall |
| Morning and Evening mine group | Pajarito |
| Morning Glory mine | Patagonia |

Table 2, Cont.

| NAME | DISTRICT |
|---|---|
| Morris group (see Ventura mine group) | Palmetto |
| Mountain View mine (see Happy Jack mine) | Wrightson |
| Mowry mine | Patagonia |
| National mine | Patagonia |
| New Hope mine group | Palmetto |
| New York mine | Patagonia |
| North Mowry mine (see Golden Gate mine) | Patagonia |
| Norton mine (see January and Norton mine group) | Harshaw |
| Ohio mine (see New York mine) | Patagonia |
| O K mine (see Glove mine group) | Tyndall |
| Old Chief mine (see Domino mine group) | Palmetto |
| Old Contest mine (see Dura mine group) | Nogales |
| Old Glory mine group | Oro Blanco |
| Old Mowry mine (see Golden Gate mine) | Patagonia |
| Old Mexican mine (see Eureka-Marble mine group) | Tyndall |
| Old Soldier mine | Oro Blanco |
| Onyx Cave (see Cave Hill deposit) | Greaterville |
| Ophir mine (see Old Glory mine group) | Oro Blanco |
| Oro (El Oro) mine | Oro Blanco |
| Oro Blanco area mines (also see Dos Amigos, Monarch, Oro Blanco, San Juan, Tres Amigos, Tres Amigos Lead, and Triangle mines) | Oro Blanco |
| Oro Blanco (White Gold) mine | Oro Blanco |
| Oro Blanco Viejo placers (see California Gulch placers) | Oro Blanco |
| Oro Fino mine | Oro Blanco |
| Ostrich mine | Oro Blanco |
| Padres mine (see January and Norton mine group) | Harshaw |
| Palmetto mine (see Tres de Mayo mine group) | Palmetto |
| Patagonia mine (see Mowry mine) | Patagonia |
| Paymaster mine | Patagonia |
| Philadelphia mine (see Anaconda mine group) | Wrightson |
| Pina mine (see Sunnyside and Volcano mines) | Harshaw |
| Pittsburg mine (see Warsaw mine group) | Oro Blanco |
| Pocahontas mine | Patagonia |
| Polatski mine (see Compadre mine group) | Tyndall |
| Poole group (see Kansas, Maine, and New York mines) | Patagonia |
| Presidential mine (see Hosey mine group) | Wrightson |

Table 2, Cont.

| NAME | DISTRICT |
|---|---|
| Pride of the West mine | Patagonia |
| Proto mine group | Patagonia |
| Quajolote mine (see Guajolote mine) | Patagonia |
| Quantrell mine (see Elephant Head mine group) | Tyndall |
| Ragnaroc mine | Oro Blanco |
| Reagan mine group | Nogales |
| Red Berry and Hidden Tunnel mines | Greaterville |
| Red Rock mine (see Basin mine group) | Harshaw |
| Reich mine (see Warsaw mine group) | Oro Blanco |
| Robert E. (Bob) Lee mine (see Tres de Mayo mine group) | Palmetto |
| Rob Roy mine (see Margarita mine group | Oro Blanco |
| Rock Candy Mountain mine) | Greaterville |
| Rough and Ready mine (see Montana mine group) | Oro Blanco |
| Rover mine (see Glove mine group) | Tyndall |
| Roy mine | Patagonia |
| Royal Blue mine group | Tyndall |
| Rubiana mine group | Oro Blanco |
| Ruby mine (see Mansfield mine group) | Wrightson |
| Rupert mine (see Mansfield mine group) | Wrightson |
| St. Christofer mine (see Gold Hill and Blue Ribbon mine group) | Oro Blanco |
| St. Louis mine (see Anaconda mine group) | Wrightson |
| St. Patrick mine | Pajarito |
| Salero mine | Tyndall |
| Salvadore mine | Harshaw |
| San Antonio mine | Patagonia |
| San Jose mine (see Lucky Shot mine group) | Oro Blanco |
| San Juan mine | Oro Blanco |
| San Lou mine (see Domino mine group) | Palmetto |
| San Ramon mine group | Tyndall |
| Santo Nino mine | Patagonia |
| Sargent mine (see Old Glory mine group) | Oro Blanco |
| Scribner mine | Oro Blanco |
| Sheehy-O'donnel mine (see Glove mine group) | Tyndall |
| Silent Friend mine (see Columbia mine group) | Nogales |
| Silver Bell mine | Patagonia |
| Silver Cave mine (see Anaconda mine group) | Wrightson |
| Skyline mine (see Gold Hill and Blue Ribbon mine group) | Oro Blanco |
| Smuggler and Texas mine | Patagonia |
| Smuggler Gulch mine group | Oro Blanco |

Table 2, Cont.

| NAME | DISTRICT |
|---|---|
| Sonoita Creek-Alum Canyon placers | Harshaw |
| Sonoita mine group | Palmetto |
| Sunnyside and Volcano mines | Harshaw |
| Sunset mine group | Pajarito |
| Sweet mine (see Mansfield mine group) | Wrightson |
| Sweetwater mine | Greaterville |
| Temporal group (see Gringo mine group) | Wrightson |
| Thessalia mine (see Gladstone mine group) | Patagonia |
| Three-R mine group | Palmetto |
| Thunderer mine (see Eureka-Marble mine group) | Tyndall |
| Tiajuana mine | Tyndall |
| Trench mine | Harshaw |
| Trenton mine | Tyndall |
| Tres Amigos mine | Oro Blanco |
| Tres Amigos Lead mine | Oro Blanco |
| Tres de Mayo mine group | Palmetto |
| Triangle mine | Oro Blanco |
| Tumacacori mine (see Columbia mine group) | Nogales |
| Two Brothers mine | Nogales |
| Ultima mine (see Anaconda mine group) | Wrightson |
| Uncle George mine (see January and Norton mine group) | Harshaw |
| Uncle Sam mine group | Nogales |
| Ventura mine group | Palmetto |
| Veta Grande (see Bonanza mine) | Tyndall |
| Victor mine | Tyndall |
| Volcano mine (see Sunnyside and Volcano mines) | Harshaw |
| Vulcan mine group | Tyndall |
| Wandering Jew mine | Tyndall |
| War Horse mine (see Blue Nose mine) | Harshaw |
| Warsaw mine group | Oro Blanco |
| Washington mine (see Pride of the West mine) | Patagonia |
| White Gold No. 3 mine (see Tres Amigos mine) | Oro Blanco |
| White Oaks and Big Steve mines | Pajarito |
| Wieland group (see Basin mine group and Buffalo mine group) | Harshaw |
| World's Fair mine | Harshaw |
| Yellow Jacket mine | Oro Blanco |

## TABLE 3
## INDEX OF MINING PROPERTY OPERATORS

| NAME | PROPERTY | DISTRICT |
|---|---|---|
| Abrams | Jesuit mine | Tyndall |
| A D E Contracting & Development Co. | Bull Springs mine | Tyndall |
| Alabama Queen Mining Co. | Bonanza mine | Tyndall |
| Allen | Vulcan mine group | Tyndall |
| Allen & Kolberg | Flux mine | Harshaw |
| Altamurano | Anaconda and Gringo mine groups | Wrightson |
| Allen Brothers | Kansas, Maine, and New York mines | Patagonia |
| Allison Brothers | California mine | Harshaw |
| Altamirano & Goodsell | Dixie mine | Wrightson |
| Altamirano & Mafrecita | Hosey mine group | Wrightson |
| Alto Consolidated Mines, Smelting, & Transportation Co. | Alto mine group | Tyndall |
| Alto Copper Company | Alto mine group | Tyndall |
| Alvarez | Black Eagle and Flux mines | Harshaw |
| Alvarez & Majalca | Indiana mine | Patagonia |
| Amado | Estelle & Louise mine | Patagonia |
| Amado & Majalca | Smuggler and Texas mines | Patagonia |
| Amado Mines | Montosa mine group | Tyndall |
| American Minerals Chemical Co. | Bender mine | Harshaw |
| American Mining & Oil Co. | Castle Butte mine | Wrightson |
| American Smelting & Refining Co. | Flux, Hardshell, and Trench mines; January & Norton mine groups | Harshaw |
| Amster | Three-R mine | Palmetto |
| Anaconda-Arizona Mining Co. | Anaconda mine group | Wrightson |
| Anders & Demulling | Gold Hill mine | Nogales |
| Anderson | Choctaw mine; Warsaw mine group | Oro Blanco |
| Apache Mining Co. | Royal Blue mine group | Tyndall |
| Arivaca Mining Co. | Idaho mine group | Oro Blanco |
| Arivaca Mining Corporation | Glove mine group | Tyndall |

Table 3, Cont.

| NAME | PROPERTY | DISTRICT |
|---|---|---|
| Arizona Consolidated Gold & Copper Mines | Compadre mine group | Tyndall |
| Arizona European Mining Co. | European mine group | Palmetto |
| Arizona Gold & Copper Co. | Flux mine | Harshaw |
| | Trenton mine | Tyndall |
| Arizona Gold Mines & Milling Co. | Gringo mine group | Wrightson |
| Arizona Gold Mining & Milling Co. | Old Glory mine group | Oro Blanco |
| Arizona Ophir Mining Co. | Old Glory mine group | Oro Blanco |
| Arizona Patagonia Silver Mining Co. | Blue Nose mine | Harshaw |
| Arizona-Pittsburg Mining & Smelting Co. | Arizona-Pittsburg mine | Tyndall |
| Artesia Investment Co. | Dos Amigos, Oro Blanco (White Gold), and Tres Amigos mines | Oro Blanco |
| Aubrey | Old Soldier mine | Oro Blanco |
| Ayala | Bland mine | Tyndall |
| Aztec Mining Syndicate | Montezuma and La Paz mines | Tyndall |
| B & R Mines | Alto mine group | Tyndall |
| Backman & Merritt Mines Co. | Tres de Mayo mine group | Palmetto |
| Bacon | Belmont, Guajolote, and Roy mines | Patagonia |
| Bacon & Koon | Victor mine | Tyndall |
| Banco del Oro Mining Co. | Buena Vista mine | Patagonia |
| Barclay | Bland mine | Tyndall |
| Barkley | Austerlitz mine group | Oro Blanco |
| Barnett & Powers | Happy Jack mine | Wrightson |
| Bartlett | Ostrich mine | Oro Blanco |
| | Holland mine | Patagonia |
| Bartlett & Linton | Last Chance mine | Wrightson |
| Beardsley & Co. | Wandering Jew mine | Tyndall |
| Bejerano | Lucky Shot mine group | Oro Blanco |
| Bekins | Tiajuana mine | Tyndall |
| Bender | Hardshell mine | Harshaw |
| Bergman | Frisco Fair mine group | Red Rock |
| Beyerle | Bender and Blue Nose mines | Harshaw |
| | Santo Nino mine | Patagonia |
| | Ventura mine group | Palmetto |

| | | |
|---|---|---|
| Big Four Mining Co. | Lucky Shot mine group | Oro Blanco |
| Big Jim Mines, Inc. | Blue Nose and Hardshell mines; January & Norton mine groups | Harshaw |
| Bird | Three-R mine group | Palmetto |
| Blabon | Gladstone mine group; Roy mine | Patagonia |
| | Lead King mine | Wrightson |
| Black Mountain Mining Co. | Buena Vista mine | Patagonia |
| Blake | Eureka-Marble mine group | Tyndall |
| Bland Mining Co. | Bland mine | Tyndall |
| Blankenship | Sunset mine group | Pajarito |
| | Christmas Gift or Horseshoe mine | Harshaw |
| Blue Flag Mining Co. | January & Norton mine groups | Harshaw |
| Bond | Alto mine group; Florida mine | Tyndall |
| Bond & Hutchins | Paymaster mine | Patagonia |
| Border Mines Co. | Austerlitz mine group | Oro Blanco |
| Border Mines, Inc. | Three-R mine group | Palmetto |
| Bossinger & Reed | Rock Candy Mountain mine | Greaterville |
| Bostwich | Belmont, Kansas, Paymaster, and Roy mines; Gladstone mine group | Patagonia |
| Boulder Mining Co. | Anaconda mine group | Wrightson |
| | Compadre mine group | Tyndall |
| Bouldin | Jefferson mine | Tyndall |
| Boykin | Montosa mine group | Tyndall |
| Bradford | Alto mine group | Tyndall |
| Bradford Copper Mining Co. | Bradford mine | Tyndall |
| Bradsher | Lead King mine; Mansfield mine group | Wrightson |
| Brown | Blue Nose and Salvadore mines; | Harshaw |
| | Domino mine group | Palmetto |
| Bruce | Warsaw mine group | Oro Blanco |
| Byrd | Salvadore mine | Harshaw |
| | Belmont, Bonanza, Double Standard, Empire, Holland, Indianapolis, Maine, New York, San Antonio, and Pride of the West mines | Patagonia |
| Calabasas Copper Co. | Montosas mine group | Tyndall |
| Callahan Zinc Lead Co. | Bonanza, Duquesne, Empire, Estelle & Louise, Holland, Indiana, Kansas, Maine, and New York mines | Patagonia |

Table 3, Cont.

| NAME | PROPERTY | DISTRICT |
|---|---|---|
| Campbell | Royal Blue mine group | Tyndall |
| Canez | Austerlitz mine group | Oro Blanco |
| Carre | La Plata mine | Red Rock |
| Cason | Sunset mine group | Pajarito |
| Castle Butte Mining Co. | Castle Butte mine | Wrightson |
| Chapin | Pride of the West mine | Patagonia |
| Chapman | Humboldt mine | Harshaw |
| | Frisco Fair mine group | Red Rock |
| Cheek | Gold Hill mine | Nogales |
| Chenoweth | Monarch mine | Oro Blanco |
| Clark | Pride of the West mine | Patagonia |
| | Triangle mine | Oro Blanco |
| Clark & Peterson | Montezuma and La Paz, Salero, Trenton mines; Eureka-Marble mine group | Tyndall |
| Clark, Peterson, and David | American Boy mine group | Wrightson |
| Clarke | St. Patrick, White Oaks and Big Steve mines | Pajarito |
| Clay & Coughanour | Gold Hill mine | Nogales |
| Cleveland | Bender mine | Harshaw |
| Col. Titus | Trench mine | Harshaw |
| Colorado Fuel & Iron Steel Corporation | Glove mine group | Tyndall |
| Colossal Mines | Three-R mine group | Palmetto |
| Conley | New Hope mine group | Palmetto |
| Cooper | Collicello & Luray mine groups | Palmetto |
| Cordova | Triangle mine | Oro Blanco |
| Coronado Mines Inc. | Buena Vista mine; Edna mine group | Patagonia |
| Costa & Morriss | San Ramon mine group | Tyndall |
| Cota & Daniel | Frisco Fair mine group | Red Rock |
| Coughlin | Holland and Maine mines | Patagonia |
| Cox | Grubstake mine | Oro Blanco |
| Cramer | Cramer mine | Oro Blanco |
| Crowder | Brick mine | Oro Blanco |
| Cummings | Tres de Mayo mine group | Palmetto |
| Curtis & Steinfeld | Jefferson mine | Tyndall |

| | | |
|---|---|---|
| Curtis Estate | Belmont, Kansas, and Pocahontas mines | Patagonia |
| Dale | Monarch, Old Soldier, and Tres Amigos Lead mines | Oro Blanco |
| Daniels | Dos Amigos, Oro Fino, Tres Amigos mines; Margarita mine group | Oro Blanco |
| D. C. Gilbert Mining Co. | Illinois mine | Patagonia |
| Davis et alia | Pocahontas mine | Patagonia |
| Delanti | Oro Fino mine | Oro Blanco |
| De la Ossa | Belmont, New York, and San Antonio mines | Patagonia |
| De la Ossas & Lemas | Blue Bird mine | Red Rock |
| Delgado | Gold Hill & Blue Ribbon mine groups | Oro Blanco |
| Discovery Process Inc. | Salero mine | Tyndall |
| | Edna mine group | Patagonia |
| Double "L" Mining Co. | Happy Thoughts mine | Patagonia |
| Drake Enterprises | Jesuit, Montezuma and La Paz mines | Tyndall |
| Driscoll | Uncle Sam mine group | Nogales |
| Dunham & Nanez | Buena Vista mine | Patagonia |
| Duquesne Mining & Reduction Co. | Annie, Belmont, Bonanza, Dave Allen, Double Standard, Duquesne, Empire, Estelle & Louise, Holland, Illinois, Indiana, Indianapolis, Kansas, Maine, Manzanita, Mary Jane, New York, San Antonio, Silver Bell, Smuggler & Texas, Pride of the West, and Pocahontas mines | Patagonia |
| Eagle-Picher Mining & Smelting Co. | Montana mine group | Oro Blanco |
| Elayer & Co. | Bonanza mine | Patagonia |
| Ellefson | Bonanza | Tyndall |
| Elliott | Dixie mine | Wrightson |
| Ellis | Uncle Same mine group | Nogales |
| El Toro Mining Co. | Rock Candy Mountain mine | Greaterville |
| Empire Mining & Milling Co. | Hardshell mine | Harshaw |
| Encinas | Flux mine | Harshaw |
| Endless Chain Mining Co. | Endless Chain mine | Patagonia |
| Eureka Mining & Milling Co. | Eureka-Marble mine group | Tyndall |
| Evans | Sonoita mine group | Palmetto |
| Everett | Kansas and New York mines | Patagonia |
| Ewing | Blue Eagle mine | Harshaw |

Table 3, Cont.

| NAME | PROPERTY | DISTRICT |
|---|---|---|
| Fairchild | Smuggler Gulch mine group | Oro Blanco |
| Farrell | Salvadore, Sunnyside & Volcano, and Trench mines; January & Norton mine groups | Harshaw |
| Ferguson | Hosey mine group | Wrightson |
| Fernald | Oro Blanco (White Gold) and Tres Amigos mines | Oro Blanco |
| Ferry | Bradford, Montezuma & La Paz mines; Eureka-Marble mine group | Tyndall |
| Fickett | Choctaw mine | Oro Blanco |
| Figueroa | Apache mine | Tyndall |
| Fish & Silverberg | Mowry mine | Patagonia |
| Fliescher | European mine group | Palmetto |
| Flux Extension Mining Co. | California mine | Harshaw |
| Flux Mining Co. | Flux mine | Harshaw |
| Foltz | Oro (El oro) mine; Black Peak mine group | Oro Blanco |
| Foote | Old Glory mine group | Oro Blanco |
| Forsythe | Gladstone mine group | Patagonia |
| Fortuna Mining Co. | Victor mine; Alto mine group | Tyndall |
| Four Metals Mining Co. | Four Metals mine | Patagonia |
| Francisco & Medina | Annie mine | Patagonia |
| Franklin | Happy Thoughts mine | Patagonia |
| Fraser | Royal Blue mine group | Tyndall |
| Fulk | Jefferson mine | Tyndall |
| Fulton | Gladstone and Proto mine groups | Patagonia |
| Gardner | Eureka-Marble mine group | Tyndall |
| Gardner & Young | Hardshell mine | Harshaw |
| Garrett & Parks | Elephant Head mine group | Tyndall |
| Gerrard | Happy Thoughts mine | Patagonia |
| Giacoma | American mine | Harshaw |
| Gleason | Dura mine group | Nogales |
| Gold Bar Mining Co. | California Gulch placers | Oro Blanco |
| Gold Canyon Mining Co. | Trench mine | Harshaw |

| | | |
|---|---|---|
| Gold Zone Mining Co. | Margarita mine group | Oro Blanco |
| Goldfields Consolidated Mines Exploration Co. | Montana mine group | Oro Blanco |
| Goodview Mining & Milling Co. | Buena Vista mine | Patagonia |
| Granillo | Estelle & Louise mine | Patagonia |
| Grant & Woodruff | Mowry mine | Patagonia |
| Grasman | Grubstake mine | Oro Blanco |
| Gray | Collicello & Luray, Domino, and New Hope mine groups | Palmetto |
| Graybill | Sunset mine group | Pajarito |
| Graybill & Jarnagin | Buena Vista mine | Patagonia |
| Green | Rubiana mine group | Oro Blanco |
| Gross | Four Metals mine | Patagonia |
| | Jarillas mine group | Palmetto |
| Gross Mining & Investment Co. | American Boy mine group | Wrightson |
| Gunsight Mining Co. | Mansfield mine group | Wrightson |
| Gusteller & Curtis | Jarillas mine group | Palmetto |
| Gzowski | Grubstake mine | Oro Blanco |
| Hack | Brown Bird mine group | Oro Blanco |
| Hack & Irwin | Old Soldier mine; Warsaw mine group | Oro Blanco |
| Hale | Blue Eagle mine | Harshaw |
| Happy Jack Mining Co. | Happy Jack mine | Wrightson |
| Happy Jack Mining & Reduction Co. | Happy Jack mine | Wrightson |
| Hardshell Mining Co. | Hardshell mine | Harshaw |
| Harrington & Gillespie | Humboldt mine | Harshaw |
| Harshaw | Pocahontas mine | Patagonia |
| Hatcher & Carpenter | Monarch mine | Oro Blanco |
| Havalina Mining Co. | Santo Nino mine | Patagonia |
| Headley | Wandering Jew mine | Tyndall |
| Heagney & Ellison | Royal Blue mine group | Tyndall |
| Henderson | Christmas Gift or Horseshoe mine | Harshaw |
| | Ventura mine group | Palmetto |
| | Apache, Bland, Jefferson, Montezuma & La Paz, and Wandering Jew mines; Alto, Eureka-Marble, and Royal Blue mine groups | Tyndall |
| Heredia | Maine mine | Patagonia |

Table 3, Cont.

| NAME | PROPERTY | DISTRICT |
|---|---|---|
| Hermosa Mining Co. | Hermosa and Salvadore mines | Harshaw |
| Hermosa Mining & Milling Co. | Hermosa mine | Harshaw |
| Hill | Triangle mine | Oro Blanco |
| Hogan | Black Eagle, Blue Nose, and Trench mines | Harshaw |
| | Uncle Sam mine | Nogales |
| Holland Smelting & Mining Co. | Holland mine | Patagonia |
| Holt | Old Soldier mine | Oro Blanco |
| Hooks | Florida mine | Tyndall |
| Hopkins | Ivanhoe mine | Tyndall |
| Hudgin | Uncle Sam mine group | Nogales |
| Humboldt Mining & Reduction Co. | Humboldt mine | Harshaw |
| Humphrey Mining Co. | Pride of the West mine | Patagonia |
| Huntington | Warsaw mine group | Oro Blanco |
| Independent Mining & Milling Co. | Gladstone mine group | Patagonia |
| Indiana Mining Co. | Indiana mine | Patagonia |
| Ish | Jarillas mine group | Palmetto |
| Ivanhoe Mining Co. | Ivanhoe mine | Tyndall |
| January Mines Co. | January & Norton mine group | Harshaw |
| Jarnagin & Bopp | Buena Vista mine | Patagonia |
| Jefferson Mines, Inc. | Jefferson mine | Tyndall |
| Jefferson Mining Co. | Buffalo mine group | Harshaw |
| Jensen | La Plata mine | Red Rock |
| Jime & Marker | Lucky Shot mine group | Oro Blanco |
| Johnson | Ivanhoe mine; Compadre mine group | Tyndall |
| Johnson & Valles | Blue Lead mine | Tyndall |
| Johnston | Dixie mine | Wrightson |
| Joplin Mining Co. | Joplin mine | Tyndall |
| Kansas Mining & Development Co. | Kansas mine | Patagonia |
| Keck Copper Co. | New Hope mine group | Palmetto |
| Keegan | Sonoita mine group | Palmetto |
| Kelly | Cramer mine | Oro Blanco |
| Kelso | Yellow Jacket mine | Oro Blanco |
| Keltz & Allen | Sunset mine group | Pajarito |

| | | |
|---|---|---|
| Kempton & O'Neill | Black Eagle mine | Harshaw |
| Kimmel | Morning & Evening mine | Pajarito |
| Kino Copper Co. | Buena Vista mine | Patagonia |
| Kolberg | Mohawk mine; Eureka-Marble mine group | Tyndall |
| Kramer | Compadre mine group | Tyndall |
| Kruse | Jefferson mine | Tyndall |
| Laguna | Wandering Jew mine; Alto mine group | Tyndall |
| La Rocque | Bull Springs mine | Tyndall |
| Las Jarillas Mining Co. | Jarillas mine group | Palmetto |
| Laycock | Mansfield mine group | Wrightson |
| Leek | Hosey mine group | Wrightson |
| Legend Group, Ltd. | Dos Amigos, Oro Blanco (White Gold), and Tres Amigos mines | Oro Blanco |
| Lenon & Vasquez | Sunnyside & Volcano mines | Harshaw |
| Lenon & Wilson | Dixie mine | Wrightson |
| Lewis | Happy Jack mine | Wrightson |
| Licano & Flores | Lucky Shot mine group | Oro Blanco |
| Litchliter | Dura mine group | Nogales |
| Loftus | Reagan mine group | Nogales |
| Logan | Mowry mine | Patagonia |
| Long Contact Mining Co. | Alto mine group | Tyndall |
| Lopez | Indian mine group | Oro Blanco |
| Lully | Alto mine group | Tyndall |
| Lynch | Paymaster mine | Patagonia |
| McCutchen | Black Eagle mine | Harshaw |
| McCutchen & Hogan | Collicello & Luray mine groups | Palmetto |
| | Connecticut | Tyndall |
| McCutchan, Wolf, and Callahan | Bull Springs mine | Tyndall |
| McDonald Mining Co. | Hosey mine group | Wrightson |
| McFarland | Bradford mine | Tyndall |
| | Duquesne mine | Patagonia |
| | Hardshell mine | Harshaw |
| McFarland & Hullinger | Brick mine | Oro Blanco |
| McIntosh | Montosa mine group | Tyndall |
| McNamee | World's Fair mine | Harshaw |
| MacGregon | Gold Hill mine | Nogales |

Table 3, Cont.

| NAME | PROPERTY | DISTRICT |
|---|---|---|
| Magoffe | San Ramon mine group | Tyndall |
| Majalca & Lizaraga | Golden Gate mine | Patagonia |
| Majalca Brothers | Smuggler & Texas mine | Patagonia |
| Maloney | Buena Vista mine | Patagonia |
| Mansfield & Ryan | Mansfield mine group | Wrightson |
| Mansfield Mining & Smelting Co. | Mansfield mine group | Wrightson |
| Manson Mining Co. | San Ramon mine group | Tyndall |
| Manson Mining Co. | San Ramon mine group | Tyndall |
| Maravilla Mineras Corp. | Montana mine group | Oro Blanco |
| Marcia Brothers | American mine | Harshaw |
| Margarita Gold Mines Co. | Margarita mine group | Oro Blanco |
| Mar-Pak Corp. | Kansas mine | Patagonia |
| Marsteller | Bender, Black Eagle, and Hermosa mines | Harshaw |
| Means | St. Patrick mine | Pajarito |
| Melba Mining Co. | Alta mine | Harshaw |
| Melville Syndicate | Tres de Mayo mine group | Palmetto |
| Merrill & Otero | Royal Blue mine group | Tyndall |
| Metler | Mowry mine | Patagonia |
| | Rock Candy Mountain mine | Greaterville |
| Miami Copper Co. | Santo Nino mine | Patagonia |
| Michels | Gladstone mine group | Patagonia |
| Michelski | Compadre mine group | Tyndall |
| Miller | Brick mine; Montana and Rubiana mine groups | Oro Blanco |
| | Jefferson mine | Tyndall |
| | Salvadore mine | Harshaw |
| | Sunset mine group | Pajarito |
| Miller & Associates | Flux mine | Harshaw |
| Miller & Sheerer | Castle Butte mine | Wrightson |
| Mining & Commercial Corp. | Flux mine | Harshaw |
| Mitchell | Mowry mine | Patagonia |
| Monarch Mining & Milling Co. | Tres de Mayo mine group | Palmetto |
| Montana Co. | Montana mine group | Oro Blanco |

| | | |
|---|---|---|
| Montana Mines Operations, Eagle-Picher Lead Co. | Montana mine group | Oro Blanco |
| Moore | San Juan mine | Oro Blanco |
| Moreno | Alto and San Ramon mine groups | Tyndall |
| Morning Glory Mining Co. | Morning Glory mine | Patagonia |
| Morning Glory Mining & Smelting Co. | Morning Glory mine | Patagonia |
| Morrison | Trench mine | Harshaw |
| Mowry | Mowry mine | Patagonia |
| Mowry Mines Co. | Mowry mine | Patagonia |
| Mumme Mining Co. | Basin and Buffalo mine groups | Harshaw |
| Nash & McFarland | Flux mine | Harshaw |
| Nash Mines | Belmont, Bonanza, Dave Allen, Double Standard, Duquesne, Empire, Estelle & Louise, Holland, Illinois, Indiana, Kansas, Maine, Manzanita, Mary Jane, Pride of the West, San Antonio, Silver Bell, and Smuggler & Texas mines | Patagonia |
| National Consolidated Mining Co. | National mine | Patagonia |
| Neal & Henderson | Morning Glory mine | Patagonia |
| Nelson | New Hope mine group | Palmetto |
| New State Mining Co. | Elephant Head mine group | Tyndall |
| Newcomer | Tres de Mayo mine group | Palmetto |
| Newman | Jefferson mine | Tyndall |
| Noon | Choctaw, Oro Fino, and Tres Amigos Lead mines; Austerlitz mine group | Oro Blanco |
| North Star Mines Inc. | Yellow Jacket mine | Oro Blanco |
| North Star Mining & Development Co. | Idaho mine group | Oro Blanco |
| Nuttall & Snyder | Jefferson mine | Tyndall |
| O'Keefe | Wandering Jew mine | Tyndall |
| Old Dominion Mining & Reduction Co. | Two Brothers mine | Nogales |
| O'Neil & Candelaria | Bonanza mine | Tyndall |
| Orion Co. | Montana mine group | Oro Blanco |
| Oro Blanco Mines Co. | Dos Amigos, Oro Blanco (White Gold), and Tres Amigos mines | Oro Blanco |
| Oro Blanco Mining Co. | Oro Blanco (White Gold) and Tres Amigos mines; Austerlitz mine group | Oro Blanco |
| Oro Fino Mining Co. | Oro Fino mine | Oro Blanco |

Table 3, Cont.

| NAME | PROPERTY | DISTRICT |
|---|---|---|
| Oro Verde Mining Co. | Lucky Shot mine group | Oro Blanco |
| Orosco | Bonanza mine | Tyndall |
| Otero & Hunter | Loma de Manganese | Oro Blanco |
| Panick | Kansas mine | Patagonia |
| Parker & Reid | Connecticut mine | Tyndall |
| Parks | Anaconda mine group | Wrightson |
| Parrish | Brown Bird mine group | Oro Blanco |
| Patagonia Metal Co. | Bender mine | Harshaw |
| Patagonia Mining Co. | Flux mine | Harshaw |
| Perkins & Medina | Annie mine | Patagonia |
| Pesano | Old Glory mine group | Oro Blanco |
| Peterson | Golden Gate and Mowry mines | Patagonia |
| Pierce | Bowling Green, Joplin, Lee, and Victor mines | Tyndall |
| | Mansfield mine group | Wrightson |
| Pierce & Gardner | Black Eagle mine | Harshaw |
| Pioneer Smelting Co. | Morning Glory mine | Patagonia |
| Platoro Corp. | Austerlitz mine group | Oro Blanco |
| Pomona Mining Co. | Redberry & Hidden Tunnel mines | Greaterville |
| Powers | Blue Nose, Trench, and World's Fair mines | Harshaw |
| | Bland mine | Tyndall |
| | Dixie mine; Mansfield mine group | Wrightson |
| Powers & Stockton | Elephant Head mine group | Tyndall |
| Pride of the West Mining Co. | Kansas mine | Patagonia |
| Prietus Mines Co. | Hermosa mine | Harshaw |
| Progressive Mining Co. | Old Soldier mine | Oro Blanco |
| Proto Brothers | Gladstone and Proto mine groups | Patagonia |
| Pyeatt | San Juan mine; Warsaw mine group | Oro Blanco |
| | Sunset mine group | Pajarito |
| Queen Mining Co. | California-Grasshopper mine group | Patagonia |
| Radon Mining Co. | Pride of the West mine | Patagonia |
| Randall | Edna mine group | Patagonia |

| | | |
|---|---|---|
| Rawson | Columbia mine group | Nogales |
| Raymond & Bostwick | Gladstone mine group | Patagonia |
| Reagan Bros. & Peck | Reagan mine group | Nogales |
| Reay & Setka | Yellow Jacket mine | Oro Blanco |
| Red Cloud Mining Co. | Montezuma & La Paz mines | Tyndall |
| Red Rock Mining Co. | Uncle Sam mine group | Nogales |
| Reichert | Arizona-Pittsburg mine | Tyndall |
| Reid | Connecticut mine; Compadre mine group | Tyndall |
| | Happy Thoughts mine | Patagonia |
| Reid & Jarhagin | Happy Thoughts mine | Patagonia |
| Reyes | Gold Hill & Blue Ribbon mine group | Oro Blanco |
| Rhea Mining Co. | Christmas Gift or Horseshoe mine | Harshaw |
| Richardson | California, Flux, Hardshell, Trench mines; Aztec mine group | Harshaw |
| | Connecticut mine | Tyndall |
| | Three-R mine group | Palmetto |
| Richmond | Gringo mine group | Wrightson |
| Rochine | Salvadore mine | Harshaw |
| Roscoe | Humboldt mine | Harshaw |
| Roxy Mining Co. | Warsaw mine group | Oro Blanco |
| Roy & Titcomb | Roy mine | Patagonia |
| Royal Blue Mining & Milling Co. | Royal Blue mine group | Tyndall |
| Royal Blue Mining Co. | Royal Blue mine group | Tyndall |
| Ruby Copper Co. | Lee mine | Tyndall |
| Russell | Bland mine | Tyndall |
| St. Clair | Triangle mine | Oro Blanco |
| Salero Mines Co. | Salero mine; Eureka-Marble mine group | Tyndall |
| Salero Mining Co. | Salero mine | Tyndall |
| Salisbury | Pride of the West mine | Patagonia |
| Santa Cruz Silver-Lead Co. | Glove mine group | Tyndall |
| Santa Rita Mining Co. | Good Luck mine | Tyndall |
| Sam Knight Mining Lease | Bonanza mine | Patagonia |
| San Ramon Mines | San Ramon mine group | Tyndall |
| Sanders | Comodore mine | Oro Blanco |
| Santa Cruz Mining & Smelting Co. | Mowry mine | Patagonia |
| Santa Rita Mining Co. | Apache mine | Tyndall |
| Santo Nino Lessees | Santo Nino mine | Patagonia |

Table 3, Cont.

| NAME | PROPERTY | DISTRICT |
|---|---|---|
| Santo Nino Mining Co. | Santo Nino mine | Patagonia |
| Scheler | Black Eagle mine | Harshaw |
| Scheley | Humboldt mine | Harshaw |
| Schell | World's Fair mine | Harshaw |
| Security Mining Co. | Royal Blue mine group | Tyndall |
| Setka | Gold Hill & Blue Ribbon mine groups | Oro Blanco |
| Sheehy | Loma de Manganese mine; Gold Hill & Blue Ribbon mine groups | Oro Blanco |
| | Frisco Fair mine group | Red Rock |
| | Glove mine group | Tyndall |
| Sim | Roy mine | Patagonia |
| Skunk | Ostrich mine | Oro Blanco |
| Smuggler Gulch Gold Mining Co. | Smuggler Gulch mine group | Oro Blanco |
| Sonoita Copper Co. | Sonoita mine group | Palmetto |
| Sortillon | Salero mine | Tyndall |
| Soto | Black Eagle and Blue Eagle mines | Harshaw |
| Soto & Lizarraga | Indianapolis mine | Patagonia |
| Southern Arizona Mining & Smelting Co. | Morning Glory mine | Patagonia |
| Southern Copper Mines Co. | Santo Nino mine | Patagonia |
| Southwest Development Co. | Alto mine group | Tyndall |
| Squaw Gulch Mining & Milling Co. | Mohawk mine | Tyndall |
| Steinfeld & Co. | Alto mine group | Tyndall |
| Steinfeld & Swain | Mowry mine | Patagonia |
| Sterling Development Co. | Flux mine | Harshaw |
| Still Bros. Mining Co. | Bender mine | Harshaw |
| Stockton | Castle Butte mine | Wrightson |
| | Domino, Jarillas, and Tres de Mayo mine groups | Palmetto |
| Stone | Mowry mine | Patagonia |
| Strong & Harris | Sunnyside & Volcano mines | Harshaw |
| Stump & Frame | Uncle Sam mine group | Nogales |
| Sullivan | Gladstone and Proto mine groups | Patagonia |
| Sunrise Mining Co. | Glove mine group | Tyndall |

| | | |
|---|---|---|
| Taft Mining & Exploration Co. | Tres de Mayo mine group | Palmetto |
| Taylor & Barclay | Three-R mine group | Palmetto |
| Thompson | Maine mine | Patagonia |
| | Austerlitz mine group | Oro Blanco |
| Three-R Mines, Inc. | Three-R mine group | Palmetto |
| Three-R Mining & Milling Co. | Three-R mine group | Palmetto |
| Tiajuana Mines, Inc. | Tiajuana mine | Tyndall |
| Tobin & Beasley | Ivanhoe mine | Tyndall |
| Tobin & Pond | Eureka-Marble mine group | Tyndall |
| Todd | Gladstone mine group | Patagonia |
| Trench Consolidated Mining Co. | Trench mine | Harshaw |
| Trench Mining Co. | Trench and World's Fair mine | Harshaw |
| Trenton Mining Co. | Trenton mine | Tyndall |
| Tully | Grubstake mine | Oro Blanco |
| Valenzuela | Hardshell mine | Harshaw |
| | Roy mine | Patagonia |
| Vanderwalker Brothers | Golden Gate Mine | Patagonia |
| Vargas | Sweetwater mine | Greaterville |
| Ventura Mines, Inc. | Ventura mine group | Palmetto |
| Verfuth & Co. | Wandering Jew Mine | Tyndall |
| Victor Mining Co. | Victor mine | Tyndall |
| Washington Trading Co. | Blue Lead mine | Tyndall |
| Weaver | Victor | Tyndall |
| Wechler | Margarita mine group | Oro Blanco |
| Weir | Salero mine | Tyndall |
| White Tail Mining Co. | Jesuit mine | Tyndall |
| Wifley | Pride of the West mine | Patagonia |
| Williams | Oro (El Oro) and Oro Fino mines | Oro Blanco |
| Wilson | California mine | Harshaw |
| | Gold Hill mine | Nogales |
| | Morning Glory mine | Patagonia |
| Wingfield & Farrel | Vulcan mine group | Tyndall |
| Wolfe & Farmer | Columbia mine group | Nogales |
| Woodruff | Golden Gate mine | Patagonia |
| World's Fair Development Co. | World's Fair mine | Harshaw |
| World's Fair Mining Co. | World's Fair mine | Harshaw |
| Wrightson Brothers | Montezuma & La Paz and Salero mines | Tyndall |

Table 3, Cont.

| NAME | PROPERTY | DISTRICT |
|---|---|---|
| Yellow Jacket Mines Co. | Yellow Jacket mine | Oro Blanco |
| Young & Gardner | Santo Nino mine | Patagonia |
| Zeckendorf | Montana mine group | Oro Blanco |
| Zero Mining Co. | World's Fair mine | Harshaw |

# TABLE 4
# INDEX OF MINING PROPERTY

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| I. Greaterville District (East slope of Santa Rita Mountains, only partly within Santa Cruz County to the north of Gardner Canyon) | 20S | 15E | ---- | Cu, Ag, Au, Pb, Zn, Onyx marble (travertine) | 1. Irregular and spotty copper and minor lead and zinc mineralization with silver and weak gold values. Oxidized near the surface. Controlled by major fault zones and intrusive contacts in strongly folded and faulted Triassic and Cretaceous sedimentary and volcanic rocks intruded by Triassic (?) to Tertiary plugs and dikes.<br>2. Onyx marble (travertine) deposit in a solution cave in faulted slices of Permian limestone. | Relatively small shaft and tunnel operations. Prospected and mined intermittently up into the 1960's. Total production would amount to some 2,000 tons of ore containing about 20 tons of copper, 6,300 ounces of silver, 12 ounces of gold and a few hundred pounds of lead. Only a small amount of onyx marble was extracted. | Schrader, 1915, p. 152-153<br>Drewes, 1971a, 1971b, 1972a, 1972b, 1973<br>ABM file data |
| 1. Cave Hill deposit (Onyx Cave) | 20S | 15E | SW ¼ 1 Protracted | Onyx marble (travertine) | Relatively small deposit of partially massive, brownish travertine in a solution cave in faulted Permian limestone. | Very minor operations in the early 1910's extracted a few blocks. | U.S.G.S. Min. Res., 1913 Pt. 2, p. 1344 |
| 2. Red Berry & Hidden Tunnel mines (Pomona Mg. Co.) | 20S | 15E | E. Cen. & SE ¼ 10 Protracted | Cu, Ag, Au- | Spotty, oxidized, argentiferous copper mineralization along a strong fault zone cutting Cretaceous sedimentary and volcanic formations. | Shallow shaft operations. Some 1,240 tons of ore, averaging about 0.8% Cu, 2.5 oz. Ag/T, and trace of Au/T shipped in 1947. | ABM file data |
| 3. Rock Candy Mountain mine (Bossinger & Reed, Metler, El Toro Mg. Co.) | 20S | 15E | NE ¼ 8 NW ¼ 9 Protracted | Cu, Ag, Pb-, Au- | Spotty, irregular, largely oxidized, argentiferous copper mineralization along an intrusive contact of Triassic (?) quartz diorite and Triassic volcanics. | Shaft and tunnel operations. Worked intermittently from 1933 to 1955, producing some 125 tons of ore averaging about 6% Cu, 22 oz. Ag/T, and minor Pb and Au. | ABM file data |
| 4. Sweetwater mine (Vargas) | 20S | 15E | NE ¼ 10 Protracted | Cu, Ag | Spotty, oxidized copper mineralization along a strong fault zone between Cretaceous conglomerate and Triassic volcanics. | Shallow workings. Some 90 tons of ore averaging about 1.5% Cu and 0.8 oz. Ag/T shipped in 1963. | ABM file data |
| II. Harshaw District (Northeastern Patagonia Mountains) | 22-23S | 15-16E | ---- | Zn, Pb, Ag, Cu, Au, Mn (F, Ba, alunite) | 1. Irregular and lensing lodes and veins of argentiferous lead mineralization with varying zinc, copper and minor gold along fault fissures and in breccia zones in Jurassic-Triassic, Cretaceous, and Laramide andesitic and rhyolite volcanics, probably intruded below by a Laramide granitic body. Some replacement of interbedded limestone in volcanics. Silver enrichment near the surface. | Shaft, tunnel, adit, and open pit operations. Developed and mined from about 1850's to the middle 1960's. Total production would be some 1.3 million tons of ore containing about 86 thousand tons of zinc, 72 thousand tons of lead, 9.2 million ounces of silver, 3.1 thousand tons of copper and 4.3 | Schrader, 1915, p. 245-279<br>Kartchner, 1944<br>Moores, 1972<br>Simons, 1974<br>ABM file data |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | 2. Disseminations and fracture fillings of copper mineralization, with varying lead and zinc, in brecciated zones in Cretaceous andesite.<br>3. Irregular mantos, lenses, and pods of manganese-silver ore as replacements in silicified, altered, and brecciated Paleozoic limestone and Jurassic-Triassic volcanics and agglomerate.<br>4. Small, spotty, and generally low grade gold placer deposits. | thousand ounces of gold. An estimated 10,000 long tons of manganese ore of variable grade also was produced, much of it as an argentiferous smelter flux. Placer gold output is unknown but probably minor. | |
| 1. Alta mine (Melba Mg. Co.) | 23S | 16E | Cen. 4 Protracted | Pb, Ag, Zn, Cu, Au- (F) | Narrow, spotty, and lensing ore shoot of argentiferous galena, pyrite, sphalerite, minor chalcopyrite, specularite, and ruby silver in a fault-fissure vein and wall rock breccia in Jurassic-Triassic rhyolitic volcanics. Quartz and reddish fluorite gangue. High grade silver halides in oxidized surface zone. Associated rhyolite dikes. | Incline shaft operations. Worked intermittently in late 1870's, early 1880's, and to minor degree into 1900's. Estimated production of some 3,500 tons of ore averaging about 35% Pb, 10 oz. Ag/T, 1% Cu and minor Au. | Schrader, 1915, p. 271-272<br>Baker, 1962<br>Moores, 1972<br>ABM file data |
| 2. American mine (Marcia Bros., Giacoma) | 23S | 16E | W. Cen. 4 Protracted | Ag, Pb, Zn, Cu-, Au- | Lensing quartz vein and replacement lenses with argentite, cerargyrite, pyrite, sphalerite, galena, and tetrahedrite in a silicified limestone conglomerate within Cretaceous andesite. Spotty high grade silver values in oxidized surface zone. Closely associated Jurassic-Triassic volcanics. | Tunnel, adit, shaft, and glory hole operations. Produced intermittently, from 1880's to 1943, some 7,800 tons of ore averaging about 21 oz. Ag/T, 2% Pb, minor Cu and Au, and some oxidized zinc ore. | Schrader, 1915, p. 277-278<br>Moores, 1972<br>ABM file data |
| 3. Aztec mine group (Andes group; Richardson) | 22S | 16E | N. Cen. 19 | Cu, Ag-, Au- | Disseminated and small banded lenses of copper carbonates, chalcocite, pyrite, chalcopyrite and bornite in a strongly sericitized fracture zone in Laramide rhyolite. | Tunnel, incline shaft, and open cut operations. A few tens of tons of 7% Cu ore produced in the early 1900's. | Schrader, 1915, p. 263-264<br>ABM file data |
| 4. Basin mine group (Wieland group, Dewey, Great Silver, Red Rock; Mumme Mg. Co.) | 22S | 16E | Cen. & E. Cen. 33 | Ag, Pb, Cu, Au- | Deeply oxidized, siliceous, lensing, quartz-shear veins, containing argentiferous galena, chalcopyrite, and tetrahedrite, cutting crushed and altered Cretaceous andesite volcanics with interbedded silicated limestone and shale. Rhyolite intrusives. | Shafts, adits, tunnels, and open cuts. Worked in 1880's and early 1900's. Produced some 100 tons of ore averaging about 15 oz. Ag/T, 5.5% Pb, and 4.5% Cu. | Schrader, 1915, p. 275-276<br>ABM file data |
| 5. Bender mine (Fernando, Mina Prieta; American Minerals Chemical Co., Patagonia Metal Co., Marsteller, Cleveland, Beyerle, Still Bros. Mg. Co.) | 23S | 16E | S. Cen. 4 Protracted | Mn, Ag, Pb-, Zn-, Cu- | Erratic and irregular replacements and open space fillings of argentiferous manganese oxides with minor lead, zinc, and copper along the fault contact of dense, silicified Jurassic-Triassic rhyolite and unaltered Paleozoic limestone. | Open cut and adit operations. Some 50 tons of 20 oz. Ag/T ore produced in the late 1800's and in 1937. During W. W. I. and from 1952 to 1955, about 6,000 long tons of manganese ore shipped to government buying stations. | Farnham et alia, 1961, p. 165-168<br>Moores, 1972<br>ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| 6. Black Eagle mine (Kempton & O'Neill, Pierce & Gardner, McCutchen, Hogan, Scheler, Alvarez, Soto, Marsteller) | 23S | 16E | S. Cen. 4 Protracted | Mn, Ag, Pb-, Cu-, Au- | Irregular, discontinuous, lenticular, argentiferous manganese oxides and sulfide, silver halides, and minor lead, copper, and gold in fault breccia in Jurassic-Triassic rhyolite and Paleozoic limestone. | Adit and incline shaft operations. Produced sporadically, from early 1900's to 1940, some 4,900 tons of manganiferous ore averaging about 22 oz. Ag/T with minor Pb, Cu, and Au. | Wilson & Butler, 1930, p. 95 Farnham et alia, 1961, p. 168-170 Moores, 1972 ABM file data |
| 7. Blue Eagle (Hale, Ewing, Soto) | 22S | 16E | W. Cen. 30 | Cu, Ag, Au-, Pb-, Zn- | Partly oxidized bornite, pyrite, chalcopyrite, galena and sphalerite with argentite in a well-banded quartz vein along a fault zone between Jurassic-Triassic rhyolite volcanics and strongly silicified sediments. Marked by a pyritic gossan. | Tunnel operations. Produced sporadically, in the early 1900's and in 1956, some 130 tons of ore averaging about 10% Cu, 11 oz. Ag/T and minor Pb, Zn, and Au. | Schrader, 1915, p. 257-258 ABM file data |
| 8. Blue Nose mine (Abe Lincoln, War Horse, Big Chief, Big Jim, Blue Nose Extension; Powers, Arizona Patagonia Silver Mg. Co., Hogan, Big Jim Mines, Inc., Beyerle, Brown) | 23S | 16E | N. Cen. 8 Protracted | Ag, Pb, Zn, Cu-, Au-, Mn- (Bi) | Pockety, argentiferous galena, sphalerite, and minor chalcopyrite and tetrahedrite, partly oxidized, along sheeted fractures close to a major fault zone in Jurassic-Triassic volcanics with interbedded limy siliceous sediments. Psilomelane, pyrolusite, and rhodochrosite in the gangue. | Shaft and tunnel operations. Worked intermittently from early 1880's to 1956, producing some 13,000 tons of ore averaging about 18 oz. Ag/T, 2% Pb, 1% Zn, 0.5% Cu and minor Au. | Schrader, 1915, p. 278-279 ABM file data |
| 9. Buffalo mine group (Lead Queen, Golden Rose, Jefferson group, Wieland group; Jefferson Mg. Co., Mumme Mg. Co.) | 22S | 16E | NW ¼ 33 | Pb, Ag, Zn, Cu, Au- (Ba) | Narrow quartz-barite veins containing rich, oxidized lead-silver ore in the upper part and mixed argentiferous lead, zinc and copper sulfides in depth. Wall rocks are Cretaceous andesite and rhyolite volcanics. | Shaft and tunnel operations. Produced some 500 tons of ore averaging about 21% Pb, 20 oz. Ag/T, 3% Zn, 2% Cu and minor gold prior to 1900. Few tons produced in 1900's. | Schrader, 1915, p. 276-277 ABM file data |
| 10. California mine (Richardson, Allison Bros., Flux Extension Mg. Co., Wilson) | 22S | 16E | W. Cen. 30 | Pb, Ag, Zn, Cu, Au- | Northward extension of Flux mine mineralization. Small lode-type deposit of argentiferous lead, zinc, and minor copper and gold mineralization along a fault-fissure zone cutting crushed, altered, and silicified Jurassic-Triassic rhyolitic volcanics and fault blocks of Paleozoic limestone. | Shaft and tunnel operations. Worked sporadically from 1890's to 1920, producing some 300 tons of ore averaging about 15% Pb, 6 oz. Ag/T and minor Cu and Au. | Schrader, 1915, p. 261 ABM file data |
| 11. Christmas Gift or Horseshoe mine (Bland Mg. Co., Henderson, Rhea Mg. Co.) | 22S | 16E | N. Cen. 16 | Ag, Pb, Cu-, Au- | Spotty and irregular argentiferous lead carbonate with minor copper and gold in a narrow fissure vein in Laramide andesite. | Relatively shallow shaft operations. Produced intermittently, from 1890 to 1938, some 100 tons of ore averaging about 40 oz. Ag/T, 20% Pb, and minor copper and gold. | Schrader, 1915, p. 265 ABM file data |

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| 12. Flux mine (Goshen; Richardson, Arizona Gold & Copper Co., Patagonia Mg. Co., Sterling Development Co., Flux Mg. Co., Allen & Kolberg, Alverez, Miller & Assoc., Encinas, Mining & Commercial Corp., Am. Smltg. & Refg. Co., Nash & McFarland) | 22S | 16E | SW ¼ 30 | Zn, Pb, Cu, Ag, Au- | Intersecting quartz-lode veins containing irregular ore shoots of rich argentiferous cerussite with minor copper oxides and silicate in the upper oxidized zone and galena, sphalerite, pyrite, and chalcopyrite in depth. Veins are along a complex fault zone involving blocks of Jurassic-Triassic volcanics, Paleozoic limestone, and Cretaceous shale. Strong brecciation and silicic, kaolinite-montmorillonite, chloritic, and propylitic wall rock alteration. Pyrite gossan at surface. | Extensive shaft and tunnel operations. Work by Mexicans as early as 1850's and mined up to 1963. Total estimated and recorded production would be some 850,000 tons of ore averaging about 8% Zn, 5% Pb, 2.5% Cu, 5 oz. Ag/T and minor Au. | Schrader, 1915, p. 258-263<br>Kartchner, 1944<br>ABM file data |
| 13. Hardshell mine (Richardson, Empire Mg. & Mllg. Co., Hardshell Mg. Co., Gardner & Young, Bender, Big Jim Mines Inc., Valenzuela, Am. Smltg. & Refg. Co., McFarland) | 23S | 16E | Cen. 4 Protracted | Pb, Ag, Mn, Cu-, Zn-, Au- | Irregular, lensing orebodies and ore shoots of ferruginous and manganiferous, argentiferous cerussite, complex lead and zinc oxidation products, cerargyrite and other silver halides, and spotty copper and gold as replacement of fault gouge and silicified fault breccia in a strong fault zone. Wall rocks are Jurassic-Triassic volcanics and Cretaceous andesite with thin interbedded limestone, shale, and conglomerate. Some spotty high grade manganese oxide areas. Cretaceous dioritic and andesitic dikes present. Generally weak, base metal sulfides found in depth. | Extensive shaft and adit operations. Worked from about 1896 through 1964, producing some 35,000 tons of ore averaging about 6% Pb, 8 oz. Ag/T, 0.5% Cu and minor Zn and Au; and about 1,000 tons of Mn ore and concentrate averaging about 40% Mn. | Schrader, 1915, p. 265-271<br>Jones & Ransome, 1920, p. 174-177<br>Wilson & Butler, 1930, p. 91-94<br>Farnham et alia, 1961, p. 170-171<br>Moores, 1972<br>ABM file data |
| 14. Hermosa mine (Hermosa Mg. Co., Prietus Mines Co., Finley, Hermosa Mg. & Mllg. Co., Marsteller) | 23S | 16E | SE ¼ 4 | Ag, Mn, Pb-, Cu-, Au-, Mo- | Irregular, tabular, oxidized quartz-lode with high grade pockets of cerargyrite and other silver chlorides in fracture fillings and replacements of Jurassic rhyolite and latite porphyry breccia along a fault zone. Considerable iron and manganese, and minor molybdenum staining of wall rocks and quartz. Weak oxidized base metal mineralization. | Extensive incline shaft and tunnel workings. From 1870's to 1900 and in 1908 and 1949-1950, some 70,000 tons of better than 20 oz. Ag/T manganese-silver ore mined and shipped. Largely used as smelter flux. | Schrader, 1915, p. 272-274<br>Moores, 1972<br>ABM file data |
| 15. Humboldt mine (Harrington & Gillespie, Humboldt Mg. & Reduction Co., Scheley, Roscoe, Chapman) | 23S | 16E | N. Cen. 5 Protracted | Pb, Ag, Zn, Cu, Au- | Narrow, lensing vein, containing argentiferous cerussite in the oxidized zone and spotty argentiferous galena, pyrite, sphalerite, bornite, tetrahedrite, and chalcopyrite with rhodochrosite in depth, along a fault fissure zone cutting Laramide rhyolite and agglomerate. Strong pyritization and alteration with some disseminated chalcopyrite. Shear zones with galena in the vein walls. | Shaft and tunnel operations. Worked intermittently from the late 1880's to 1952, producing some 1,200 tons of ore averaging about 7% Pb, 19 oz. Ag/T, 1.5% Zn, 1% Cu and minor Au. | Schrader, 1915, p. 251-252<br>Kartchner, 1944<br>ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
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| 16. January & Norton mine group (Padres, Blue Flag & Red Bird, Uncle George; Blue Flag Mg. Co., Farrell, January Mines Co., Big Jim Mines Inc., Am. Smltg. & Refg. Co.) | 22S | 16E | SE ¼ 32 | Zn, Pb, Ag, Cu-, Au- (Mn) | Strong and persistent quartz vein, with rich argentiferous cerussite in the oxide zone and sphalerite, pyrite, galena, and minor chalcopyrite in depth, in a fault zone cutting altered Cretaceous andesite. Wall rock locally strongly pyritized and propylitized. Manganese and iron oxide gassen. Alum and sulfur leaching from the dump. | Operations from shafts and neighboring Trench mine. Worked from early 1870's for high grade silver and in 1925-1928 and 1944-1949 for zinc and lead. Total production probably some 71,000 tons of ore averaging about 6% Zn, 4% Pb, 7 oz. Ag/T, and minor Cu and Au. | Schrader, 1915, p. 252-253<br>Kartchner, 1944<br>ABM file data |
| 17. Salvadore mine (Hermosa Mg. Co., Miller, Rochine, Farrell, Byrd, Brown) | 23S | 16E | Cen. 4 Protracted | Ag, Mn, Pb-, Cu-, Zn-, Au- | Shear veins and replacement bodies of manganiferous silver ore in faulted, brecciated, silicified, and kaolinized limestone conglomerate and rhyolite in Jurassic-Triassic volcanics. Minor, mostly oxidized, base metal sulfides and gold. | Open cut, adit, and shaft operations. Some 1,000 tons of 30 oz. Ag/T ore mined in the 1880's and 2,800 tons of 20 oz. Ag/T with minor Pb, Cu, Zn, and Au and high Mn content shipped in 1936-1944. | Schrader, 1915, p. 275<br>Farnham et alia, 1961, p. 171-173<br>Moores, 1972<br>ABM file data |
| 18. Sonoita Creek-Alum Canyon placers | 22S | 15E | SW ¼ 13<br>SE ¼ 14<br>NE ¼ 23<br>NW ¼ 24 | Au, Pb | Spotty and irregular gold and native lead in Quaternary gravels with interbedded rhyolite tuff underlying eroded terrace at junction of Sonoita Creek and Alum Canyon. | Worked in small way by jigging in 1870's and 1880's. No record of production but probably minor. | Schrader, 1915, p. 279 |
| 19. Sunnyside & Volcano mines (Includes Pina, Horseshoe, and others; Farrell, Lenon & Vasquez, Strong & Harris) | 23S | 16E | E. Cen. 6 Protracted | Cu, Ag, Pb-, Zn-, Au- | Mineralized and silicified shear zone containing copper carbonates and minor tenorite, chalcopyrite, galena, and sphalerite, along a fault cutting Laramide rhyolite conglomerate and porphyry. | Shallow shafts and open cuts. Worked in late 1890's and sporadically through 1953. Some 1,600 tons of picked ore averaged about 8% Cu, 1.6 oz. Ag/T, and minor Pb, Zn, and Au. | Schrader, 1915, p. 254-256<br>Karchner, 1944<br>ABM file data |
| 20. Trench mine (Includes Josephine; Col. Titus, Hogan, Powers, Farrell, Morrison, Richardson, Trench Consolidated Mg. Co., Wilson, Trench Mg. Co., Gold Canyon Mg. Co., Am. Smltg & Refg. Co.) | 23S | 16E | NE ¼ 5 Protracted | Pb, Zn, Ag, Cu-, Au-, Mn | Lensing, banded, porous, and drusy vein containing argentiferous cerussite, smithsonite, manganese carbonate (rhodochrosite) and oxides, and iron oxides with quartz in oxidized zone and base metal sulfides, pyrite, tetrahedrite, freibergite, pearcite, and manganese sulfide (alabandite) in depth. Wall rock is Cretaceous andesite cut by rhyolite intrusions. Strong pyrite gossan. | Extensive shaft operations. Worked from late 1850's to late 1890's, and from 1918 to 1945. Produced some 237,000 tons of ore averaging about 8.5% Pb, 6.3% Zn, 13 oz. Ag/T and minor Cu and Au. | Schrader, 1915, p. 253-254<br>Kartchner, 1944<br>ABM file data |

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| 21. World's Fair mine (McNamec, Powers, World's Fair Development Co., World's Fair Mg. Co., Zero Mg. Co., Trench Mg. Co., Schell) | 22S | 16E | W. Cen. 32 | Ag, Pb, Cu-, Zn-, Au- | Narrow fissure veins with rich argentiferous cerussite in the oxidized zone and argentiferous galena, pyrite, tetrahedrite, freibergite, sphalerite and silver antimonides with quartz and barite in depth. The veins are along the contact between Cretaceous andesite and Laramide rhyolitic volcanics containing some limestone blocks. Wall rocks are strongly propylitized and pyritized. Some antimonial silver ore rich in gold. Strong pyrite gossan. Disseminated silver values in wall rocks. Some native silver. | Extensive tunnel and shaft operations. Worked from the early 1880's to 1954 and produced some 13,000 tons of ore averaging about 58 oz. Ag/T, 6.6% Pb, 0.7% Cu, and minor Au and Zn. | Schrader, 1915, p. 248-251<br>Kartchner, 1944<br>ABM file data |
| III. Nogales (Gold Hill) District (Mount Benedict area between Santa Cruz River and Nogales Wash) | 23S | 14E | ---- | Au, Pb, Ag, Cu, W (Mo) | 1. Irregular fissure veins, with spotty, often banded, pyrite, cerussite, galena, and minor copper carbonates and sulfides, in Jurassic quartz monzonite that has been strongly sliced by sheeted fracturing and intruded by aplite, granite porphyry, diorite, lamprophyre, and diabase dikes.<br>2. Irregular and lensing, comb structured, quartz-wulframite veins with minor scheelite associated with lamprophyre dikes cutting Jurassic quartz monzonite.<br>3. Spotty gold placer deposits reported in Guebabi Canyon (NE , T23S, R14E) and on east slope of Mt. Benedict. | Mostly shallow shaft, tunnel and open cut operations. Worked as early as the 1850's and sporadically up to 1967. Estimated and recorded production would amount to some 1,100 tons of ore containing about 1,019 oz. gold, 95 tons of lead, 14,200 oz. silver and 9 tons of copper. About 1,500 pounds of 50% $WO_3$ concentrates may have been shipped. Output from gold placers unknown but probably relatively small. | Schrader, 1915, p. 348-355<br>Simmons, 1974<br>ABM file data |
| 1. Columbia mine group (Silent Friend, Tumacacori; Wolfe & Farmer, Rawson) | 23S | 14E | NW ¼ 28 | Pb, Ag, Au, Cu- | Irregular shear zones containing banded lenses of quartz and crushed, sheared, and altered Jurassic quartz monzonite showing partly oxidized and spotty galena, pyrite, and chalcopyrite. Associated dark lamprophyric dikes. | Shaft, tunnel, adit, pit and open cut operations. Worked sporadically from prior to 1900 to 1941 producing some 100 tons of ore averaging about 5% Pb, 5 oz. Ag/T, 0.5 oz. Au/T, and up to 0.5% Cu. | Schrader, 1915, p. 352-353<br>ABM file data |
| 2. Dura mine group (International, Old Contest; Litchliter, Gleason) | 23S | 14E | SE ¼ 28 | Au, Pb, Ag, Sb-, Mo- | Lensing vein in a shear zone in altered Jurassic quartz monzonite with brecciated and crudely banded quartz, quartz stringers and altered wall rock. Irregular pockets and impregnations of galena, cerussite, pyrite, chalcopyrite, malachite, and minor stibnite and wulfenite. Associated pyritized lamprophyric dike. | Shaft and tunnel operations. Worked by Mexicans as early as the 1840's and intermittently up to 1900's. Possibly up to 100 tons of picked ore had high values in Au, Pb, and Ag. | Schrader, 1915, p. 350-351 |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| 3. Gold Hill mine (MacGregor, Clay, & Coughanour; Wilson, Anders & Demulling, Cheek) | 23S | 14E | E. Cen. 29 | Au, Pb, Ag | Narrow, irregular fissure veins of quartz and brecciated Jurassic quartz monzonite mineralized with spotty, partly oxidized, auriferous and argentiferous galena and minor chalcopyrite. Associated dark pyritized dikes. | Shallow pit, trench, and adit operations. Prospected in mid-1800's and mined sporadically into 1940's. Produced some 60 or more tons of ore averaging about 0.4 oz. Au/T, 3% Pb, and 2 oz. Ag/T. | ABM file data |
| 4. Reagan mine group (Reagan Bros. & Peck, Loftus) | 23S | 14E | SW¼ 7 NW¼ 18 | W | Lensing quartz fissure veins, comb structured and banded, with spotty wolframite and minor scheelite, cutting Jurassic quartz monzonite and in a dike swarm of chloritized and locally epidotized lamprophyre. Mineralization appears shallow, local, and pockety. | Pit and open cut operations. Wolframite discovered in 1906 and deposit worked sporadically in early 1900's and late 1930's. Estimated production would be about 1,500 lbs. of 50% $WO_3$ concentrates. | Hill, 1910<br>Schrader, 1915, p. 353-355<br>Wilson, 1941, p. 50<br>Dale et alia, 1960 p. 119-120<br>ABM file data |
| 5. Two Brothers mine (Old Dominion Mg. & Reduction Co.) | 23S | 14E | E. Cen. 29 | Au, Pb, Ag, Cu- | Irregular shear veins containing spotty, largely oxidized, auriferous and argentiferous lead and minor copper mineralization in roughly banded quartz and brecciated Jurassic quartz monzonite wall rock. Associated lamprophyre and diorite dikes. | Shallow shaft and tunnel operations. Worked sporadically from the mid-1800's to 1915. The production would be some 100 tons averaging about 0.8 oz. Au/T, 4% PB, 4 oz. Ag/T and minor Cu. | ABM file data |
| 6. Uncle San mine group (Hardscrabble; Ellis, Hogan, Driscoll, Stump & Frame, Hudgin, Red Rock Mg. Co.) | 23S | 14E | SE¼ 28 | Pb, Ag, Au-, Cu- | Shear veins of roughly banded quartz and brecciated, altered Jurassic quartz monzonite wall rock with largely oxidized argentiferous and auriferous galena and minor chalcopyrite. Many associated dikes. | Shaft operations. Prospected and worked for gold in mid-1800's and sporadically until 1967 with estimated and recorded production of some 250 tons of ore averaging about 9% Pb, 8 oz. Ag/T, and minor Cu. | Schrader, 1915, p. 351-352<br>ABM file data |
| IV. Old Baldy District (West slope Santa Rita Mountains, on drainage of that part of Madera Canyon which is within Santa Cruz County) | 20S | 14E | ---- | Cu-, Pb-, Zn-, Ag-, Au-, Mo- | Spotty and weak, partially oxidized, base metal sulfides with associated minor gold and silver values, with or without quartz, along shear zones in Laramide intrusives or metamorphosed volcanics. | Scattered, small, and generally shallow operations. Mostly prospects with no recorded production. | Schrader, 1915, p. 166-180<br>Whitacre, 1964<br>Drewes, 1971, 1972a, 1972b<br>ABM file data |
| V. Oro Blanco (Ruby) District (Oro Blanco Mountains area) | 22-23S | 10-11E | ---- | Pb, Zn, Au, Ag, Cu, Mn-, U- | 1. Irregular and lensing quartz veins with spotty, often oxidized, auriferous and argentiferous, base metal sulfides and pyrite in fracture fillings or as partial replacements | One major mining operation, the Montana mine, and many small, shallow operations and prospects throughout the district, some | Blake, 1899<br>Milton, 1913<br>Wilson et alia, 1934 (Rev. 1967), p. 187-192 |

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| | | | | | along faults and at fault intersections. Strong supergene enrichment of gold and silver. Host rocks are altered Cretaceous conglomerate and sandy sediments or Jurassic volcanic tuffs with local disseminated pyrite. Most deposits limited in extent and in depth. 2. Flat-dipping and shallow zones of quartz veinlets and stringers, locally containing gold and silver values and very minor base metal sulfides, usually associated with strong pyritization. Host rock is strongly fractured, sericitized Jurassic volcanic tuff. 3. Steeply-dipping, tabular and lensing, brecciated shear zones containing fine grained native gold and silver associated with finely crystalline quartz and weak iron and manganese oxides in Jurassic volcanic tuff. 4. Small gold-silver placers in several stream beds, derived from the weathering of the many small lode deposits. 5. Weak occurrence of manganese oxides. 6. Weak uranium mineralization in fracture zones in volcanic tuffs. | dating back to early Spaniards and Mexican work on the enriched surface outcrops. Estimated and recorded lode production of base and precious metals through 1972 would be some 909,000 tons of ore containing about 126 thousand ounces of gold, 4.6 million ounces of silver, 30.5 thousand tons of lead, 26.3 thousand tons of zinc, and 2.6 thousand tons of copper. Probably at least one thousand ounces of gold and two hundred ounces of silver has been recovered from placers. A small amount of sorted manganese ore was shipped from one deposit. No uranium ore was shipped. | Wilson & Fowler, 1951<br>Wilson, 1961, p. 82-83<br>Knight, 1970<br>ABM file data |
| 1. Alamo gold placer | 23S | 10E | SE ¼ 9<br>SW ¼ 10 | Au, Ag | Fine to coarse gold particles containing about 1:5 alloyed silver found in gravels of Alamo and neighboring gulches, derived from the weathering of numerous small gold-silver bearing veins and blanket-like deposits of the Oro Blanco Mountains. | Mostly crude operations prior to 1900. Estimated production would be several hundred ounces of gold-silver amalgom. | Blake, 1899<br>Wilson, 1961, p. 82-83<br>Johnson, 1972, p. 46-47<br>ABM file data |
| 2. Annie Laurie prospect | 23S | 11E | SW ¼ 8 | U-, Pb-, Zn-, Cu-, F- | Fissure zone between Jurassic rhyolite porphyry and Cretaceous sediments containing sparse pitchblende and secondary uranium minerals in the highly fractured rhyolite porphyry which also contains thin fracture fillings of calcite, sparse base metal sulfides, pyrite, and fluorite. Travertine at small spring shows some weak radioactivity. | Shallow prospect operations in 1948-1955. Some material shipped for testing but no commercial production. | U. S. AEC Prelim. Rec. Rpts, USGS-PRR 3/6/51; A-R-4, 1 & 2, 9/4/53 & 10/21/55<br>Wright, 1951<br>Anderson & Kurtz, 1955<br>Granger & Raup, 1962, p. 39-42<br>Knight, 1970 |
| 3. Austerlitz mine group (Thompson, Noon, Barkley, Border Mines Co., Canez, Oro Blanco Mg. Co., Platoro Corp.) | 22S | 10E | E. Cen. 36 | Au, Ag, Cu, Pb-, Zn- | Quartz-fissure veins with spotty and generally weak auriferous and argentiferous chalcopyrite, pyrite, tetrahedrite and minor galena and sphalerite; and silicified lens-like bodies of auriferous quartz veinlets and stringers. Wall rocks are Jurassic welded tuff in fault contact with Cretaceous sediments. Associated Tertiary intrusive quartz monzonite dikes. Weak wall rock alteration. Oxidation and supergene enrichment produced limited, rich, near surface ore. | Shaft and tunnel operations. Worked intermittently from late 1800's to 1963 and produced some 3,800 tons of ore averaging about 0.5 oz. Au/T, 12 oz. Ag/T, 1% Cu, and minor Pb and Zn. | Milton, 1913<br>Wilson et alia, 1934 (Rev. 1967), p. 190<br>Knight, 1970<br>ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| 4. Black Peak mine group (Foltz) | 23S | 10E | N. Cen. 11 | Au, Ag, Cu-, Pb-, Zn- | Irregular, narrow, and lensing, partly oxidized and enriched, quartz-fissure vein with weak base metal sulfides. Gold and silver halides in near surface zone. | Shallow operations. Some 120 tons of ore produced intermittently from 1910-1916, averaging about 0.6 oz. Au/T, 0.4 oz. Ag/T, and minor Cu and Pb. | ABM file data |
| 5. Brick mine (Miller, Crowder, McFarland & Hullinger) | 23S | 11E | NE ¼ 6 | Ag, Au, Cu-, Pb-, Zn- | Lensing, vuggy, quartz-fissure vein with calcite, disseminated fine grained pyrite, galena, sphalerite, chalcopyrite and tetrahedrite, in a fault zone intersection. Wall rock is partly propylitized brecciated and recemented Cretaceous conglomerate, Jurassic quartz latite tuff, and Laramide diorite. Native wire silver with gold and silver enrichment in oxidized zone. | Shaft and open cut operations. Old surface workings reopened in 1939 and produced intermittently to 1966 some 3,700 tons of ore averaging about 17 oz. Ag/T, 0.1 oz. Au/T and minor Cu. | Knight, 1970<br>ABM file date |
| 6. Brown Bird mine group (Blue Wing; Parrish, Hack) | 23S | 11E | Cen. 6 | Au, Ag, Cu-, Pb-, Zn- | Lensing quartz-fissure vein along contact zone of Jurassic quartz latite tuff and Laramide diorite. Spotty base metal sulfides. Enriched near the surface in gold and silver values. | Shallow shaft and open cut operations. Some 100 tons of ore averaging about 0.3 oz. Au/T, 4 oz. Ag/T and minor Cu produced from 1937 through 1940. | ABM file data |
| 7. California Gulch placers (Oro Blanco Viejo, Gold Bar; Gold Bar Mg. Co.) | 23S | 11E | S. Cen. 20<br>N. Cen. 29 | Au, Ag | Flour to small nuggets of gold with alloyed silver in a gravel terrace derived from numerous weathered gold-silver bearing veins, and blanket deposits along California Gulch, Warsaw Canyon, and their tributaries. | Mostly crude operations prior to 1900. Possibly up to 1,000 ounces of gold-silver amalgam produced. | Blake, 1899<br>Randolph, 1903<br>Bird, 1916<br>Girand, 1933<br>Wilson, 1961, p. 82-83<br>Johnson, 1972, p. 47<br>ABM file data |
| 8. Choctaw mine (Noon, Anderson, Fickett) | 22S | 10E | SE ¼ 24 | Pb, Zn, Ag, Cu-, Au- (Bi) | Intersecting, lensing, quartz-fissure veins, with disseminated and spotty sphalerite, galena, and minor pyrite, chalcopyrite, and argentite, partly oxidized, in Cretaceous conglomerate. Some minor bismuth mineralization. | Tunnel and shaft operations. Originally prospected in late 1800's but mainly worked from 1948 through 1950, producing some 420 tons of ore averaging about 7% each in Pb and Zn, 5 oz. Ag/T and minor Cu and Au. | Knight, 1970<br>ABM file data |
| 9. Commodore mine (Sanders) | 23S | 11E | SW ¼ 19 | Ag, Au, Pb-, Cu-, Zn- | Irregular quartz-fissure veins with weak and spotty base metal sulfides, mostly oxidized near the surface with supergene enrichment in silver. Wall rock is Cretaceous sediments and Jurassic volcanic tuff intruded by Laramide granitic body. | Shaft and open cut operations. Prospected and worked originally in late 1800's and again in 1934. Production would be some 100 tons of ore averaging about 32 oz. Ag/T, 0.1 oz. Au/T and minor Pb and Cu. | ABM file data |
| 10. Cramer mine (Nevada; Cramer, Kelly) | 23S | 11E | SE ¼ 17 | Ag, Au, Cu- | Spotty, supergene enriched, silver and gold values in a weakly mineralized, lensing and | Tunnel and shaft operations. Worked sporadically in the past | ABM file data |

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| | | | | | | tabular zone of brecciated and sheared Jurassic volcanic tuff showing iron and manganese staining. | with a production of some 130 tons of ore averaging about 30 oz. Ag/T, 0.6 oz. Au/T and minor Cu. | |
| 11. | Gold Hill & Blue Ribbon mine group (Skyline, St. Christofer; Setka, Sheehy, Reyes, Delgado) | 22S | 10E | SE ¼ 26 | Au, Ag, Cu-, Pb-, Zn- | Irregular and lensing quartz-fissure veins, with partly oxidized and disseminated base metal sulfides, cutting Jurassic welded tuff. | Shaft operations. Prospected and worked intermittently from late 1800's but mainly from 1935 through 1941, producing some 120 tons of ore averaging about 0.6 oz. Au/T, 2 oz. Ag/T and minor Cu and Pb. | Knight, 1970<br>ABM file data |
| 12. | Grubstake mine (Scribner; Tully, Gzowski, Grasman, Cox) | 23S | 11E | SE ¼ 19 | Au, Ag, Cu- | Irregular, lensing fissure zone of brecciated Jurassic tuff cemented by finely crystalline quartz containing fine grained gold, silver, and copper mineralization. Argillitic alteration. | Shaft operations. Probably prospected in past but worked mainly from 1933 through 1940, producing some 250 tons of ore averaging about 0.8 oz. Au/T, 7 oz. Ag/T and minor Cu. | Knight, 1970<br>ABM file data |
| 13. | Idaho mine group (Arizona group; North Star Mg. & Development Co., Arivaca Mg. Co.) | 22S | 11E | S. Cen. 32<br>Protracted | Ag, Pb, Zn, Cu-, Au- (Sb, As) | Lensing quartz-fissure vein, containing disseminated galena, sphalerite, tetrahedrite, chalcopyrite, and pyrite, cutting Cretaceous conglomerate and sandy, limy, and silty sediments. Intrusive Laramide diorite porphyry. | Shaft and tunnel operations. Intermittent production from early 1910's through 1968, amounting to some 6,800 tons of ore averaging about 3 oz. Ag/T, 2% Pb, 1% Zn, 0.3% Cu and minor Au. | Warren & Loofbourow, 1932, p. 578-585<br>Wilson & Fowler, 1951, p. 44<br>Knight, 1970<br>ABM file data |
| 14. | Indian mine group (Indio; Lopez) | 23S | 10E | NE ¼ 13 | Au, Ag, Pb-, Cu- | Irregular, lensing quartz-fissure vein with spotty base metal sulfides, largely oxidized with supergene enrichment in gold and silver. Wall rock is Jurassic volcanic tuff and some Cretaceous sediments. | Shallow operations. In 1935-1936, produced some 110 tons of ore averaging about 0.7 oz. Au/T, 3 oz. Ag/T and minor Pb and Cu. | ABM file data |
| 15. | Loma de Manganese (Sheehy, Otero & Hunter) | 23S | 10E | SE ¼ 1 | Mn, Ag-, Cu- | Irregular, lenticular masses of psilomelane and pyrolusite with manganiferous calcite and iron oxides along a fissure in Jurassic rhyolite volcanics. | Open cut and shaft operation. Some 45 long tons of sorted 47% Mn ore produced in 1953-1954. | Farnham et alia, 1961, p. 191-192 |
| 16. | Lucky Shot mine group (San Jose, Half & Half; Bejerano, Licano & Flores, Jime & Marker, Oro Verde Mg. Co., Big Four Mg. Co.) | 23S | 11E | N. Cen. 8 | Zn, Pb, Ag, Cu-, Au- | Lensing quartz-fissure veins containing spotty sphalerite, galena, and chalcopyrite, partly oxidized. Wall rocks are Jurassic volcanic flows and tuff or Cretaceous sediments. | Shaft operations. Probably originally prospected in late 1800's but worked mainly during 1939-1940 and 1947-1948 when produced some 220 tons of ore averaging about 8% Zn, 4% Pb, 1 oz. Ag/T, and minor Au and Cu. | Wilson, 1951, p. 42<br>Knight, 1970<br>ABM file data |
| 17. | Margarita mine group (Golden Eagle, Rob Roy; Gold Zone Mg. Co., McDonald, Margarita Gold Mines Co., Daniels, Wechler) | 23S | 11E | NE ¼ 7 | Au, Ag, Pb-, Zn-, Cu- | Irregular, silicified blanket zone of numerous quartz veinlets and stringers containing abundant pyrite and very fine grained gold and silver mineralization associated mainly with oxidized sulfides. Country rock is a strongly silicified and sericitized Jurassic volcanic tuff. | Numerous open cut, shaft, and adit operations. Originally worked in 1890's but mostly in 1903 and from 1933 through 1941, producing some 4,400 tons of ore averaging about 0.3 oz. Au/T, 0.6 oz. Ag/T, and minor Pb and Cu. | Wilson, 1934 (Rev. 1967), p. 191-192<br>Knight, 1970<br>ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCES |
|---|---|---|---|---|---|---|---|
| 18. Montana mine group mines (Rough & Ready; Orion Co., Montana Co., Zeckendorf, Goldfield Consolidated Mines Exploration Co., Montana Mines Operations, Eagle-Picher Mg. & Smltg. Co., Miller, Maravilla Mineros Corp.) | 23S | 11E | N. 5 | Pb, Zn, Ag, Cu (Cd, Sb, As) | Lensing, vuggy, quartz veins containing sphalerite, pyrite, galena, chalcopyrite and tetrahedrite as fracture fillings, in vugs, and as replacements of quartz and sheared and brecciated wall rock. En echalon veins are along a fault zone cutting blocks of Cretaceous conglomerate and Laramide diorite that are intruded and offset by later diorite porphyry dikes. Sulfides oxidized near the surface with enrichment of silver and gold. | Extensive operations from shafts. Located in the early 1870's and worked intermittently on a small scale until 1928 through 1940. Some sporadic work up to 1958. Total production would be some 870,000 tons of ore averaging about 3.5% Pb, 3.5% Zn, 5 oz. Ag/T, 0.5 oz. Au/T, and 0.3% Cu. | Andrus, 1931<br>Head, 1931<br>Warren & Loofbourow, 1932<br>Fowler, 1938<br>Wilson & Fowler, 1951<br>Knight, 1970<br>ABM file data |
| 19. Old Glory mine group (Sargent, Esperanza, Blaine Ledge, Ophir; Arizona Gold Mg. & Mllg. Co., Arizona Ophir Mg. Co., Foote, Pesano) | 23S | 11E | S. Cen. 7 | Au, Ag, Pb-, Cu-, Zn- | Flat dipping, siliceous bed having a quartz core bordered by zones of quartz veinlets and abundant pyrite containing sparse base metal sulfides. Oxidation and supergene enrichment has produced high grade gold and silver values in iron oxide. Chalcanthite found. | Shallow adit and open cut workings. Prospected and worked sporadically since 1880's. Production would be some 700 tons of ore averaging about 0.4 oz. Au/T, 1 oz. Ag/T and minor Cu and Pb. | Wilson, 1934 (Rev. 1967, p. 189-190)<br>Knight, 1970<br>ABM file data |
| 20. Old Soldier mine (Progressive Mg. Co., Holt, Aubrey, Dale, Hack & Irwin) | 23S | 11E | N. Cen. 20 | Ag, Au | Gold and silver mineralization in a shear zone of brecciated, pulverized and sericitized Jurassic volcanic tuff cemented by finely crystalline quartz. | Tunnel and shaft operations. Worked sporadically since late 1800's through 1942, producing some 1,250 tons of ore averaging about 12 oz. Ag/T and 0.4 oz. Au/T. | Knight, 1970<br>ABM file data |
| 21. Oro (El Oro) mine (Williams, Foltz) | 23S | 10E | W. Cen. 13 | Ag, Au, Cu-, Pb-, Zn- | Irregular and lensing quartz fissure veins containing spotty base metal sulfides, oxidized and supergene enriched in silver and gold. Wall rock is Jurassic volcanic tuff. | Shaft operations. Prospected and worked in 1890's and intermittently into 1900's. Produced some 100 tons of ore averaging about 15 oz. Ag/T, 0.5 oz. Au/T and minor Cu and Pb. | Knight, 1970<br>ABM file data |
| 22. Oro Blanco area mines (Large group of claims and mines, often overlapping or restaked, owned and/or worked in whole or part by various companies, owners or lessors. Major mines are listed below. | 23S | 11E | SW ¼ 17<br>SE ¼ 18<br>NE ¼ 19<br>NW ¼ 20 | Au, Ag, Cu-, Pb- | Lensing tabular zones of brecciated and sheared Cretaceous conglomerate or Tertiary volcanics with finely crystalline quartz cement, minor iron and manganese oxides, wall rock bleaching, and fine grained gold and silver values. Ratio of silver to gold about 10:1. Deposits appear limited in vertical and horizontal extent. | Shallow operations from adits, open cuts, and shafts. Worked sporadically since before the 1900's. Estimated and recorded production would be some 3,000 tons of ore averaging about 0.7 oz. Au/T and 7 oz. Ag/T with minor Cu and Pb. Some high grade streaks mined locally. | Blake, 1899<br>Wilson et alia, 1934 (Rev. 1967), p. 188-191<br>Knight, 1970<br>ABM file data |
| a. Dos Amigos mine (Daniels, Legend Group Ltd, Artesia Investment Co., Oro Blanco Mines Co.) | 23S | 11E | NW ¼ 20 | Au, Ag | Irregular, lensing zone of brecciated to pulverized Cretaceous conglomerate cemented by finely crystalline quartz containing fine grained gold and silver mineralization. Iron and manganese oxides. Mineralization all in oxidized zone. | Tunnel and shaft operations. | Wilson et alia, 1934 (Rev. 1967), p. 191<br>Knight, 1970<br>ABM file data |

# EXPLANATION

Quaternary-Tertiary alluvium (Qs, QTs, Ts)

Tertiary intrusives (Ti)

Tertiary sedimentaries and volcanics (Ts, Tvs, Tv)

Mesozoic and Laramide intrusives (Mi, Li)

Mesozoic and Laramide sedimentaries, volcanics and metamorphics (Ms, Mv, Mvs, Ls, Lv, Lvs)

Paleozoic sedimentaries (P)

Precambrian metamorphics and intrusives (p€m, p€i)

Contact

Normal fault

Thrust fault (marked by teeth on upper plate)

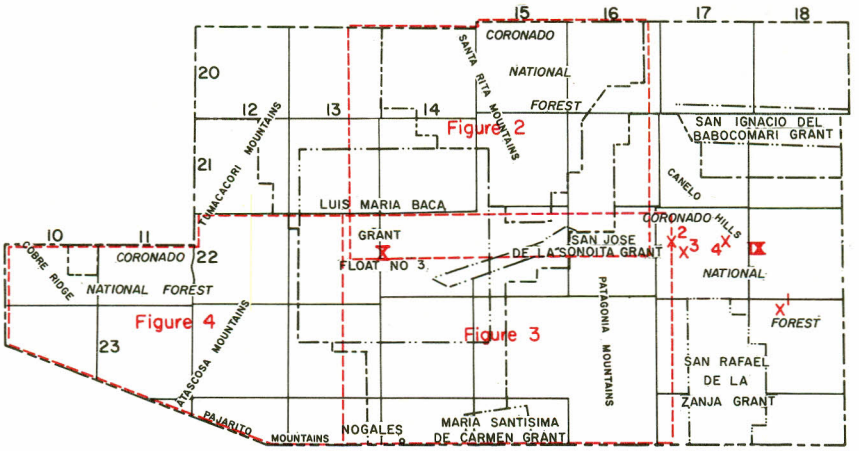


Figure 1. Index map to Mining Districts in Santa Cruz County and Explanation of Geologic Symbols

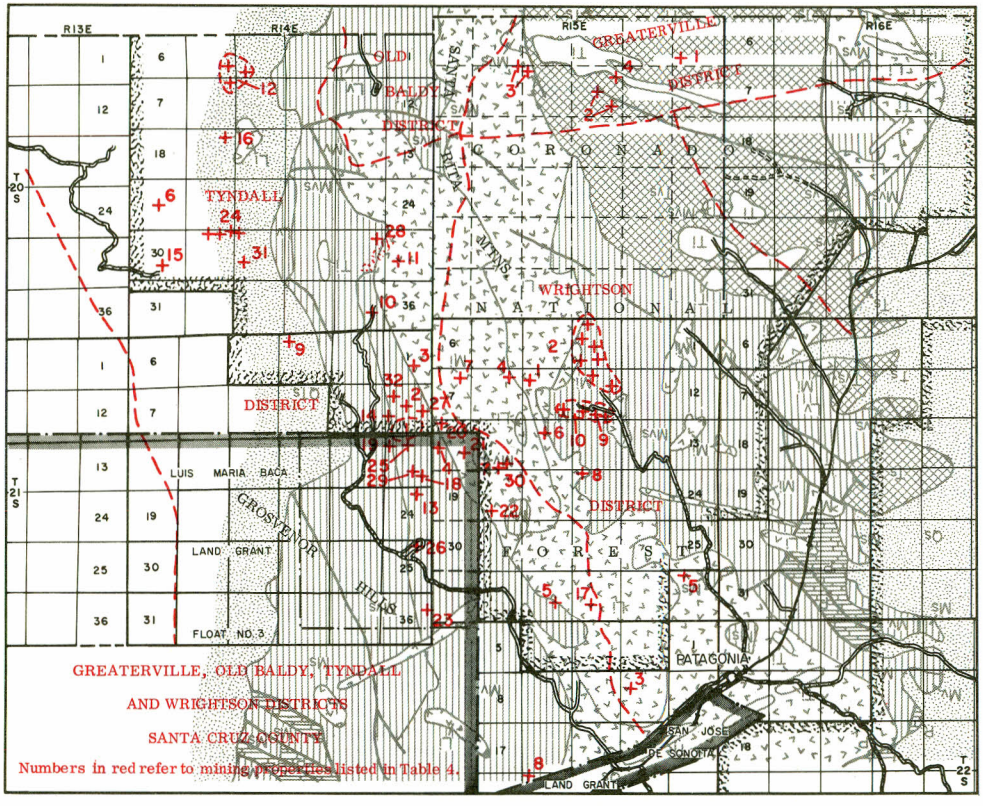


Figure 2. Greaterville, Old Baldy, Tyndall, and Wrightson Districts

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| b. Monarch mine (Hatcher & Carpenter, Dale, Chenoweth) | 23S | 11E | NE ¼ 19 | Ag, Au, Cu- | Brecciated, lensing fissure zone in Jurassic tuff cemented by finely crystalline quartz containing fine to medium native gold and silver mineralization with iron and manganese oxides. | Mostly shallow open cut operations. | Wilson et alia, 1934 (Rev. 1967), p. 191<br>Knight, 1970<br>ABM file data |
| c. Oro Blanco (White Gold) mine (Oro Blanco Mg. Co., Fernald, Legend Group Ltd., Artesia Investment Co., Oro Blanco Mines Co.) | 23S | 11E | SW ¼ 17 | Au, Ag, Cu-, Pb-, Zn- | Lensing fissure zone of brecciated and pulverized Tertiary volcanics cemented by finely crystalline quartz containing fine grain gold and silver with sparse oxidized base metal sulfides and iron and manganese oxides. | Shaft and adit operations. | Wilson et alia, 1934 (Rev. 1967), p. 188, 190-191<br>Knight, 1970<br>ABM file data |
| d. San Juan mine (Pyeatt, Moore) | 23S | 11E | NE ¼ 19 | Au, Ag, Cu- | Fissure zone of lensing brecciated Cretaceous conglomerate cemented by finely crystalline quartz containing fine grain gold and silver and sparse oxidized copper mineralization. | Shaft operations. | ABM file data |
| e. Tres Amigos mine (White Gold #3; Oro Blanco Mg. Co., Fernald, Daniels, Legend Mines Group, Artesia Investment Co., Oro Blanco Mines Co.) | 23S | 11E | NE ¼ 19 | Au, Ag, | Irregular, lensing fissure zone of brecciated and pulverized Jurassic volcanic tuff cemented by finely crystalline quartz containing fine grain gold and silver. | Tunnel and winze operations. | Keyes, 1923<br>Wilson et alia, 1934 (Rev. 1967), p. 190-191<br>Knight, 1970<br>ABM file data |
| f. Tres Amigos Lead mine (Noon, Dale) | 23S | 11E | NW ¼ 20 | Pb, Ag | Shear vein in Cretaceous conglomerate with spotty high grade argentiferous lead mineralization. | Adit and shaft operations. | ABM file data |
| g. Triangle mine (St. Clair, Clark, Hill, Cordova) | 23S | 11E | NE ¼ 19 | Au, Ag | Brecciated shear zone cemented by finely crystalline quartz containing fine grain gold and silver mineralization. Wall rock is Cretaceous conglomerate. | Shaft operations. | ABM file data |
| 23. Oro Fino mine (Williams, Daniels, Delanti, Noon, Oro Fino Mg. Co.) | 23S | 11E | SE ¼ 19 | Au, Ag, Pb-, Cu-, Zn- | Lensing quartz-fissure vein with fracture fillings and partial replacement of quartz and pyrite by galena, chalcopyrite, and sphalerite. Oxidation and supergene enrichment in gold and silver. Wall rock is Cretaceous sediments. | Shaft and adit operations. Worked intermittently from 1890's through 1940, producing some 200 tons of ore averaging about 0.6 oz. Au/T, 3 oz. Ag/T and some Pb and Cu. | Knight, 1970<br>ABM file data |
| 24. Ostrich mine (Bartlett, Skunk) | 22S | 10E | S. Cen. 22 N. Cen. 27 | Au, Ag, Cu-, Pb, Zn- | Narrow, irregular, lensing quartz-fissure veins containing spotty, disseminated, base metal sulfides, largely oxidized and supergene enriched in gold and silver. Wall rock is Jurassic welded tuff. Considerable gouge. | Shaft operations. Discovered by Spaniards and worked mainly in 1870's and 1880's. Some minor operations since then. Estimated production would amount to several hundred tons of gold-silver ore. | Knight, 1970<br>ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| 25. Ragnaroc mine | 22S | 10E | E. Cen. 36 | Au, Ag, Pb-, Cu-, Zn- | Flat, shallow, silicified zone of quartz veinlets and stringers and strong pyritization containing sparse base metal sulfides, oxidized and supergene enriched in gold and silver. Fracture filling and replacement in Jurassic volcanic tuff and Cretaceous sediments. | Shallow operations. Sporadic production from 1890's through 1904 of some 100 tons of ore averaging about 0.3 oz. Au/T, 7 oz. Ag/T and minor Pb. | Knight, 1970 ABM file data |
| 26. Rubiana mine group (Green, Miller) | 23S | 11E | Cen. 6 | Ag, Au, Cu-, Pb-, Zn- | Lensing, quartz-fissure vein with disseminated pyrite and minor base metal sulfides, oxidized and supergene enriched in silver and gold. Some silver chlorides. Wall rock is Jurassic volcanic tuff. | Open cut, adit, and tunnel operations. Worked sporadically from 1890's through 1942, producing some 600 tons of ore averaging about 28 oz. Ag/T, 0.2 oz. Au/T and minor Cu and Pb. | Knight, 1970 ABM file data |
| 27. Smuggler Gulch mine group (Gold Base, Monster; Smuggler Gulch Gold Mg. Co., Fairchild) | 23S | 11E | SE ¼ 18 | Au, Ag, Cu-, Pb-, Zn- | Irregular, lensing fissure zone of brecciated and pulverized, sericitized Jurassic welded tuff wall rock cemented by finely crystalline quartz containing disseminated pyrite and minor base metal sulfides, oxidized and enriched with gold and silver. | Tunnel and shaft operations. Probably worked since late 1800's and mainly in the 1930's. Total production would be some 250 tons of ore averaging about 1.2 oz. Au/T, 1.5 oz. Ag/T and minor Cu. | Knight, 1970 ABM file data |
| 28. Warsaw mine group (Pittsburg, Reich; Huntington, Pyeatt, Hack, Anderson, Roxy Mg. Co., Bruce) | 23S | 11E | S. Cen. 18 N. Cen. 19 | Ag, Au, Cu, Pb, Zn | Lensing quartz vein along a fault zone with pyrite strings and associated disseminated chalcopyrite, galena, and sphalerite, largely oxidized and supergene enriched to chalcocite, covellite, malachite, native silver, embolite and possibly other silver halides. Wall rock at the Warsaw mine is Jurassic diorite while the Reich is an offset section in Jurassic tuff and diorite cut by rhyolite dikes. | Shaft and adit workings. Located in the late 1800's and produced through 1964 some 800 or more tons of ore averaging about 11 oz. Ag/T, 0.2 oz. Au/T, 2% Cu, and 1% Pb. | Knight, 1970 ABM file data |
| 29. Yellow Jacket mine (Yellow Jacket Mines Co., Kelso, Reay & Setka, North Star Mines Inc.) | 22S | 10E | W. Cen. 22 | Au, Ag, Cu- | Lensing quartz vein along a major fault zone containing disseminated pyrite and sparse base metal sulfides, mostly oxidized with supergene enrichment of gold and silver. Wall rock is Jurassic welded tuff cut by rhyolite dikes. | Shaft operations. One of oldest mines of district dating back to the 1800's and intermittently productive through 1938. Total estimated and recorded production would be some 200 or more tons of ore averaging about 1.5 oz. Au/T, 1.6 oz. Ag/T, and minor Cu. | Knight, 1970 ABM file data |

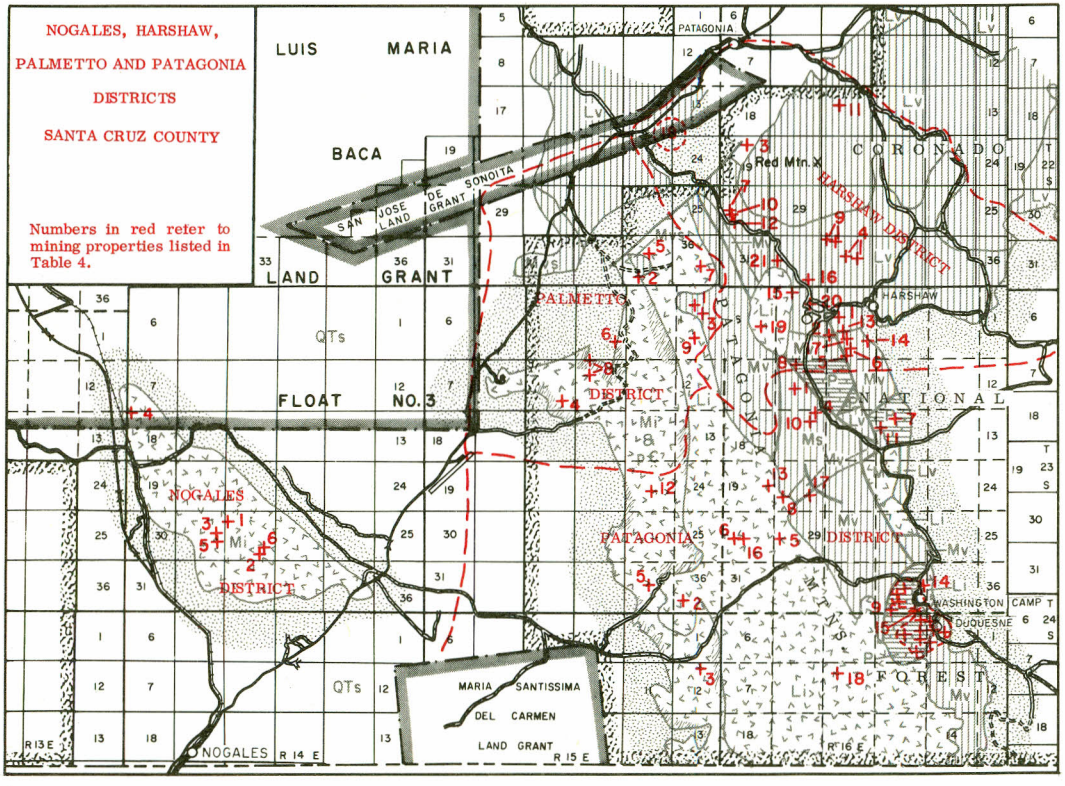


Figure 3. Nogales, Harshaw, Palmetto, and Patagonia Districts

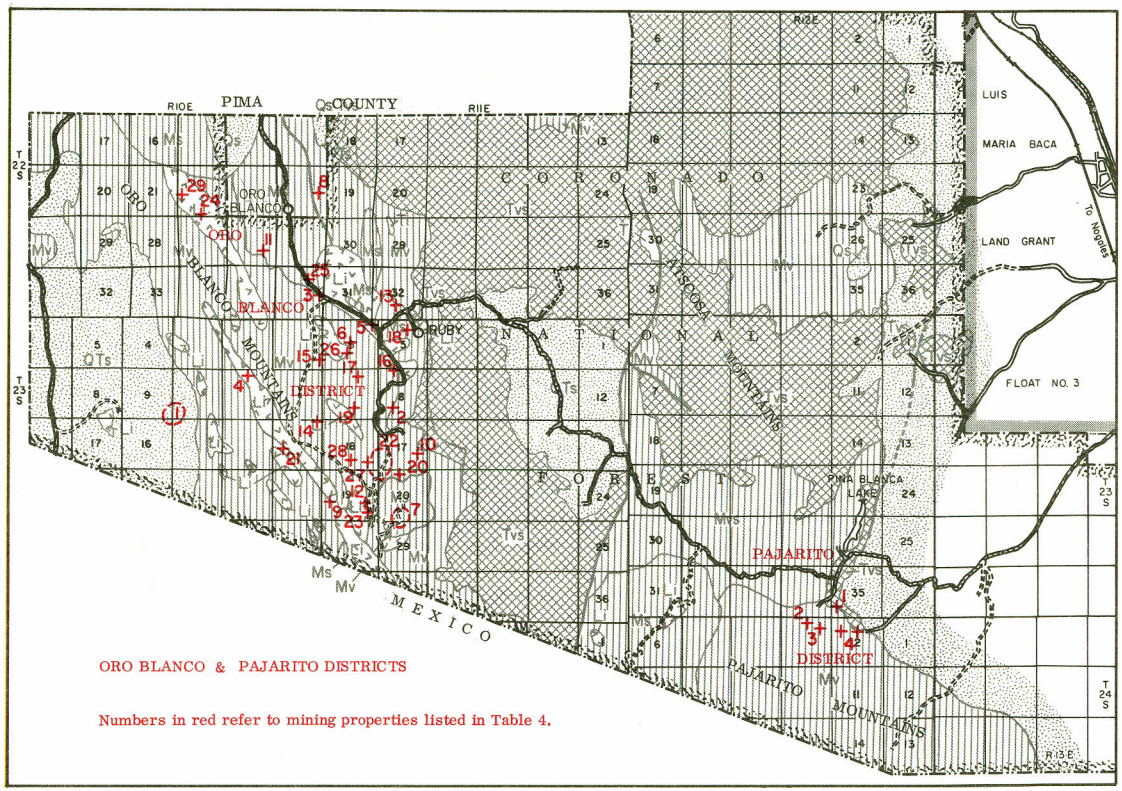


Figure 4. Oro Blanco and Pajarito Districts

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|---|---|---|---|---|---|---|---|
| VI. Pajarito District (Pajarito Mountains) | 23-24S | 12E | ---- | Ag, Pb, Au, Cu-, Zn-, U- (As, F, Mo, V, Hg, Mn) | Relatively small area of irregular and lensing fissure veins containing spotty argentiferous galena, pyrite, marcasite, and traces of chalcopyrite, sphalerite, arsenopyrite, cinnabar, wulfenite, vanadinite, fluorite, and locally pitchblende. Oxidation and supergene enrichment produced anglesite, cerussite, argentite, native silver and rich gold pockets. Mineralization replaces gouge and altered wall rock or fills fractures in Cretaceous quartz latite volcanics. | Relatively shallow shafts, adits and open cuts. Worked since mid-1800's when high grade silver pockets mined. Total estimated and reported production would be some 1,000 tons of ore containing about 41 thousand ounces of silver, 159 tons of lead, 216 ounces of gold, 2.5 tons of copper and a few hundred pounds of zinc. A small amount of picked uranium ore was shipped. | Blake, 1901<br>Webb & Coryell, 1954<br>Nelson, 1963<br>ABM file data |
| 1. Morning & Evening mine group (Kimmel) | 23S | 12E | SW¼ 35 | Ag, Pb, Au, Cu-, Zn (Mn) | Argentiferous galena in pockets, largely oxidized to cerussite, anglesite, and argentite, with pyrite and copper carbonates, on irregular and lensing, narrow fissure veins cutting Cretaceous quartz latite volcanics. Strongly oxidized pyrite and manganese gossan with high grade silver pockets. | Shallow shaft, adit, and open cut operations. Worked sporadically from late 1800's through 1930, producing some 100 or more tons of ore averaging about 200 oz. Ag/T, 22% Pb, and minor Au and Cu. | Nelson, 1963<br>ABM file data |
| 2. St. Patrick mine (Clarke, Means) | 24S | 12E | N. Cen. 3 | Ag, Pb, Au-, Cu-, Zn- | Spotty, argentiferous lead carbonate and sulfate with minor gold, copper, and zinc in gouge and fracture fillings along an irregular, lensing, and narrow fissure zone cutting Cretaceous quartz latite volcanics. High grade silver pockets in oxidized pyrite gossan. | Shallow shaft and adit operations. High grade silver mined from surface prior to 1900. Total production would be some 100 or more tons of ore averaging about 110 oz. Ag/T, 18% Pb, and minor Au and Cu. | Nelson, 1963<br>ABM file data |
| 3. Sunset mine group (Keltz & Allen, Miller, Blankenship, Pyeatt, Cason, Graybill) | 24S | 12E | NE¼ 3 | Ag, Pb, Au, Cu-, Zn- (U, Mo, V) | Spotty, oxidized argentiferous lead mineralization with pyrite and minor chalcopyrite, wulfenite, vanadinite, and traces of uranium in irregular, lensing, and narrow fissure zone cutting Cretaceous quartz latite volcanics. Silver and gold pockets in oxidized pyrite gossan. | Shaft, adit, and open cut operations. Worked prior to 1900 and sporadically from 1924 through 1969, producing over 300 tons of ore averaging about 60 oz. Ag/T, 33% Pb, 0.3 oz. Au/T and minor Cu. | USAEC Prelim. Rec. Rpt. A-P-287, 1954<br>Nelson, 1963<br>ABM file data |
| 4. White Oaks & Big Steve mines (Clarke) | 24S | 12E | N. Cen. 2 | Pb, Ag, Cu-, Au-, Zn-, U- | Irregular, narrow, shear zones containing spotty argentiferous, oxidized, lead mineralization, largely cerussite, pyrite, and minor copper, zinc, and gold, cutting Cretaceous quartz latite volcanics. Mineralization fills fissures and partly replaces gouge and breccia. Spotty kasolite, uranophane, autunite and uranium-bearing pyromorphite recognized. Pyrite gossan. | Shaft, adit, and open cut operations. Worked for high silver values prior to 1900 and sporadically from 1925 through 1958. Total production probably some 500 or more tons of ore averaging about 15% Pb, 6 oz. Ag/T, and minor Cu and Au. A small amount of picked uranium ore reportedly shipped. | USAEC Prelim. Rec. Rpt. D-441, 1952, A-R-2, 1953<br>Granger & Raup, 1962, p. 42-44<br>Nelson, 1963<br>ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| VII. Palmetto District (West slope of Patagonia Mountains between Sonoita Creek to the North and Cañada de la Paloma to the South) | 22-23S | 15E | ---- | Cu, Pb, Ag, Au, Zn-, Mn-, Mo-, alunite | 1. Irregular, tabular, and lensing orebody of oxidized copper mineralization along a fault zone cutting altered and locally mineralized Jurassic granite.<br>2. Narrow, lensing, quartz-fissure veins of argentiferous lead ore in the contact zone of Jurassic granitic intrusive and Precambrian metamorphic rocks.<br>3. Disseminated and extensively oxidized, pyrite-chalcopyrite mineralization in shear zones cutting Jurassic granitic intrusive and intruded Precambrian metamorphic rocks.<br>4. Minor gold placers in stream gravel in Three-R Canyon. | Numerous but mostly small and shallow operations, prospected and mined since the mid-1800's. Total estimated and recorded production would be some 132 thousand tons of ore containing about 5.5 thousand tons of copper, 225 tons of lead, 75 thousand ounces of silver, 240 ounces of gold, and one ton of zinc. Only a few ounces of gold came from placer workings. | Schrader, 1915, p. 279-292<br>Moger, 1969<br>Simons, 1974<br>ABM file data |
| 1. Collicello & Luray mine groups (Gray, Cooper, McCutchen & Hogan) | 23S | 15E | N. Cen. 1 Protracted | Cu, Ag, Au | Roughly banded, narrow quartz stringers and veinlets with pyrite and chalcopyrite, oxidized largely to covellite and chalcocite near the surface, in Jurassic granitic intrusive that is strongly silicified and pyritized. | Tunnel, shaft, and adit operations. Worked intermittently from early 1900's through 1917, producing some 100 tons of selected ore averaging about 20% Cu, 9 oz. Ag/T and 0.2 oz. Au/T. | Schrader, 1915, p. 291-292<br>ABM file data |
| 2. Domino mine group (Old Chief, San Lou, Brownee; Stockton, Gray, Brown) | 22S | 15E | SW¼ 35 | Ag, Pb, Cu, Au-, Zn-, Mo- | Pockety argentiferous galena, partly oxidized to cerussite, minor oxidized copper minerals, and wulfenite in a quartz and gouge gangue along a strong shear zone cutting altered and leached Precambrian metamorphic rocks, intruded by Jurassic granitic intrusive. | Shaft and pit operations. Over 250 tons of Pb-Ag ore mined in the late 1800's and up through 1937 the output would be some 350 tons of ore averaging about 56 oz. Ag/T, 39% Pb, 1% Cu, and minor Au. | Schrader, 1915, p. 287-288<br>ABM file data |
| 3. European mine group (Buena Vista group; Fliescher, Arizona European Mg. Co.) | 23S | 15E | NE¼ 1 | Cu, Ag, Au, Pb-, Zn- | Largely oxidized pyrite and chalcopyrite with minor lead and zinc mineralization in fractures and disseminations with gouge, quartz, and breccia in sheared and jointed Jurassic granitic intrusive. | Tunnel and shaft operations. Worked sporadically from 1913 through 1929, producing some 320 tons of ore averaging about 10% Cu, 4 oz. Ag/T, and 0.1 oz. Au/T. | ABM file data |
| 4. Jarillas mine group (Bullion; Stockton, Ish, Gusteller & Curtis, Las Jarillas Mg. Co., Gross) | 23S | 15E | SE¼ 9 | Ag, Pb, Au-, Cu-, Mo-, Mn- | Lensing fissure veins with well banded quartz, argentiferous galena, and minor chalcopyrite that has been crushed. Gouge borders. Few pockets of wulfenite. Oxidized near the surface to drusy quartz, psilomelane, lead and copper carbonates, and pockets of horn silver. Lead mineralization increased with depth. Deposit lies along a fault zone parallel to a contact of Jurassic granite with Precambrian metamorphics. | Shaft operations. Mined by Mexicans prior to 1880 and sporadically to 1924. Estimated and recorded production would be some 100 tons of ore averaging about 190 oz. Ag/T, 37% Pb, 0.1 oz. Au/T and minor Cu. | Schrader, 1915, p. 288-290<br>Moger, 1969<br>ABM file data |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5. New Hope mine group (Dona Maria Elena; Gray, Conley, Nelson, Keck Copper Co.) | 22S | 15E | Cen. 35 | Cu, Ag, Zn-, Pb-, Au- | Disseminated pyrite, chalcopyrite, and minor galena and sphalerite associated with quartz on fractures and joints in epidotized, sheared and silicified Triassic sediments. Deposit oxidized near the surface with some supergene enrichment. | Shaft and open cut operations. Prospected originally in the late 1800's but mined mainly for leaching ore from 1957 through 1969, producing some 400 tons of ore averaging about 1.7% Cu, 1.6 oz. Ag/T, and minor Zn, Pb, and Au. | Schrader, 1915, p. 291<br>ABM file data |
| 6. Sonoita mine group (Keegan, Sonoita Copper Co., Evans) | 23S | 15E | SE¼ 3 | Cu, Ag, Au-, Pb-, Mn- | Intersections of faults and fractures containing spotty pyrite, chalcocite, galena, and ruby silver in a gangue of quartz, psilomelane, and gouge. Strong oxidation but weak alteration of Precambrian metamorphic and Jurassic granitic intrusive wall rocks. | Shaft operations. Sporadic mining in 1880's and from 1916 through 1918. Produced some 500 tons of ore averaging about 8% Cu, 11 oz. Ag/T and minor Au and Pb. | Schrader, 1915, p. 290-291<br>Moger, 1969<br>ABM file data |
| 7. Three-R mine group (Richardson, Amster, Three-R Mg. & Mllg. Co., Three-R Mines, Inc., Border Mines, Inc., Bird, Colossal Mines, Taylor & Barclay) | 22S | 15E | Cen. 36 | Cu, Ag-, Pb-, Zn-, Au-, alunite | Large, steeply dipping, lensing orebody of disseminated cupriferous pyrite with minor chalcopyrite, bornite, and minor lead and zinc, along a fault zone intersected by numerous fractures. Zone is strongly oxidized and supergene enriched to high grade chalcocite and some covellite. Wall rock is a shattered and altered Jurassic granite which contains disseminated pyrite and sparse copper mineralization in quartz-sericite veinlets around the orebody. Alunite masses occur in the fault zone. | Tunnel and shaft operations. Located in the late 1800's but mined mainly from 1908 through 1956, producing some 130,000 tons of ore averaging about 4% Cu with minor Ag, Pb, Zn, and Au. | Probert, 1914<br>Schrader, 1914, p. 347-350; 1915, p. 282-287<br>Handverger, 1963<br>ABM file data |
| 8. Tres de Mayo mine group (Palmetto, Robert E. (Bob) Lee, Hassayampa, Hollywood, La Palma; Stockton, Backman & Merritt Mines Co., Monarch Mg. & Mllg. Co., Taft Mg. & Exploration Co., Melville Syndicate, Newcomer, Cummings) | 23S | 15E | SW¼ 3<br>N½ 10 | Ag, Pb, Au-, Cu-, Zn-, Mn- | Lenses of argentiferous galena with minor chalcopyrite and sphalerite in a quartz, psilomelane, and gouge gangue in fissure-zone veins, oxidized to cerussite, argentite, and rich cerargyrite pockets. Wall rock is strongly sheared and fractured Precambrian rock intruded by Jurassic granite. A major fault passes through the area and a northeast striking fracture zone contains weak, oxidized sulfide mineralization. Psilomelane often contains lead and silver values. | Shaft operations. Worked by Mexicans prior to 1880 but mainly from 1910 through 1942, producing in total some 200 tons of ore averaging about 70 oz. Ag/T, 25% Pb and minor Cu and Au. | Schrader, 1915, p. 290<br>Moger, 1969<br>ABM file data |
| 9. Ventura mine group (Morris group; Henderson, Ventura Mines, Inc., Beyerle) | 23S | 15E | Cen. 1 | Cu, Ag, Pb, Zn-, Au-, Mn- | Quartz-gouge veins with spotty pyrite, chalcopyrite, chalcocite and minor galena and sphalerite, roughly banded, along fissures and joints in strongly silicified and weakly mineralized Precambrian metamorphosed volcanics and sediments intruded by Jurassic granite. Oxidation produced abundant iron oxide and psilomelane. | Tunnel operations. Sporadic production in 1913 and from 1933 through 1950 produced some 440 tons of ore averaging about 6% Cu, 16 oz. Ag/T, 1% Pb, and 0.2 oz. Ag/T. | Schrader, 1915, p. 291-292.<br>ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| VIII. Patagonia District (Southern Patagonia Mountains) | 23-24S | 15-16E | ---- | Zn, Pb, Cu, Ag, Au, Mo, Mn, V, W | 1. Pyrometasomatic deposits of base metal sulfides in complexly faulted and folded Paleozoic limestone blocks and roof pendants intruded by Late Laramide porphyritic granodiorite.<br>2. Replacement deposits of argentiferous lead, copper, and zinc mineralization in Paleozoic and Cretaceous limestone adjacent to or along fault or shear zones.<br>3. Quartz-fissure veins, quartz veinlets, and zones of strong silicification with disseminated copper and molybdenum mineralization in Late Laramide granodiorite.<br>4. Minor tungsten mineralization in pyrometasomatic deposits in Paleozoic limestone and with molybdenum and copper in shear zones in Jurassic granite.<br>5. Irregular pods, seams, and narrow veinlets of manganese oxides, often with iron oxides and minor base and precious metals along fractures or faults or replacements in Paleozoic limestone or Laramide granodiorite intrusive.<br>6. Small gold placer deposits in stream alluvium. | Many shaft, open cut, and tunnel operations. Prospected and mined since Spanish and Mexican occupation to recent years. Several large mining operations. Total estimated and recorded production would be some 691,000 tons of base and precious metal ore containing about 26.9 thousand tons of zinc, 21.5 thousand tons of lead, 18.3 thousand tons of copper, 3.3 million ounces of silver, and 7.3 hundred ounces of gold. Some 200 tons of molybdenum ore and 6.5 hundred pounds of tungsten oxide also have been produced. Possibly about 100 ounces of placer gold recovered. | Schrader, 1915, p. 292-348<br>Smith, 1956<br>Baker, 1962<br>Simons, 1971; 1974 |
| 1. Augusta mine | 23S | 16E | Cen. 8 Protracted | Pb, Ag, Zn, Au | Narrow and irregular compound vein or group of parallel quartz-carbonate stringers containing spotty argentiferous galena and sphalerite, oxidized to produce enriched silver chlorides near the surface. Wall rock is folded Cretaceous Bisbee Formation sedimentary rocks. | Shaft operations. Mined by "chloriders" prior to 1900. Reportedly some 100 tons of ore averaging about 57% Pb, 40 oz. Ag/T, 10% Zn, and 0.2 oz. Au/T produced. | Schrader, 1915, p. 308 |
| 2. Buena Vista mine (Goodview; Maloney, Black Mountain Mg. Co., Banco del Oro Mg. Co., Goodview Mg. & Mllg. Co., Kino Copper Co., Coronado Mines Inc., Graybill & Jarnagin, Dunham & Nañez, Jarnagin & Bopp) | 23S | 15E | SW¼ 36 Protracted | Cu, Ag, Au-, Pb-, Mo- | Series of narrow, irregular quartz-calcite veins, associated with bands of crushed mineralized rock, containing pyrite, chalcopyrite, bornite and minor molybdenite. Fault or shear zone cutting Laramide granodiorite. Minor oxidation with some covellite and galena showing at the surface. | Extensive tunnel operations. Located in the late 1800's and mined intermittently through 1958. Produced some 850 tons of ore averaging about 3% Cu, 1 oz. Ag/T, and minor Au and Pb. | Copper Handbook, 1903<br>Schrader, 1915, p. 314-315<br>ABM file data |

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| 3. Edna mine group (Martha Washington; Julio, Coronado Mines Inc., Discovery Process Inc., Randall) | 24S | 15E | NE¼ 12 | W, Mo-, Cu- | Sporadic scheelite with minor molybdenite and copper carbonates in quartz and gouge pockets along a shear zone cutting Jurassic granite. | Adit and open cut operations. Known and developed prior to 1914 but produced mainly in 1968 through 1971 when some 240 tons of about 1.3% $WO_3$ ore shipped. | Dale, 1960, p. 120-122<br>ABM file data |
| 4. Duquesne-Washington group of mines (Large group of claims and mines owned or worked as a group or individually by various individuals, companies or lessors as listed below) | 23S<br>24S | 16E<br>16E | 34<br>2, 3<br>Protracted | Zn, Pb, Cu, Ag, Au- (W) | Tabular to lensing, massive to spotty, pyrometasomatic and replacement deposits of varying amounts of sphalerite, galena, chalcopyrite, and pyrite at the margins of skarn zones or along fault zones in faulted and folded Permian Naco Group limestones with intrusions of Laramide granodiorite. Oxidized to various depths. Skarn is largely garnet with other calcium silicates. Minor tungsten found in skarn zones. | Extensive shaft, tunnel, and open cut operations but generally shallow to not over 300-500 feet in depth. High grade Pb-Ag oxidized ore prospected and mined out by Spaniards, Mexicans, and early Americans prior to 1880. Sporadic large scale mining in 1900's through 1966. Production would be some 350,000 tons of ore averaging about 6% Zn, 3% Pb, 3% Cu, 6 oz. Ag/T and minor Au. | Crosby, 1906<br>Schrader, 1915, 321-343<br>ABM file data |
| a. Annie mine (Duquesne Mg. & Reduction Co., Perkins & Medina, Francisco & Medina) | 24S | 16E | E. Cen. 3<br>Protracted | Zn, Pb, Ag, Cu, Au- | Small, irregular lense of partly oxidized sphalerite, galena, and chalcopyrite in a pyrometasomatic deposit in faulted and folded Permian Naco Group limestone. Strong garnetization. | Shaft operations. Mined for oxide ore in late 1800's and for sulfide in early 1900's. Produced some 500 tons of ore averaging about 5% Zn, 3% Pb, 0.5% Cu, 5 oz. Ag/T and a trace of Au. | Crosby, 1906<br>ABM file data |
| b. Belmont mine (Bacon, Duquesne Mg. & Reduction Co., Bostwick, Curtis Estate, De la Ossa, Byrd, Nash Mines) | 24S | 16E | E. Cen. 3<br>Protracted | Zn, Cu, Pb, Ag, Au- | Sphalerite, chalcopyrite, and galena, partly oxidized near the surface, in a large, irregular, and massive lens of garnetized and silicated, Permian Naco Group limestone along a contact with Laramide granodiorite. Gangue minerals are quartz, calcite, and calcium silicates. | Extensive shaft, open cut, and tunnel operations. Worked by Mexicans for Pb and Ag prior to 1860. In 1930's and 1940's mined by lessees. Total production probably 2-3 thousand tons of ore averaging about 9% Zn, 3% Cu, 3% Pb, 6 oz. Ag/T and minor Au. | Crosby, 1906<br>Schrader, 1915, p. 340-341<br>ABM file data |
| c. Bonanza mine (Duquesne Mg. & Reduction Co., Callahan Zinc Lead Co., Byrd, Elayer & Co., Sam Knight Mining Lease, Nash Mines) | 24S | 16E | NW¼ 2<br>Protracted | Zn, Cu, Pb, Ag, Au- (Mn) | Sphalerite, chalcopyrite, galena, and pyrite, oxidized to a depth of about 100 feet, in a garnet-quartz gangue in a large cluster of lensing bodies and bunches along a fault contact of pyrometamorphosed Permian Naco Group limestone and Jurassic-Triassic volcanics. Manganese stained gossan. | Extensive shaft operations. Located in 1880's and worked mainly in early 1900's to 1921, and in 1941 through 1944, and 1951 through 1957. Total production would be over 55,000 tons of ore averaging about 7% Zn, 3% Cu, 1% Pb, 4 oz. Ag/T and minor Au. | Crosby, 1906<br>Schrader, 1915, p. 335-336<br>ABM file data |
| d. California-Grasshopper mine group (Duquesne Mg. & Reduction Co., Queen Mg. Co.) | 24S | 16E | E. Cen. 3<br>Protracted | Pb, Zn, Cu, Ag, Au- | Galena, sphalerite, and chalcopyrite, partly oxidized near the surface, in a pyrometasomatic lens in Permian Naco Group limestone at the edge of a strong garnet zone. | Shaft operations. Worked sporadically from the early 1900's through 1951. Total production would be a few hundred tons of ore averaging about 10% Pb, 5% Zn, 4% Cu, 4 oz. Ag/T, and minor Au. | ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| e. Dave Allen mine (Duquesne Mg. & Reduction Co., Nash Mines) | 24S | 16E | N. Cen. 3 | Zn, Pb, Cu, Ag, Au- | Spotty, disseminated sphalerite, galena, and chalcopyrite, partly oxidized, in narrow pyrometasomic lenses of Permian Naco Group limestone along the contact with Laramide granodiorite. | Relatively shallow operations. Produced some 100 tons of ore averaging about 12% Zn, 7% Pb, 0.7 % Cu, and 9 oz. Ag/T. | ABM file data |
| f. Double Standard mine (Dudley-Standard; Duquesne Mg. & Reduction Co., Byrd, Nash Mines) | 24S | 16E | NE¼ 3 Protracted | Zn, Cu, Pb, Ag, Au- | Sphalerite, chalcopyrite, and galena, partly oxidized, disseminated, and in bunches, in two parallel zones in pyrometasomatized Permian Naco Group limestone along strong fault zones and close to Laramide granodiorite. | Shaft, tunnel, and open cut operations. Mined intermittently from early 1900's through 1951, producing some 300-400 tons of ore averaging about 6% Zn, 3% Cu, 2% Pb, 3 oz. Ag/T and minor Au. | Crosby, 1906<br>ABM file data |
| g. Duquesne mine (Duquesne Mg. & Reduction Co., Callahan Zinc Lead Co., Nash Mines, McFarland) | 24S | 16E | E. Cen. 3 W. Cen. 2 Protracted | Zn, Pb, Cu, Ag, Au- | Bunchy and disseminated sphalerite, galena, chalcopyrite and pyrite in pyrometasomatized lenses in Permian Naco Group limestone along a nose of strong garnetization. Mineralization controlled by bedding and faulting. | Shaft operations. Worked sporadically in 1940's and 1950's, producing some 20,000 tons of ore averaging about 8% Zn, 3% Pb, 1.5% Cu, 5 oz. Ag/T and minor Au. | ABM file data |
| h. Empire mine (Duquesne Mg. & Reduction Co., Callahan Zinc Lead Co., Byrd, Nash Mines) | 24S | 16E | E. Cen. 3 Protracted | Zn, Pb, Cu, Ag, Au- | Mineralized garnet zone in crystalline Permian Naco Group limestone containing sphalerite, galena, chalcopyrite, and pyrite, partly oxidized and enriched in silver and lead near the surface. Gangue is garnet, silicated limestone, quartz, iron oxide, and calcium silicates. Contact with Laramide granodiorite is nearby. | Surface and shaft operations. One of oldest productive mines of the district. Worked by 'chloriders', lessees, and companies intermittently since 1870's. Total estimated and recorded production would be some 8,000 tons or more of ore averaging about 7% Zn, 4% Pb, 1% Cu, 7 oz. Ag/T and minor Au. | Crosby, 1906<br>Schrader, 1915, p. 341-342<br>ABM file data |
| i. Estelle & Louise mine (Duquesne Mg. & Reduction Co., Callahan Zinc Lead Co., Nash Mines, Amado, Granillo) | 24S | 16E | Cen. 2 Protracted | Zn, Pb, Cu, Ag, Au- | Sphalerite, galena, chalcopyrite, and pyrite in irregular deposits in Permian Naco Group limestone along a strong fault zone between limestone and Jurassic-Triassic volcanics. Pyrometasomatic mineralization. | Shaft operations. Mined mainly from 1940 through 1963, producing a total of some 21,000 tons of ore averaging about 9% Zn, 2% Pb, 2% Cu, 4 oz. Ag/T and minor Au. | ABM file data |
| j. Holland mine (Holland Smltg. & Mg. Co., Coughlin, Bartlett, Duquesne Mg. & Reduction Co., Callahan Zinc Lead Co., Byrd, Nash Mines) | 24S | 16E | Cen. 3 Protracted | Zn, Pb, Cu, Ag, Au- | Sphalerite, galena, chalcopyrite, and pyrite, oxidized to iron oxides and carbonates with manganese oxide near the surface, in massive, irregular lens-like orebodies with a gangue of silicated limestone, quartz, and calcium silicates, in pyrometasomatized Permian Naco Group limestone. Mineralization is along a garnetiferous zone close to Laramide granodiorite. | Shaft and open cut operations. Worked extensively prior to 1900 for high grade oxidized Pb-Ag ore. Total production would be some 80,000 tons of ore averaging about 18% Zn, 10% Pb, 2% Cu, 12 oz. Ag/T and minor Au. | Schrader, 1915, p. 338-340<br>ABM file data |

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| k. Illinois mine (Duquesne Mg. & Reduction Co., Nash Mines, D. C. Gilbert Mg. Co.) | 24S 16E NW¼ 2 Protracted | Zn, Cu, Pb, Ag, Au- | Sphalerite, chalcopyrite, galena, and pyrite, partly oxidized, in irregular deposits along a fault zone between pyrometamorphosed Permian Naco Group limestone and Jurassic-Triassic volcanics. Mineralization is disseminated and in bunches mixed with silicated limestone, quartz, and calcium silicates. | Shaft and open cut operations. Worked by chloriders prior to 1900 and mined in the late 1950's. Production would amount to some 2,000 tons of ore averaging about 9% Zn, 4% Cu, 2% Pb and 4 oz. Ag/T. | ABM file data |
| l. Indiana mine (Duquesne Mg. & Reduction Co., Callahan Zinc Lead Co., Nash Mines, Alvarez & Majalca, Indiana Mg. Co.) | 24S 16E Cen. 34 Protracted | Zn, Cu, Pb, Ag, Au- | Partly oxidized sphalerite, chalcopyrite, galena, and pyrite disseminated and in bunches in pyrometamorphosed Permian Naco Group limestone or as replacement bodies in silicated limestone, along the fault contact zone between the limestone and Jurassic-Triassic volcanics. | Shaft and open cut operations. Mined intermittently from the early 1940's through 1966, producing some 10,000 tons of ore averaging about 17% Zn, 3% Cu, 2% Pb, 4 oz. Ag/T and minor Au. | ABM file data |
| m. Indianapolis mine (Duquesne Mg. & Reduction Co., Byrd, Soto & Lizarraga) | 24S 16E Cen. 3 Protracted | Pb, Cu, Ag | Lenses of partly oxidized, patchy galena, chalcopyrite, and pyrite in pyrometasomatized Permian Naco Group limestone along the contact with Laramide granodiorite. | Shaft and open cut operations. Worked mainly by lessees with production of some 100 tons averaging about 11% Pb, 2% Cu, and 6 oz. Ag/T. | ABM file data |
| n. Kansas mine (Poole group; Allen Bros., Pride of the West Mg. Co., Duquesne Mg. & Reduction Co., Panick, Everett, Bostwick, Kansas Mg. & Development Co., Curtis Estate, Callahan Zinc Lead Co., Nash Mines, Mar-Pak Corp.) | 23S 16E Cen. 34 Protracted | Zn, Pb, Cu, Ag, Au- | Large vein-like replacement deposits and bunches and pockets of sphalerite, galena, pyrite, and chalcopyrite in pyrometasomatized Permian Naco Group limestone, oxidized near the surface to limonite, cerussite, malachite, azurite and lead and copper sulfates with enrichment in silver. Mineralization is associated with a strong fault zone along the contact with Jurassic-Triassic volcanics. Strong pyrite gossan. | Shaft operations. Mined sporadically from the late 1870's through 1959, producing more than 40,000 tons of ore averaging about 6% Zn, 4% Pb, 3% Cu, 4 oz. Ag/T and minor Au. | Schrader, 1915, p. 342-343<br>ABM file data |
| o. Maine mine (Poole group, Ella; Allen Bros., Thompson, Coughlin, Duquesne Mg. & Reduction Co., Byrd, Callahan Zinc Lead Co., Nash Mines, Heredia) | 23S 16E Cen. 34 Protracted | Zn, Cu, Pb, Ag, Au- | Sphalerite, chalcopyrite, galena, and pyrite, oxidized with supergene enrichment near the surface, in pyrometasomatized Permian Naco Group limestone along a fault contact with Jurassic-Triassic volcanics. Intrusive Laramide granodiorite nearby. Some native copper found at surface. | Tunnel, shaft, and open cut operations. Worked from 1880's through 1965, mainly by lessees, producing some 4,000 tons of ore averaging about 8% Zn, 4% Cu, 3% Pb, 5 oz. Ag/T and minor, Au. | Schrader, 1915, p. 342-343<br>ABM file data |
| p. Manzanita mine (Duquesne Mg. & Reduction Co., Nash Mines) | 24S 16E E Cen. 3 Protracted | Zn, Pb, Cu, Ag, Au- | Small, irregular lenses of sphalerite, galena, chalcopyrite, and pyrite in strongly garnetized and pyrometasomatized Permian Naco Group Limestone bordering Laramide granodiorite. | Shaft and tunnel operations. Worked mainly by lessees, producing several 100 tons of ore averaging about 7% Zn, 4% Pb, 1% Cu, and 9 oz. Ag/T. | ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| q. Mary Jane mine (Duquesne Mg. & Reduction Co., Nash Mines) | 23S | 16E | E. Cen. 3 Protracted | Zn, Pb, Cu, Ag, Au- | Small, spotty, and irregular lenses of sphalerite, galena, chalcopyrite, and pyrite in pyrometasomatized Permian Naco Group limestone, partly oxidized near the surface with supergene enrichment in silver. | Tunnel, open cut, and shaft operations. Worked sporadically by lessees, mainly in the 1950's, and produced some 800 tons of ore averaging about 7% Zn, 6% Pb, 2% Cu, and 6 oz. Ag/T. | ABM file data |
| r. New York mine (Poole group, Ohio; Allen Bros., Duquesne Mg. & Reduction Co., Everett, Callahan Zinc Lead Co., Byrd, De la Ossa) | 23S | 16E | Cen. 34 Protracted | Pb, Zn, Cu, Ag, Au | Lensing and irregular mineralization of galena, sphalerite, chalcopyrite, and pyrite, oxidized with silver enrichment near the surface, in pyrometasomatized Permian Naco Group limestone near a dike-like intrusion of Laramide granodiorite. | Shaft and tunnel operations. High grade Pb-Ag ore mined in the late 1870's and in the 1880's. Main production in 1900's of some 20,000 tons of ore averaging about 9% Pb, 4% Zn, 2% Cu, and 7 oz. Ag/T. | Schrader, 1915, p. 342<br>ABM file data |
| s. San Antonio mine (Duquesne Mg. & Reduction Co., Nash mines, Byrd, De la Ossa) | 24S | 16E | W. Cen. 2 Protracted | Zn, Pb, Cu, Ag, Au- | Small, irregular lenses of sphalerite, galena, chalcopyrite, and pyrite in pyrometamorphosed Permian Naco Group limestone. Supergene enrichment of silver in oxidized zone. | Shaft operations. Worked sporadically, mostly by lessees since the early 1900's, producing a few 100 tons of ore averaging about 7% Zn, 6% Pb, 2% Cu and 6 oz. Ag/T. | ABM file data |
| t. Silver Bell mine (Duquesne Mg. & Reduction Co., Nash Mines) | 24S | 16E | SE¼ 3 Protracted | Zn, Pb, Cu, Ag, Au- | Irregular lenses containing sphalerite, galena, chalcopyrite, and pyrite with calcium silicates in pyrometamorphosed Permian Naco Group limestone. Oxidized with strong iron oxides and some copper carbonates near the surface. Abundant garnet. Mineralization controlled by faults and contact with Laramide granodiorite. | Shaft and tunnel operations. Rich Pb-Ag ore mined from surface in late 1800's and some mining in 1900's. Production would be some 500 tons of ore averaging about 5% Zn, 4% Pb, 1% Cu, and 3 oz. Ag/T. | Schrader, 1915, p. 341<br>ABM file data |
| u. Smuggler & Texas mine (Duquesne Mg. & Reduction Co., Nash Mines, Majalca Bros., Amado & Majalca) | 24S | 16E | NE¼ 3 Protracted | Zn, Cu, Pb, Ag, Au- | Replacement lenses and irregular bodies of calcium silicates with sphalerite, chalcopyrite, galena, and pyrite, oxidized and supergene enriched in silver near the surface, in tilted fault blocks of pyrometamorphosed Permian Naco Group limestone. | Shaft operations. Early work by chloriders and main production in 1950's when over 1,000 tons of ore produced, averaging about 14% Zn, 3% Cu, 1% Pb, and 9 oz. Ag/T. | ABM file data |
| 4. Endless Chain mine (Endless Chain Mg. Co. | 23S | 16E | NE¼ 17 Protracted | Cu, Ag | Relatively narrow, roughly banded, mineralized replacement of brecciated, pyritic quartzite by chalcopyrite, pyrite, tetrahedrite, and chalcocite in Cretaceous Bisbee sedimentary formations. | Shaft and tunnel operations. About 100 tons of copper-silver ore produced prior to 1900. | Schrader, 1915, p. 307-308 |

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| 5. Four Metals mine (Guajolote lode; Gross, Four Metals Mg. Co.) | 23S | 16E | W. Cen. 29 | Cu, Ag, Au, Pb-, Zn- | Sheeted, shattered, crushed, and strongly altered Laramide granodiorite mineralized with pyrite, chalcopyrite, chalcocite, and minor galena and possibly sphalerite, occurring as dispersed grains or aggregate masses in a quartz stockwork or as fissure fillings. Mineralization mostly low grade. | Extensive tunnel operations. Only a few tons of picked ore shipped which ran about 7% Cu, 40 oz. Ag/T and 0.1 oz. Au/T. | Schrader, 1915, p. 317-320<br>Baker, 1961<br>ABM file data |
| 6. Gladstone mine group (Independencia, Thessalia, Eureka, Arizona; Independent Mg. & Mllg. Co., Forsythe, Michels, Proto Bros., Bostwick, Fulton, Sullivan, Raymond & Bostwick, Todd, Blabon) | 23S | 16E | W. Cen. 30 Protracted | Cu, Ag, Au, Pb-, Zn- | Irregular vein-like mineralization of chalcopyrite and oxidized copper minerals, with spotty and minor galena and sphalerite, along fault or shear zones in Laramide granodiorite. | Tunnel and shaft workings. Mined sporadically from early 1900's through 1951, producing some 2,000 tons of ore averaging about 8% Cu, 3 oz. Ag/T, 0.1 oz. Au/T and minor Pb. | Schrader, 1915, p. 316<br>ABM file data |
| 7. Golden Gate mine (Bullwhacker, North Mowry, Old Mowry; Vanderwalker Bros., Majalca & Lizaraga, Woodruff, Peterson) | 23S | 16E | N. Cen. 15 Protracted | Pb, Ag, Zn-, Cu-, Au-, Mn | Irregular replacement bodies of argentiferous cerussite and galena with spotty chalcopyrite and sphalerite, oxidized with supergene enrichment in the upper part. Manganiferous and ferrous gangue. Also erratic lenticular bodies of wad and pyrolusite, containing minor cerussite, silver and iron oxides. Mineralization is controlled by fracturing, faulting, and bedding planes in Paleozoic limestone. | Shaft and open pit operations. Intermittent production since late 1800's of some 200 tons of ore averaging about 10% Pb, 3 oz. Ag/T and minor Cu and Zn. About 200 long tons of Mn ore, mostly low grade, also shipped. | Schrader, 1915, p. 305-306<br>Farnham et alia, 1961, p. 162-165<br>ABM file data |
| 8. Guajolote mine (Quajolote; Bacon) | 23S | 16E | SW ¼ 20 Protracted | Cu, Ag, Au | Chalcopyrite, pyrite, and copper carbonates near the surface in a banded quartz vein cutting Laramide granodiorite. Strong fault zone near-by. | Shaft operation. Sporadic production in the late 1930's and early 1940's yielded some 300 tons of ore averaging about 2% Cu, 3 oz. Ag/T, and 0.2 oz. Au/T. | ABM file data |
| 9. Happy Thoughts mine (Franklin, Reid, Gerrard, Reid & Jarnagin, Double "L" Mg. Co.) | 23S | 16E | S. Cen. 34 Protracted | Zn, Pb, Cu, Ag, Au- | Irregular lenses of sphalerite, galena, chalcopyrite, and pyrite, oxidized and supergene enriched near the surface, in pyrometamorphosed Permian Naco Group limestone along the fault contact with Cretaceous Bisbee Formation sedimentary rocks. | Tunnel operations. Worked sporadically since early 1900's, producing some 300 tons of ore averaging about 8% Zn, 5% Pb, 2% Cu, 5 oz. Ag/T and minor Au. | ABM file data |
| 10. Morning Glory mine (Neal & Henderson, Wilson, Morning Glory Mg. Co., Pioneer Smltg. Co., Southern Arizona Mg. & Smltg. Co., Morning Glory Mg. & Smltg. Co.) | 23S | 16E | NE ¼ 17 Protracted | Cu, Ag, Au-, Zn-, Pb (Ba) | Replacement deposit of pyrite, chalcopyrite, local and spotty sphalerite, minor galena, sometimes banded quartz, hematite and specularite, and minor barite, in a dipping, altered bed of limestone in the Cretaceous Bisbee Formation. Shallow oxidation. | Shaft and tunnel operation. Worked in late 1880's for silver but mainly for copper from 1907 through 1929, producing some 5,000 tons of ore averaging about 3% Cu, 4 oz. Ag/T, and minor Zn and Au. | Schrader, 1915, p. 306-307<br>Baker, 1961<br>ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| 11. Mowry mine (Patagonia, Enterprise; Mowry, Fish & Silverberg, Steinfeld & Swain, Mowry Mines Co., Santa Cruz Mg. & Smltg. Co., Mitchell, Stone Logan, Peterson, Grant & Woodruff, Metler) | 23S | 16E | NW¼ 15 Protracted | Pb, Ag, Zn-, Cu-, Au-, Mn (Be, Mo, V, Sb) | Argentiferous galena, cerussite, anglesite, minor copper minerals, bindheimite, wulfenite, and vanadinite in tabular replacement orebodies, with ferruginous and manganiferous gangue, along a strong fault zone and associated fissures in Paleozoic limestone. Deep oxidation and supergene enrichment produced high grade lead-silver ore in upper section. Pods and pockets of psilomelane and pyrolusite in fracture zones in limestone. | Shaft operations. Probably worked by Jesuits and Mexicans prior to 1850 and later mined up through 1952. Total estimated and reported production of Pb-Ag ore would be some 200,000 tons of ore averaging about 4% Pb, 3 oz. Ag/T, and minor Cu, Zn, and Au. During WW I and WW II, some 7,500 long tons of about 25% Mn shipped. | Mowry, 1864<br>Prout, 1907<br>Dinsmore, 1909<br>Schrader, 1915, p. 296-306<br>Farnham et alia, 1961, p. 159-162<br>ABM file data |
| 12. National mine (Erin; National Consolidated Mg. Co.) | 23S | 15E | Cen. 23 Protracted | Cu, Ag, Pb, Au | Quartz-chalcopyrite-pyrite and quartz-argentiferous galena veins in brecciated Jur-porphyritic granite along a strong fault zone. Granite intrudes Precambrian metamorphic and igneous, hornblende rich rocks. Some oxidation and supergene enrichment. | Shaft and adit operations. Mined from 1906 through 1915, producing some 150 tons of ore averaging about 6.5% Cu, 21 oz. Ag/T, 1.1% Pb, and 0.4 oz. Au/T. | Schrader, 1915, p. 310-311<br>ABM file data |
| 13. Paymaster mine (Bostwick, Lynch, Bond & Hutchins) | 23S | 16E | E. Cen. 19 Protracted | Cu, Ag, Au-, Pb-, Zn- (As) | Quartz vein containing chalcopyrite, bornite, pyrite, arsenopyrite, galena, and sphalerite along a strong shear zone in strongly altered Laramide granodiorite. Oxidation and enrichment near the surface. | Shaft operations. Produced some 130 tons of ore averaging about 7% Cu, 8 oz. Ag/T, and minor Au. | Baker, 1961<br>ABM file data |
| 14. Pocahontas mine (Harshaw, Davis et alia, Duquesne Mg. & Reduction Co., Sestiago, Curtis Estate) | 23S | 16E | W. Cen. 35 Protracted | Pb, Ag, Au-, Cu- | Irregular and shallow replacement orebody containing mainly argentiferous lead carbonate in silicated Permian Naco Group limestone along the contact with Laramide granodiorite. In depth, only weakly mineralized brecciated and altered rock. | Open pit operations. Worked for Pb-Ag ore in 1880's and 1930's. Total production would be some 2,000 tons of ore averaging about 23% Pb, 20 oz. Ag/T, and minor Au and Cu. | Schrader, 1915, p. 343<br>ABM file data |
| 15. Pride of the West mine (Washington; Salisbury, Clark, Chapin, Wifley, Pride of the West Co., Duquesne Mg. & Reduction Co., Humphrey Mg. Co., Byrd, Radon Mg. Co., Nash Mines) | 23S | 16E | SE¼ 34 Protracted | Cu, Ag, Zn, Pb-, Au- | Massive, banded and bedded, partly drusy, replacement bodies of irregularly mixed quartz, calcite, garnet, sphalerite, chalcopyrite, galena, pyrite, pyrrhotite, and magnetite in crystalline and pyrometamorphosed Permian Naco Group limestone along a contact with intrusive Laramide granodiorite. Shallow oxidation and some supergene enrichment. | Tunnel and shaft operations. Worked from early 1880's and sporadically through 1955, producing some 103,000 tons of ore averaging about 4.5% Cu, 4 oz. Ag/T, 1.4% Zn and minor Pb and Au. | Copper Handbook, 1902<br>Crosby, 1906<br>Schrader, 1915, p. 322-325, 332-335<br>Baker, 1961<br>ABM file data |
| 16. Proto mine group (Proto Bros., Fulton, Sullivan) | 23S | 16E | Cen. 30 Protracted | Cu, Ag, Pb-, Au- | Drusy and banded quartz vein with spotty chalcopyrite, pyrite, and minor galena, partly oxidized, along a shear zone cutting Laramide granodiorite. Strong wall rock alteration. | Shaft and tunnel operations. Production since early 1900's would be some 1,200 tons of ore averaging about 8% Cu, 3 oz. Ag/T, and minor Pb and Au. | Schrader, 1915, p. 316-317<br>Baker, 1961<br>ABM file data |

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| 17. Roy mine (Roy & Titcomb, Bostwick, Bacon, Blabon, Sim, Valenzuela) | 23S | 16E | SE¼ 20 Protracted | Cu, Ag, Au, Pb- | Drusy, quartz vein with partly oxidized copper and minor lead mineralization along a fault or shear zone in Laramide granodiorite. | Shaft operations. Sporadic mining from 1915 through 1946. Produced some 400 tons of ore averaging about 3.5% Cu, 2.3 oz. Ag/T and 0.1 oz. Au/T. | ABM file data |
| 18. Santa Nino mine (Havalina Mg. Co., Miami Copper Co., Southern Copper Mines Co., Beyerle, Santo Nino Mg. Co., Young & Gardner, Santo Nino Lessees) | 24S | 16E | NW¼ 9 | Cu, Mo, Ag, Au-, Pb-, Zn- | Lenticular, intensely feldspathized zone with disseminated chalcopyrite, pockets of molybdenite, pyrite and pods of quartz surrounded by zones of quartz-sulfide veinlets along faults, fissures, and joints in Laramide granodiorite. | Adit operations. Worked sporadically from early 1900's through 1955, producing some 20,100 tons of ore averaging about 7% Cu, 1 oz. Ag/T and minor Au. Some 200 tons of Mo ore concentrated to 16 tons of $MoS_2$ concentrates. | Kupfer, 1965<br>ABM file data |
| IX. Redrock District | 21-23S | 16-18E | ---- | Cu, Ag, Pb, Zn-, Au-, Mn | 1. Small, shallow, and generally weak, oxidized copper, lead, and zinc mineralization, with some supergene enrichment in silver, associated with fault and fracture zones in Laramide andesitic and rhyolitic volcanics. 2. Manganese minerals in a fractured and brecciated zone in Jurassic welded tuff. | Shallow shaft, adit, and open cut operations. Prospected and worked sporadically from the 1880's, mainly for pockets of high grade silver. Total production would amount to some 530 tons of ore containing about 20 tons of copper, 21 tons of lead, 2 tons of zinc, a few ounces of gold and 56,000 ounces of silver. A few tens of tons of hand picked manganese ore have been shipped. | Schrader, 1916, p. 239-245<br>ABM file data |
| 1. Blue Bird mine (De la Ossa & Lemas) | 23S | 18E | E. Cen. 5 | Mn | Manganese oxides in narrow stringers and irregular pods in fractures and breccia in Jurassic welded tuff. | Shaft and open cut operations. Worked in WW I and in early 1950's, producing a few tens of tons of sorted 40-42% Mn. | Farnham et alia, 1961, p. 175-176 |
| 2. Durham Copper claims | 22S | 17E | NE¼ 18 | Cu, Ag, Au- | Oxidized copper mineralization with supergene enrichment of silver in narrow fractures in Laramide volcanics. | Shallow shaft and adit operations. Worked sporadically from 1937 through 1941, producing some 70 tons of hand picked ore averaging about 24% Cu, 70 oz. Ag/T and minor Au. | ABM file data |
| 3. Frisco Fair mine group (Hummer, Apex, Margaret; Sheehy, Bergman, Chapman, Cofa & Daniel) | 22S | 17E | S. Cen. 17 | Pb, Ag, Cu | Small, irregular lenses and pockets of oxidized argentiferous lead mineralization, with some copper, along a fracture zone in Laramide volcanics cut by a granite porphyry dike. | Shaft and open cut operations. Sporadic production from 1916 through 1948 of some 70 tons of ore averaging about 24% Pb, 7 oz. Ag/T, and 2.5% Cu. | ABM file data |
| 4. La Plata mine (Black Ace; Carre', Jensen) | 22S | 17E | NW¼ 14 | Ag, Cu-, Pb-, Zn-, Mn- | Small, irregular pockets and stringers containing argentite and cerargyrite, associated with copper, lead, and zinc carbonates, iron and manganese oxides, and calcite, along a fracture zone in Laramide volcanics. | Tunnel and shaft operations. Worked prior to 1900 with a small production of high grade silver ore. | Schrader, 1915, p. 241-242 |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
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| X. San Cayetano District (San Cayetano Mountains) | 21-22S | 13-14E | ---- | Cu, Ag | Quartz veins and veinlets containing spotty and weak argentiferous copper mineralization in Laramide quartz diorite and in a strong fault zone cutting Cretaceous and Tertiary rhyodacite volcanics. | Shallow shaft and tunnel operations. Worked in the early 1900's but only a relatively few tons of copper-silver ore were ever shipped. | Schrader, 1915, p. 355-358<br>Simons, 1974<br>ABM file data |
| XI. Tyndall District (Western slope of southern part of Santa Rita Mountains) | 21-23S | 14-15E | ---- | Pb, Ag, Zn, Cu, Au | 1. Irregular and lensing quartz fissure veins containing spotty argentiferous lead, zinc, and copper mineralization and some barite. Generally shallow oxidation with supergene enrichment. Wall rocks are Cretaceous rhyodacite volcanics with interbedded arkose or Jurassic granite.<br>2. Replacement deposits of argentiferous lead and zinc mineralization with minor copper in strongly faulted blocks of Paleozoic limestone. Deep solution and oxidation produced supergene enrichment in silver, and lead and zinc carbonates. | Numerous scattered mines and prospects, some worked from time of Jesuits to recent times. The total estimated and reported production would be some 56,000 tons of ore containing about 9,400 tons of lead, 2,800 tons of zinc, 520 tons of copper, 480,000 ounces of silver, and 1,260 ounces of gold. | Schrader, 1915, p. 180-220<br>ABM file data<br>Drewes, 1971a, b; 1972a, b, c |
| 1. Alto mine group (Gold Tree, El Plomo, B. & R., Long Contact; Lully, A. Steinfeld & Co., Alto Consolidated Mines, Smltg. & Transportation Co., Alto Copper Co., Southwest Development Co., Henderson, Bradford, Bond, Laguna, Moreno, Long Contact Mg. Co., B. & R. Mines, Fortuna Mg. Co.) | 21S | 14E | S.½ 12 N.½ 13 | Pb, Ag, Cu, Zn, Au (Sb, Bi, As, Ba, U) | Series of roughly parallel, strong, quartz-barite fissure veins carrying lenses and pods of galena, argentite, pyrite, tetrahedrite, chalcopyrite, chalcocite, and local sphalerite, oxidized and supergene enriched near the surface. Wall rocks are Cretaceous rhyodacite welded tuff with interbedded arkose, underlain by Jurassic granite. Sparse fine grain uraninite crystals in a cross fracture. | Extensive tunnel and shaft operations. Worked originally by Jesuits and later by others, intermittently, since 1680's. Total estimated and recorded production probably more than 3,500 tons of ore averaging about 12% Pb, 14 oz. Ag/T, 3% Cu, and minor Zn and Au. | Schrader, 1915, p. 197-203<br>Copper Handbook, 1903<br>USAEC Prelim. Rec. Rpt., A-P-360, 1955<br>ABM file data |
| 2. Apache mine (Santa Rita Mg. Co., Henderson, Figueroa) | 21S | 14E | Cen. 12 | Pb, Ag, Cu, Zn-, Au- | Quartz-fissure vein, containing argentiferous galena, chalcopyrite, and sphalerite, largely oxidized, in Cretaceous rhyodacite underlain by Jurassic granite. | Tunnel and shaft operations. Worked intermittently since late 1800's with a total production of some 500 tons of ore averaging about 14% Pb, 29 oz. Ag/T, 2% Cu, and minor Au. | Schrader, 1915, p. 205-206<br>ABM file data |
| 3. Arizona-Pittsburg mine (Black Hills; Reichert, Arizona-Pittsburg Mg. & Smltg. Co.) | 21S | 14E | E. Cen. 1 | Pb, Ag, Cu, Zn-, Au- (Ba) | Narrow, lensing, quartz-barite fissure vein containing spotty galena, pyrite, chalcopyrite, tetrahedrite, and minor sphalerite, oxidized near the surface with iron and manganese oxides, copper carbonates and silver enrichment. | Shaft operations. Worked from 1890's through early 1900's, producing some 100 tons of ore averaging about 30% Pb, 9 oz. Ag/T, 2% Cu, and minor Au. | Schrader, 1915, p. 207-208 |

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| 4. Bland mine (Powers, Bland Mg. Co., Henderson, Ayala, Russell, Barclay) | 21S | 15E | E. Cen. 18 Protracted | Pb, Ag, Cu, Zn, Au- | Irregular fault fissure veins with partly oxidized lenses of massive pyrite and chalcopyrite; banded quartz, galena, chalcopyrite, bornite, and sphalerite; and some disseminated pyrite and chalcopyrite in crushed wall rock and gouge. Wall rock is Jurassic granite intruded by Laramide quartz monzonite. | Shaft and tunnel operations. Worked sporadically from late 1880's to 1948, producing some 700 tons of ore averaging about 18% Pb, 14 oz. Ag/T, 4% Cu, 4% Zn, and minor Au. | Schrader, 1915, p. 209-211<br>Copper Handbook, 1904<br>ABM file data |
| 5. Blue Lead mine (Johnson & Valles, Washington Trading Co.) | 21S | 15E | SE ¼ 33 | Pb, Ag, Cu-, Au- | Irregular, lensing, quartz-fissure vein containing argentiferous galena and some chalcopyrite, oxidized near the surface with enrichment, in Laramide diorite. | Shaft and tunnel operations. Worked in 1912 through 1916, and in 1912 through 1916, and in 1920 and 1923. Produced some 340 tons of ore averaging about 22% Pb, 18 oz. Ag/T, 0.6% Cu, and minor Au. | ABM file data |
| 6. Bonanza mine (Devil's Cash Box group, Veta Grande; Orosco, Alabama Queen Mg. Co., O'Neil & Candelaria, Ellefson) | 20S | 14E | Cen. 19 | Pb, Ag, Cu, Zn-, Au- | Largely oxidized, irregular replacement lenses of argentiferous galena, chalcopyrite, pyrite, and sphalerite in Permian limestone along a fault contact with Cretaceous arkose, in a folded and faulted synclinal thrust block. Some high grade zinc carbonate ore. | Shaft and adit operations. Worked intermittently from early 1900's through 1961, producing some 300 tons of ore averaging about 8% Pb, 8 oz. Ag/T, 3% Cu, and minor Au. | Schrader, 1915, p. 185<br>ABM file data |
| 7. Bowling Green mine (Lucky Spur group; Pierce) | 21S | 15E | Cen. Bor. 17, 20 | Pb, Ag, Cu, Au- (U) | Largely oxidized argentiferous galena and minor chalcopyrite in a quartz-sulfide pocket in an altered shear zone cutting Jurassic granite. Traces of uraninite and metatorbernite. | Shallow shaft operations. Some 430 tons of ore averaging about 21% Pb, 16 oz. Ag/T, 0.5% Cu and minor Au produced in 1923. | USAEC Prelim. Rec. Rpt. A-P-359, 1955<br>ABM file data |
| 8. Bradford mine (Ferry, Bradford Copper Mg. Co., McFarland) | 22S | 15E | NW ¼ 21 | Cu, Ag, Pb-, Au- | Copper carbonates and oxides with minor cerussite in quartz and iron oxides in sheared, altered, and metamorphosed Cretaceous sedimentary rocks and tuff breccia engulfed in Laramide quartz diorite. | Shaft and open cut operations. Worked sporadically from 1870's through 1912, producing some 300 tons of ore averaging about 10% Cu, 4 oz. Ag/T and minor Pb and Au. | Schrader, 1915, p. 219-220<br>Copper Handbook, 1903<br>ABM file data |
| 9. Bull Springs mine (A. D. E. Contracting & Development Co., McCutchan, Wolf & Callahan, LaRocque) | 21S | 14E | NW ¼ 3 | Pb, Ag, Zn, Cu-, Au- | Spotty, partly oxidized, argentiferous galena, sphalerite, pyrite, and chalcopyrite in a quartz-fissure vein cutting Cretaceous rhyodacite welded tuff and interbedded arkose members. | Shaft operations. Some 550 tons of ore averaging about 10% Pb, 11 oz. Ag/T, 5% Zn, and minor Cu produced from 1950 through 1955. | ABM file data |
| 10. Compadre mine group (Le Roy, Polatski, Mary; Michelske, Reid, Johnson, Kramer, Arizona Consolidated Gold & Copper Mines, Boulder Mg. Co.) | 20S | 14E | SE ¼ 35 | Zn, Cu, Pb, Ag, Au- | Spotty, partly oxidized sphalerite, pyrite, chalcopyrite, and galena in a narrow, lensing quartz fissure vein cutting Cretaceous rhyodacite welded tuff and interbedded arkose near intrusive Laramide diorite. | Adit and shaft operations. Sporadic production of some 350 tons of ore averaging about 7% Zn, 3% Cu, 2% Pb, and 3 oz. Ag/T, from the early 1900's through 1960. | Schrader, 1915, p. 188<br>ABM file data |
| 11. Connecticut mine (McCutchen & Hogan, Reid, Richardson, Parker & Reid) | 20S | 14E | SW ¼ 25 | Cu, Pb, Zn, Ag, Au- | Partly oxidized, spotty chalcopyrite, argentiferous galena, and sphalerite with iron oxides along a shear zone in crushed and silicified Laramide diorite. Considerable zinc mineralization. | Tunnel and shaft operations. Developed in mid-1890's and produced intermittently through 1937 some 240 tons of ore averaging about 11% Cu, 9% Pb, 8 oz. Ag/T and minor Au. | Schrader, 1915, p. 189-190<br>ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| 12. Elephant Head mine group (Quantrell, Eureka; Powers & Stockton, Garrett & Parks, New State Mg. Co.) | 20S | 14E | SW ¼ 4 SE ¼ 5 NE ¼ 8 | Pb, Ag, Cu-, Zn-, Au- | Partly oxidized, argentiferous galena with minor chalcopyrite, and spotty sphalerite in a quartz fissure vein and in a sheared and altered zone along rhyolite dikes cutting Laramide quartz monzonite wall rock. | Adit and shaft operations. Worked in the early 1900's and in 1913 and 1914, producing some 950 tons of ore averaging about 8% Pb, 3 oz. Ag/T, and minor Cu, Zn, and Au. | Schrader, 1915, p. 182-183<br>Mines & Copper Handbook, 1918<br>ABM file data |
| 13. Eureka-Marble mine group (Thunderer, Highside, Old Mexican; Clark & Peterson, Ferry, Blake, Salero Mines Co., Gardner, Tobin & Pond, Henderson, Kolberg, Eureka Mg. & Mllg. Co.) | 21S | 14E | NE ¼ 24 | Pb, Ag, Cu, Zn, Au- | Argentiferous galena with minor chalcopyrite, tetrahedrite, pyrite, argentite, and spotty sphalerite, oxidized in part to chrysocolla, azurite, covellite, malachite and limonite with supergene enrichment of silver, in a crushed, banded quartz gangue, recemented with iron oxide and silica, in a fissure zone cutting Laramide diorite. Strong pyrite gossan. | Shaft operations. Prospected as early as 1850's and worked intermittently through 1942, producing some 950 tons of ore averaging about 12% Pb, 22 oz. Ag/T and minor Cu and Au. | Schrader, 1915, p. 211-212<br>ABM file data |
| 14. Florida mine (Hooks, Bond) | 21S | 14E | SE ¼ 12 | Cu, Pb, Ag, Au | Partly oxidized argentiferous galena and chalcopyrite with pyrite in an irregular, lensing quartz-fissure vein cutting Cretaceous rhyodacite tuff and interbedded arkose. | Adit and shaft operations. Spotty production of some 140 tons of ore, averaging about 6% Cu, 5% Pb, 20 oz. Ag/T and 0.7 oz. Au/T, in 1910's and 1920's. | ABM file data |
| 15. Glove mine group (Sheehy-O'Donnell, O. K., Rover; Sheehy, Santa Cruz Silver-Lead Co., Sunrise Mg. Co., Arivaca Mg. Corp., Colorado Fuel & Iron Steel Corp.) | 20S | 14E | Cen. & SE ¼ 30 | Pb, Zn, Ag, Cu, Au-, Mo | Argentiferous galena, sphalerite, and small amounts of pyrite, chalcopyrite, and quartz deposited in permeable zones at the intersection of a bedding plane fault and favorable beds in Permian Naco limestone. Extensive solution of the limestone and deep oxidation concentrated cerussite, anglesite, wulfenite, and smithsonite in the leached caverns as sand carbonate ore. | Shaft and adit operations. Worked at various times from about 1911 through 1972, producing some 29,260 tons of ore averaging about 22% Pb, 9% Zn, 7 oz. Ag/T, 0.3% Cu, and minor Au. | Schrader, 1915, p. 185<br>Anthony, 1951<br>Olson, 1961<br>See, J. M., Jr., 1964<br>ABM file data |
| 16. Good Luck mine (Santa Rita Mg. Co.) | 20S | 14E | NE ¼ 17 | Pb, Au, Ag | Oxidized pyritic zone in Laramide quartz monzonite containing, near the surface, supergene enriched silver and lead values and concentrations of gold. Mineralization probably controlled by fractures. | Surface workings. In 1908, some 384 tons of ore were concentrated 20:1 to yield about 28 oz. Au/T. 13 oz. Ag/T and 16% Pb. | Schrader, 1915, p. 184-185<br>ABM file data |
| 17. Ivanhoe mine (Ivanhoe Mg. Co., Johnson, Tobin & Beasley, Hopkins) | 21S | 15E | S. Cen. 34 | Ag, Cu, Pb-, Au, Mo- (Sb) | Irregular, crudely-banded, iron and manganese stained, quartz-fissure vein containing spotty ore shoots of chalcopyrite and pyrite and small pockets of galena. Oxidation and supergene enrichment produced copper carbonates, cerussite, wulfenite, and silver halides. | Shaft operations. Worked by Mexicans as early as the 1850's and by others through 1924, producing some 420 tons of ore averaging about 51 oz. Ag/T, 2% Cu and minor Pb. | Schrader, 1915, p. 216-218<br>ABM file data |

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| 18. Jefferson mine (Curtis & Steinfeld, Henderson, Kruse, Fulk, Newman, Miller, Jefferson Mines Inc., Bouldin, Nuttal & Snyder) | 21S | 14E | SE ¼ 13 | Pb, Ag, Zn, Cu, Au | Irregular, lensing quartz-fissure vein containing galena, sphalerite, pyrite, and chalcopyrite, oxidized near the surface, along a dike cutting Laramide diorite. | Shaft and adit operations. Worked from early 1900's through 1950, producing some 6,500 tons of ore averaging about 15% Pb, 5 oz. Ag/T, 2% Zn, 0.4% Cu, and minor Au. | Schrader, 1915, p. 209<br>ABM file data |
| 19. Jesuit mine (Abrams, White Tail Mg. Co., Drake Enterprises) | 21S | 14E | NW ¼ 13 | Ag, Pb, Cu, Au- | Lensing and irregular quartz-fissure vein containing galena, pyrite and chalcopyrite, oxidized near the surface with supergene enrichment, producing some high grade silver values. Wall rock is a Cretaceous arkose in rhyodacite tuff. | Tunnel operations. Worked sporadically from mid-1930's through 1961, producing some 460 tons of ore averaging about 10 oz. Ag/T, 2% Pb, 1.5% Cu and minor Au. | ABM file data |
| 20. Joplin mine (Joplin Mg. Co., Pierce) | 21S | 15E | NW ¼ 18 | Pb, Ag, Cu, Au | Irregular, lensing, quartz-fissure vein containing spotty ore shoots of argentiferous galena, pyrite, and chalcopyrite, oxidized and enriched in silver values and copper carbonates. Wall rock is Jurassic quartz monzonite and granite showing some disseminated sulfide mineralization. | Tunnel and shaft operations. Worked intermittently from the 1880's through 1926, producing some 270 tons of ore averaging about 14% Pb, 13 oz. Ag/T, 2% Cu, and 0.3 oz. Au/T. | Schrader, 1915, p. 205<br>ABM file data |
| 21. Lee mine (Ruby Copper Co., Pierce) | 21S | 15E | E. Cen. 18 | Cu, Pb, Ag, Au- | Disseminations and spotty high grade ore shoots of chalcopyrite and argentiferous galena with pyrite, oxidized and enriched near the surface, along and in a quartz-fissure vein cutting Laramide diorite and engulfed blocks of Cretaceous volcanic tuff and arkose. | Shaft operations. Worked from about 1914 through 1918, producing some 100 tons of ore averaging about 9% Cu, 8% Pb, 13 oz. Ag/T, and minor Au. | Mines Handbook, 1918<br>ABM file data |
| 22. Mohawk mine (Squaw Gulch Mg. & Mllg. Co., Kolberg) | 21S | 15E | SW ¼ 29 | Pb, Ag, Cu, Au- | Irregular, lensing quartz-fissure vein with spotty argentiferous galena, pyrite, and chalcopyrite, oxidized and enriched near the surface, cutting Laramide diorite. | Shaft operations. Worked mainly in 1928 and 1929, producing some 140 tons of ore averaging about 8% Pb, 7 oz. Ag/T, 4% Cu and minor Au. | ABM file data |
| 23. Montezuma and La Paz mines (Wrightson Bros., Aztec Mg. Syndicate, Clark & Peterson, Red Cloud Mg. Co., Ferry, Henderson, Drake Enterprises) | 21S | 14E | E. Cen. 36 | Ag, Cu, Pb-, Au- | Irregular, generally narrow, quartz stringers containing pyrite, chalcopyrite, galena, and argentite along a quartz-fissure zone in Laramide quartz diorite and quartz monzonite. Zone is brecciated, silicified, and oxidized with iron and manganese oxides and with enrichment in silver, copper carbonates, and chalcocite. | Shaft and surface operations. Worked by Jesuits in early 1800's and by others intermittently through the 1930's, producing some 300 or more tons of ore averaging about 3% Cu, 11 oz. Ag/T, and minor Pb and Au. | Schrader, 1915, p. 212-213<br>ABM file data |
| 24. Montosa mine group (Isabella, Amado, Black Diamond; Calabasas Copper Co., Boykin, Amado Mines, McIntosh) | 20S | 14E | NE ¼ 28<br>NW ¼ 29 | Pb, Cu, Ag, Zn-, Au | Largely oxidized galena, chalcopyrite, pyrite, and sphalerite in an irregular replacement body in a large exotic Paleozoic limestone block engulfed in a Cretaceous dacitic volcanic breccia and also as spotty mineralization in a quartz-fissure vein cutting the dacite volcanics. | Shaft and open cut operations. Worked sporadically from early 1900's through 1949, producing some 1,000 tons of ore averaging about 22% Pb, 3% Cu, 3 oz. Ag/T and minor Zn and Au. | Schrader, 1915, p. 186-187<br>Sulik, 1957<br>ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| 25. Royal Blue mine group (Apache Mg. Co., Frazer, Security Mg. Co., Henderson, Royal Blue Mg. & Mllg. Co., Heagney & Ellison, Royal Blue Mg. Co., Campbell, Merrill & Otero) | 21S | 14E | N. Cen. 13 | Pb, Ag, Cu, Zn, Au- | Irregular, lensing, quartz-fissure veins containing ore shoots of argentiferous galena, pyrite, chalcopyrite, and sphalerite, oxidized with supergene enrichment near the surface. Wall rock is largely Cretaceous arkose members interbedded in rhyodacite tuff. | Shaft and tunnel operations. Worked mainly from 1912 through 1920 and 1945 through 1949, producing some 2,400 tons of ore averaging about 6% Pb, 12 oz. Ag/T, 3% Cu, 1% Zn and minor Au. | Schrader, 1915, p. 203<br>ABM file data |
| 26. Salero mine (Darwin, Constitution; Wrightson Bros., Salero Mg. Co., Clark & Peterson, Weir, Salero Mines Co., Sortillon, Discovery Process Inc.) | 21S | 14E | NE¼ 25 | Pb, Ag, Cu-, Zn-, Au- | Strong quartz-fissure zone with veins of crushed, drusy, laminated quartz containing spotty argentite, chalcopyrite, minor galena and some pyromorphite in sheeted and fractured Cretaceous rhyodacite tuff and Laramide diorite. Strong and deep oxidation produced cerargyrite, lead chlorides, iron and manganese staining, and copper carbonates in upper part. | Shaft operations. One of oldest mines of the district, worked by Jesuit and Franciscan missionaries and early Americans prior to 1900 and only on small scale since then. Total production would be some 500 tons of ore averaging about 12% Pb, 24 oz. Ag/T, less than 1% Cu and Zn, and minor Au. | Schrader, 1915, p. 194-197<br>ABM file data |
| 27. San Ramon mine group (Moreno, Costa & Morriss, Manson Mg. Co., Magoffe, San Ramon Mines) | 21S | 14E | E. Cen. 12 | Pb, Ag, Zn, Cu, Au- | Lensing quartz-fissure vein containing argentiferous galena, sphalerite, pyrite, and chalcopyrite, oxidized with silver enrichment near the surface, cutting Cretaceous arkose and rhyodacite tuff and Jurassic granite close to intrusive Laramide diorite. | Shaft and tunnel operations. Worked mainly from mid-1940's through mid-1950's, producing some 250 tons of ore averaging about 8% Pb, 7 oz. Ag/T, 2.5% Zn, 1% Cu and minor Au. | ABM file data |
| 28. Tiajuana mine (Tiajuana Mines Inc., Bekins) | 20S | 14E | NE¼ 26 | Ag, Pb, Zn Cu, Au- | Strong quartz-fissure vein with spotty argentiferous galena, sphalerite, pyrite, and chalcopyrite, oxidized at surface with iron, manganese, and copper carbonates and oxides. Spotty high grade silver chlorides. Wall rock is Laramide quartz monzonite or quartz diorite. | Shallow shaft and adit operations. Worked for silver chlorides in 1870's and some sporadic mining through 1968. Production would be some 100 tons of ore averaging about 15 oz. Ag/T, 3% Pb, 3% Zn, and 1% Cu. | Schrader, 1915, p. 191-193<br>ABM file data |
| 29. Trenton mine (Clarke & Peterson, Arizona Gold & Copper Co., Trenton Mg. Co.) | 21S | 14E | SE¼ 13 | Pb, Ag, Cu-, Zn-, Au- | Irregular ore shoots of argentiferous galena, pyrite, and minor chalcopyrite and sphalerite in a brecciated stock work of quartz-barite fissure veins cutting Laramide diorite. | Shaft operations. Worked in late 1800's and early 1900's, producing some 1,300 tons of ore averaging about 4% Pb and 5 oz. Ag/T. | Copper Handbook, 1902<br>Schrader, 1915, p. 208-209<br>ABM file data |
| 30. Victor mine (Bacon & Koon, Pierce, Victor Mg. Co., Weaver, Fortuna Mg. Co.) | 21S | 15E | S. Cen. 17 | Pb, Ag, Zn-, Cu, Au- | Narrow, irregular quartz-fissure vein containing argentiferous galena, pyrite, and minor sphalerite and chalcopyrite, largely oxidized near the surface. Wall rock is Jurassic granite. | Tunnel operations. Worked sporadically from late 1800's through 1959, producing some 800 tons of ore averaging about 10% Pb, 5 oz. Ag/T and minor Zn, Cu and Au. | Schrader, 1915, p. 214-215<br>ABM file data |

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| 31. Vulcan mine group (Allen, Wingfield & Farrel) | 20S | 14E | SW¼ 28 | Cu, Ag- | Copper carbonates and sparse chalcopyrite and pyrite as irregular replacements in engulfed exotic blocks of Paleozoic limestone and in ferruginous quartz-fissure veins in Cretaceous dacite volcanic breccia. Associated Tertiary quartz latite dikes. | Adit operations. Worked in early 1900's and in 1954, producing some 650 tons of ore averaging about 8% Cu and 1 oz. Ag/T. | Schrader, 1915, p. 187-188, 214<br>ABM file data |
| 32. Wandering Jew mine (Verfuth & Co., Henderson, Laguna, Beardsley & Co., O'Keefe, Headley) | 21S | 14E | NW¼ 12 | Pb, Ag, Cu-, Zn-, Au- | Argentiferous galena, pyrite, chalcopyrite, and sphalerite, oxidized near the surface with silver enrichment, in an irregular quartz-fissure vein cutting Cretaceous rhyodacite tuff and interbedded arkose. | Shaft and adit operations. Worked sporadically from the early 1900's through 1951, producing some 1,700 tons of ore averaging about 11% Pb, 3 oz. Ag/T, and minor Cu and Au. | Schrader, 1915, p. 203-205<br>Mines & Copper Handbook, 1918<br>ABM file data |
| XI. Wrightson District (Southwestern part of Santa Rita Mountains) | 20-22S | 15-16E | ---- | Pb, Ag, Cu, Zn, Au (Ba) | Irregular groups and parallel bands of lensing quartz-fissure veins containing spotty base metal sulfides, pyrite, and often barite, largely oxidized and enriched near the surface. Wall rocks are a banded belt of folded and faulted Mesozoic and Tertiary volcanics with interbedded sedimentary or tuffaceous members, Jurassic granite and quartz monzonite, and Laramide and Tertiary granodiorite stocks with rhyolite and quartz latite dikes. | Numerous, scattered prospects and small mines worked since the late 1870's and up through the 1900's. Total estimated and recorded production would be some 4,000 tons of ore containing about 475 tons of lead, 51 thousand ounces of silver, 118 tons of copper, and 386 ounces of gold. | Schrader, 1915, p. 220-239<br>Rohrbacker, 1964<br>Drewes, 1967<br>ABM file data |
| 1. American Boy mine group (Clark, Peterson & David, Gross Mg. & Investment Co.) | 21S | 15E | NW¼ 9 | Pb, Ag, Cu, Zn, Au (Ba) | Series of irregular quartz and breccia veins containing seams, shoots, and stringers of spotty argentiferous galena, massive pyrite, chalcopyrite, tetrahedrite, bornite, and sphalerite in quartz, calcite, and some bladed barite gangue. Oxidized near the surface with enrichment in argentiferous cerussite. Wall rock is Triassic quartz monzonite intruded by Jurassic quartz monzonite and aplitic bodies. | Tunnel and shaft operations. Worked from about 1906 through 1918 and sporadically through 1951, producing some 200 tons of ore averaging about 4.5% Pb, 8 oz. Ag/T, 4% Cu and 0.1 oz. Au/T. | Schrader, 1915, p. 229-230<br>Mines and Copper Handbook, 1918<br>Rohrbacker, 1964<br>ABM file data |
| 2. Anaconda mine group (Double Header, Ultima, Copper Mountain or Armada, Philadelphia, Little Joker, St. Louis, Silver Cave; Parks, Anaconda-Arizona Mg. Co., Altamirano, Boulder Mg. Co.) | 21S | 15E | NW¼ Cen. S. Cen. & SW¼ 3 N. Cen. & NE¼ 10 | Ag, Pb, Cu, Zn-, Au- | Lensing quartz-fissure veins containing calcite and barite, and with shoots, stringers, and seams of argentiferous galena, chalcopyrite, sphalerite, tetrahedrite and pyrite. Veins are often vuggy with mineralization banded or lining vugs. Wall rock is Triassic rhyolite and latite volcanics. | Tunnel and shaft operations. Worked from early 1870's and intermittently through 1949, producing some 300 tons of ore averaging about 5% Pb, 30 oz. Ag/T, 3% Cu, and minor Au. | Schrader, 1915, p. 233-237<br>E. & M. J., Jan. 15, 1910<br>Rohrbacker, 1964<br>ABM file data |

Table 4, Cont.

| MINING DISTRICT AND MINES | LOCATION T. | R. | Sec. | MINERAL PRODUCTS | GEOLOGY | TYPE OF OPERATION AND PRODUCTION | REFERENCE |
|---|---|---|---|---|---|---|---|
| 3. Castle Butte mine (Stockton, Castle Butte Mg. Co., American Mg. & Oil Co., Miller & Sheerer) | 22S | 15E | W. Cen. 11 | Cu, Ag, Au | Irregular, lensing quartz fissure vein containing spotty copper carbonates and silicate, iron and manganese oxides, epidote, and some gypsum and crushed wall rock in Tertiary rhyolite welded tuff and flows. | Shaft, tunnel, and open cut operations. Worked since the 1880's and sporadically through 1918, producing some 100 tons of ore averaging about 10% Cu, 2.5 oz. Ag/T, and 0.1 oz. Au/T. | Schrader, 1915, p. 237-239<br>ABM file data |
| 4. Dixie mine (Powers, Jonston, Elliott, Altamirano & Goodsell, Lenon & Wilson) | 21S | 15E | NE ¼ 8 | Pb, Ag, Cu-, Zn-, Au- | Series of parallel fissure veins of massive quartz containing abundant pyrite, bladed masses of barite, and shoots and stringers of argentiferous galena, pyrite, and minor chalcopyrite and sphalerite, cutting Triassic monzonite intruded by Jurassic aplite. Oxidized and enriched near the surface. | Tunnel operations. Worked intermittently from 1911 through 1953, producing some 310 tons of ore averaging about 17% Pb, 7 oz. Ag/T, 0.5% Cu, and minor Au. | Rohrbacker, 1964<br>ABM file data |
| 5. Gringo mine group (Francis group, Temporal group; Arizona Gold Mines & Mllg. Co., Altamirano, Richmond) | 21S | 15E | NW ¼ 36 | Au, Ag, Pb, Cu, Zn- | Series of irregular lensing quartz-calcite veins, some of coarse grained, banded quartz, minor calcite, and crushed rock, containing fine grained free gold with minor silver, iron and manganese staining and sparse copper and lead sulfides and molybdates, deeply oxidized. Others with more calcite contain more copper and lead mineralization. Wall rock is Cretaceous rhyolitic tuff and andesite. | Shaft operations. Discovered in 1890's but worked mainly for gold in 1907-1908. Minor lead-copper production in 1929-1930 and 1937. Total output some 100 tons of 0.43 Au/T and 0.5 oz. Ag/T ore and some 40 tons of 6% Pb, 4% Cu and 12 oz. Ag/T. | Schrader, 1915, p. 222-226<br>ABM file data |
| 6. Happy Jack mine (Mountain View, Clipper, Eclipse; Lewis, Barnett & Powers, Happy Jack Mg. Co., Happy Jack Mg. & Reduction Co.) | 21S | 15E | N. Cen. 16 | Pb, Ag, Cu, Au-, Zn- (U?) | Irregular and lensing quartz-fissure veins containing brecciated and altered wall rock, gouge, and streaks and shoots of argentiferous galena, tetrahedrite, argentite, chalcopyrite, and pyrite in Jurassic granite cut by lamprophyre dikes. Possible uranium reported but not confirmed. | Tunnel operations. Worked sporadically from 1881 through 1908, producing some 150 tons of ore averaging about 34% Pb, 24 oz. Ag/T, 2% Cu and 0.1 oz. Au/T. | Copper Handbook, 1903, 1918<br>Schrader, 1915, p. 231-233<br>USGS Prelim. Rec. Rpt. 3/15/31<br>Rohrbacker, 1964<br>ABM file data |
| 7. Hosey mine group (Augusta, Presidential, Exposed Reef; Presidential Mg. Co., Leek, Ferguson, McDonald Mg. Co., Altamirano & Matrecita) | 21S | 15E | NE ¼ 7 | Pb, Cu, Ag, Zn-, Au- | Lensing quartz-fissure veins containing brecciated wall rock and shoots and stringer of massive, granular, and crystalline pyrite, argentiferous galena, chalcopyrite, tetrahedrite, chalcocite, argentite, and minor calcite and hematite. Some spotty sphalerite. Wall rock is Triassic monzonite intruded by Jurassic granite. | Shaft operations. Worked in 1880's and sporadically through 1936, producing some 450 tons of ore averaging about 15% Pb, 9% Cu, 9 oz. Ag/T and 0.4 oz. Au/T. | Copper Handbook, 1903, 1918<br>Schrader, 1915, p. 230-231<br>Rohrbacker, 1964<br>ABM file data |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8. Last Chance mine (Bartlett & Linton) | 21S | 15E | NW¼ 22 | Ag, Cu | Disseminations and stringers of oxidized copper and silver mineralization in a quartz fissure vein along the intrusive contact of Jurassic granite with contact metamorphosed Triassic dacite and latitic flows. | Tunnel operations. Produced some 100 tons of ore averaging about 5.5 oz. Ag/T and 1.6% Cu. | Rohrbacker, 1964<br>ABM file data |
| 9. Lead King mine (Blabon, Bradsher) | 21S | 15E | S. Cen. 10 | Pb, Ag, Cu, Zn | Lensing quartz-fissure vein containing spotty argentiferous galena, pyrite, chalcopyrite and sphalerite with a calcite-barite-quartz gangue. Wall rocks are altered Triassic and Cretaceous volcanics intruded by Laramide dikes. | Adit operations. Worked mainly from 1933 through 1942, producing about 280 tons of ore averaging about 12% Pb, 13 oz. Ag/T, 6% Cu and minor Au. | ABM file data |
| 10. Mansfield mine group (Sweet, Black Cap, Ruby, Rupert, Lee; Mansfield & Ryan, Gunsight Mg. Co., Powers, Mansfield Mg. & Smltg. Co., Pierce, Laycock, Bradsher) | 21S | 15E | SE¼ 9<br>S.½ 10 | Pb, Ag, Cu, Zn, Au | Cluster of roughly parallel quartz-fissure veins containing pyrite, argentiferous galena, sphalerite, tetrahedrite, chalcopyrite, bornite, in a quartz, calcite, barite and manganese gangue. Wall rocks are strongly altered Triassic dacitic and latitic flows and Cretaceous andesite breccia intruded by Laramide quartz latite dikes, stocks, sills, and breccia. | Tunnel and shaft operations. Worked intermittently from 1879 through 1951, producing some 370 tons of ore averaging about 19% Pb, 22 oz. Ag/T, 2% Cu, and 0.1 oz. Au/T. | Schrader, 1915, p. 226-229<br>Rohrbacker, 1964<br>ABM file data |

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