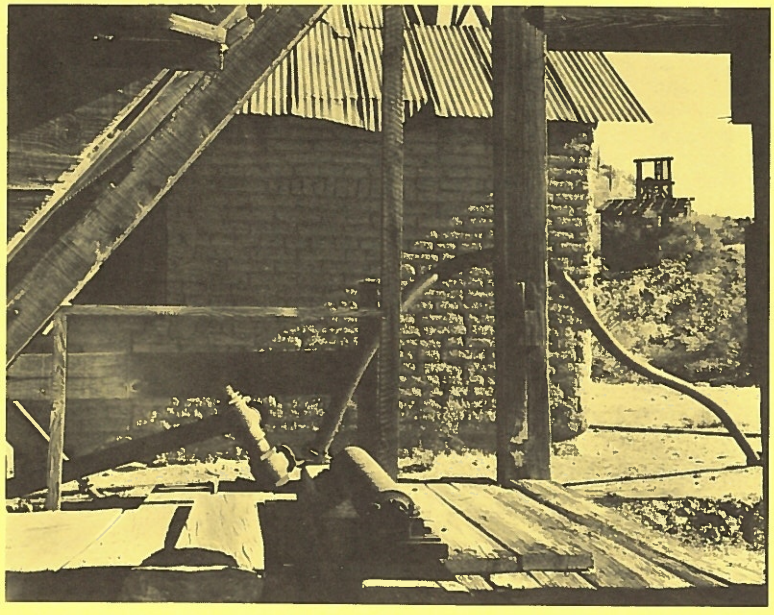
INDEX OF MINING PROPERTIES IN PIMA COUNTY, ARIZONA

by
Stanton B. Keith
Geologist



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Arizona
Bureau of Geology and Mineral Technology
Geological Survey Branch

The University of Arizona
Tucson

ARIZONA

BUREAU OF GEOLOGY AND MINERAL TECHNOLOGY

The Arizona Bureau of Geology and Mineral Technology was established in 1977 by an act of the State Legislature. Under this act, the Arizona Bureau of Mines, created in 1915, was renamed and reorganized and its mission was redefined and expanded.

The Bureau of Geology and Mineral Technology, a Division of the University of Arizona administered by the Arizona Board of Regents, is charged by the Legislature to conduct research and provide information about the geologic setting of the State, including its mineral and energy resources, its natural attributes, and its natural hazards and limitations. In order to carry out these functions, the Bureau is organized into two branches:

Geological Survey Branch. Staff members conduct research, do geologic mapping, collect data, and provide information about the geologic setting of the State to: a) assist in developing an understanding of the geologic factors that influence the locations of metallic, non-metallic, and mineral fuel resources in Arizona, and b) assist in developing an understanding of the geologic materials and processes that control or limit human activities in the state.

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1. respond to requests for information on the geology of Arizona
2. prepare maps and reports for publication or open file
3. maintain a library of published and unpublished maps and reports
4. maintain a repository for rock cores, well cuttings, and other samples
5. conduct qualitative tests on ores and mineral specimens native to Arizona
6. publish a quarterly newsletter, *Fieldnotes*
7. provide lectures, talks, displays and exhibits for the education of the general public

Cover Photo: San Xavier mine 1942, Pima County, Arizona. (Photo courtesy of Tad Nichols).

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PREFACE

Bulletin 189, first printed in 1974, has been reprinted with no modifications, except the redrafting of all figures. For these revisions, we thank Joe LaVoie and Ken Matesich.

Pima County, which now leads the State in mineral production because of copper mines in the Pima and Ajo districts, was originally a silver mining area. Padre Eusebio Francisco Kino mentioned in his writings in 1705 that rich silver ores, probably from the Santa Rita Mountains, were being mined. Although large tonnages and values were not produced, there were many small mines. Silver and gold from these mines were probably used to fashion religious ornaments for the missions.

Prior to 1853 the area south of the Gila River, including Tucson and what are now Pima, Santa Cruz, Cochise, and southern Graham Counties, was part of Mexico. This area became part of the United States through the Gadsden Purchase in 1853. Word of the region's abandoned Spanish silver mines, known as "antiguas," had already been spread by American soldiers, explorers, prospectors, and Boundary Commission surveyors and scientists. "Antiguas" had been reported in the Oro Blanco, Patagonia, Santa Rita, Sierrita, Tucson, and Catalina Mountains.

In 1856 Charles D. Poston and Samuel P. Heintzelman organized the Sonora Exploring and Mining Company and traveled from Cincinnati to southern Arizona, then part of Dona Ana County, Territory of New Mexico, to reopen these mines. The stockholders' report they prepared in late 1857 listed title to 78 mines (25 near Arivaca, 24 in the Santa Rita Mountains, and 29 surrounding Cerro Colorado) and two veins, referred to as the San Coyetano Tract, 8 miles southwest of Tubac.

Prospectors and small-mine operators were very active and made many metallic mineral discoveries in Arizona during the 1870's and 1880's. They did not realize, however, that some of the relatively small deposits they had found were merely near-surface manifestations of larger ore bodies. The large copper deposits were not discovered until the 1950's. In 1982 nine of the nation's 25 leading copper-producing mines were in Pima County.

Are other seemingly unimportant mineral occurrences in Pima County also marks of deeper, hidden deposits? Only time, favorable economics, exploration, and luck will tell.

Larry D. Fellows
State Geologist

March 1984

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INTRODUCTION

"Index of Mining Properties in Pima County, Arizona" is the second of the planned series covering the counties of the State. The first, on Cochise County, was published in 1973 as Arizona Bureau of Mines Bulletin 187. The total mineral output from Arizona for over one hundred years has come from many mines, ranging from major operations to small mines and prospects. The record of those operations are scattered in numerous publications of Federal and State agencies, in articles in various technical journals, in public and private reports, and in newspaper clippings. Many such sources are not readily available to persons seeking such information. Thus these indices are designed to provide, in a concise form, as much information on mining properties as may be found.

No attempt has been made to name and describe every mining property that may have been located. The selection has been made by the compiler on the basis of production records, special geologic or mineralogic character, or importance in relation to known or possibly hidden mineral resources. The identification of areas of high probability for mineral that might become economic to mine is important not only from the standpoint of a future national resource but also in planning the best use for the land involved. Comments, suggestions, or corrections on the material presented will be welcome.

Many individuals and companies have provided assistance in the collection of the included data and their help is gratefully acknowledged. Thanks also are due to personnel of the Arizona Bureau of Mines, especially Mr. J. R. LaVoie,

in the preparation of the format and maps.

EARLY HISTORY

Several Spanish expeditions entered southern Arizona in search of precious metals in the 1500's and by the late 1600's, Jesuit Fathers and early Spanish settlers had moved into the Santa Cruz Valley from Mexico. The area was then known as Primera Alta. The first detail description and map of the Pima County area was made by Father Kino in the late 1600's. He noted the discovery of precious metals in the region. The local Indians used stone implements and colorful or useful minerals or mineral pigments found on the surface. They appear to have had little interest in metals or mining. Later, under Spanish and Mexican rule, when the area was a part of the District of Arizonac, State of Sonora, prospecting and mining increased. Gold placers were found and worked near Arivaca, at Cañada del Oro, and in washes along the slopes of the Santa Rita and other mountains. Silver-rich outcrops of mineralized veins at Cerro Colorado, around Arivaca, and in the Santa Rita, Sierrita, Tucson, and Comobabi Mountains yielded modest amounts of silver ore, extracted and treated by primative methods. Production records are missing for that period but the operations were limited, hampered by hostile Indian and bandit raids, poor and recalcitrant Indian labor, and the natural difficulties of an isolated frontier area.

The earliest Americans in the area were trappers and scouts who may have carried out minor prospecting on the side. Few American settlers arrived prior to the early 1800's. After the Mexican War of 1846-48 and the Gadsden Purchase of 1853, the area of Pima County was annexed by the United States as a part of Dona Ana County of the Territory of New Mexico. The Territory of Arizona was created in 1863 and, in November, 1864, the Territorial Legislature designated Pima County as one of the first four counties of the new Territory. At that time Pima County covered all the area south of the Gila River from the New Mexico border to the present boundary with Yuma County. Subsequently, northern sections went to Maricopa County (1871) and Pinal County (1875), eastern sections to Cochise

and Graham Counties (1881), and a southern section to Santa County (1899). Tucson has always been the County Seat. The name "Pima" came from the original Spanish interpretation of the Indian word for negation as given in reply to questions.

The early American military and boundary survey parties moved through the newly acquired territory and noted the old and often abandoned Spanish and Mexican mine workings. Some of the military men organized companies to reopen the mines at Cerro Colorado and in the Santa Rita Mountains. Stage lines operating through Pima County in 1857 and 1858 facilitated mineral developments but in spite of scattered military protection, Indian harassment was common. With the outbreak of the Civil War in 1861, all military protection was withdrawn and for some ten years little or no mining activity was possible due to constant Apache Indian raids. By the 1870's when military protection was reestablished and the hostile Indians brought under control, mining activity increased rapidly. The construction of the Southern Pacific rail line through Pima County in 1878-1880 was a major aid to the mining industry. The Greaterville gold placers were discovered in 1873; the copper deposits at Silver Bell, Helvetia, Rosemont, and Twin Buttes were opened up in the late 1870's; and the silver-lead deposits at San Xavier and in the Empire Mountains were being worked by 1880. This mining boom subsided with the depression of 1884 and although revived sporadically in subsequent years, suffered from the drop in silver prices in 1893. In the late 1890's metal mining activity again boomed for a few years but price fluctuations, metallurgical difficulties, and frequent changes in management and ownership still plagued any large sustained operations. The World War I period brought a strong revival of mining in Pima County and the development of the first large-scale, open pit copper operation at Ajo. Again the depression of 1929 and following years marked a decline in major mining activities although hundreds of small prospects were worked by individuals who eked out a meager living from the recovery of precious metals. The major production period in Pima County started in the 1950's with the entrance of the Banner Mining Company into the Pima district and the development and operation of new open pit copper mines in the Pima and Silver Bell districts. Through 1972, the eight open pit mines in operation in the County have accounted for over 99 percent of the total

ore mined and over 98 percent of the total copper produced. The Pima district now leads in the total value of metals produced, followed by Ajo, Silver Bell, Helvetia-Rosemont, and Empire. The Pima and Ajo districts have produced over one billion dollars worth of metals.

An accurate record of the mineral production from Pima 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 and published the summary results in "Mineral Resources of the United States", through 1931, and in "Minerals Yearbook", from 1932 to the present. However, until recent years, few detail statistics on County production of mineral products other than precious and base metals have been made available. Thus for the period prior to 1901, and for other mineral materials, production must be largely estimated from fragmentary sources such as U. S. Mint Reports, articles in technical publications, and newspaper articles. Although the reliability of some such data may be questionable, the estimations used 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 materials produced in Pima County would amount to millions of tons and dollars but the lack of reliable data makes any estimate impractical.

Table I is a summary of the known and estimated production of base and precious metals by mining districts in Pima County, through 1972. From the total 781.7 million tons of ore mined, about 5.4 million tons of copper, 55 thousand tons of lead, 142 thousand tons of zinc, 57.8 million ounces of silver, and 1.67 million ounces of gold were produced, for a total value of some 3.8 billion dollars. Other metallic minerals produced in Pima County would include about 35 thousand tons of molybdenum concentrates, 270 tons of tungsten concentrates, and 10 thousand long tons of manganese oxides. Over 20 million tons of limestone and marble have been mined for cement and lime production, or for decorative and roofing stone, and several tens of thousand tons of smelter flux have been produced. Excluding sand, gravel, and common stone, the total value of all mineral production from Pima County, through 1972, would exceed four billion dollars.

Pima County, particularly the eastern half, appears to

be one of the most heavily mineralized areas in Arizona. Copper is the predominant metal found but other metals and nonmetallics also occur in scattered deposits. Most mineralization is closely associated with Laramide intrusives which intruded older rocks ranging from Precambrian to possibly Lower Tertiary formations. In a general way, the intrusives and strong zones of mineralization appear to have a northwest striking alignment which is sometimes further marked by later Tertiary intrusions, suggesting deep and continuous structural breaks in the earth's crust that may have been present for a long period of geologic time. Such a structural feature is strongly suggested along a line through the Silver Bell, Tucson, and northern Santa Rita Mountains. Other similar structural lines such as the one from the Arivaca area through the Quijotoa-Brownell Mountains may be inferred. Tertiary block and thrust faulting has complicated the interpretation of those possible intrusive and mineralization trends and the wide valley and basin areas between the mountain ranges effectively mask the evidence of the continuity of such trends. The exposed mineralized outcrops in this eastern part of the County have been well prospected and developed but many of the mountain shoulder and rock pediments, covered with varying thicknesses of alluvium, remain to be carefully examined for mineral deposits. In the western half of the County, only one major deposit, Ajo, has been found but in that section most rock exposures are post-mineralization volcanics or less favorable pre-mineralization Mesozoic intrusives or metamorphics. However, some scattered Laramide intrusives and Paleozoic sediments do occur in the western area and would indicate that the presence of favorable loci for ore deposits could have existed and now may be hidden by later volcanics or valley alluvium.

The Papago Reservation covers almost 42 percent of Pima County and although no major mineral deposits have been opened up within the County in that area, there is no reason to believe that such might not exist. Major deposits occur to the East, West, and North and scattered mineralization is found in the Comobabi, Quijotoa-Brownell, Santa Rosa, and Cimarron-Sheridan mountains. With favorable negotiated terms for mineral exploration and mining leases within the Reservation, the area could become an important hunting ground for ore deposits in the future.

Major mineral deposits will continue to be found in Pima County but with increasing difficulty and expense, providing onerous or prohibitive restrictions are not placed on legitimate exploration, development, and mining.

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 Pima 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 of mining properties and owners or operators is by no means all inclusive. It includes those names found to be most well-known but may not list all names, including present owners. Names of mines and owners have changed frequently and this practice often complicates the task of identifying individual mining properties.

Table IV is the main index, giving briefly, detail information on the mining properties, listed alphabetically by districts. The locations are given by surveyed or protracted township, range, and section, and wherever possible to the position within the section. Mineral products are listed by chemical symbols or by name, generally in the order of their apparent importance in the deposit. Minor or trace elements identified are shown in parentheses. The general geology of the deposit is briefly described, based largely on reports listed in the references. The type of operation is noted briefly and the production figures are based on reported or estimated figures. The references cited are listed in the bibliography. They are not all inclusive but are believed to be representative of the most informative data available.

The small scale maps show the location of the mining districts in Pima 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

AGUA DULCE MINING DISTRICT

The Agua Dulce mining district, covering the Agua Dulce Mountains and the O'Neil Hills, lies in the Sonoran Desert region of extreme southwestern Pima County. The name comes from a small spring or water seep used by wild animals, indians, and travelers and prospectors that passed through the area. O'Neil was an old desert prospector who worked and died in that area. This east-west chain of relatively low, rugged, strongly dissected, sierra-type, detached hills and mountains is surrounded by an extensive mountain pediment extending out under the desert alluvium. The exposed rocks have been classed as coarse-grained gneiss with included areas of schist and granite, all believed to be of Mesozoic age. A few isolated remnants of Quaternary-Tertiary basaltic andesite suggest that the area was once covered by volcanics, now eroded away. No strong structural features are apparent from reconnaissance mapping but block faulting undoubtedly accounts for the range.

The district has been prospected for mineral deposits in the past since it was close to the old desert trail between Yuma and Ajo. Several gold and copper prospects in weathered and oxidized, quartz-fissure veins or along basaltic dikes were opened up but except for minor values near the surface, only one, the Papago mine of the Papago Mining Company, warrented more extensive development. Several shafts were sunk on this property in the late 1800's and early 1900's but only a few tons of hand-picked gold-silver-copper ore were shipped.

The district now lies within the Cabeza Prieta Game Range and the Luke-Williams Air Force Range which, along with the extreme desert condition, scarcity of water, and isolated location, probably excludes the area at present from active mineral exploration. No detail study of the geology and possible mineralization is available but the geologic conditions in the district do not appear to be favorable for economic mineral deposits.

AJO MINING DISTRICT

The Ajo mining district is located in and around the Little Ajo Mountains and the mining town of Ajo in western Pima County. The name "Ajo" probably came from a Papago Indian work meaning "red paint" but its spelling is the same as the Spanish word for garlic, in reference to the onion-

like Ajo lily that grows in the area.

The relatively low, ragged, strongly dissected mountains, hills, and pinnacles of the district have been carved out of fault blocks and thick lava flows. The exposed sedimentary, metamorphic, intrusive, and extrusive rocks range in age from Precambrian to recent time. The basement Precambrian gneiss was originally covered by Paleozoic sedimentary formations as evidenced by fossiliferous, Paleozoic, limestone boulders found in later sedimentary formations. Also there are outcrops of Paleozoic limestone in the nearby Growler Pass area. Mesozoic sediments and volcanics also were present but mostly eroded away except where preserved in fault blocks. During the Mesozoic, large composite granitic to quartz dioritic intrusions invaded southwestern Arizona and one is exposed in the western side of the Ajo district. In the Laramide intrusive period, about 63 million years ago, a large quartz monzonite stock with quartz diorite border facies invaded the northern part of the district and was accompanied and followed by uplift, faulting, tilting, volcanic activity, and strong erosion. The thick Early Tertiary fanglomerate, containing coarse fragments of the older formations and interbedded andesite breccia, tuff, and lava, gives evidence of these many geologic events. Since that time continued erosion, sedimentation, volcanic activity, and block faulting have created the present geologic and topographic picture.

Some minor sulfide mineralization, and the emplacement of scattered pegmatites dikes and bodies, are associated with the Mesozoic granitic intrusion. The economic copper mineralization came during the Laramide intrusive period, mainly along fractures and as disseminations in a strongly brecciated and hydrothermally altered, southward extending prong of the quartz monzonite stock and in the bordering Cretaceous volcanics. Scattered, minor, and spotty copper mineralization also occurs along near-by major fault zones in the volcanics and in the main intrusive but seldom in economic amounts. Erratic secondary copper mineralization occurs in the Tertiary fanglomerate but has been of minor significance. Small, local, gold placers have been worked along the dry gulches draining the mineralized area and the pegmatites in the Mesozoic granite of the Chico Shunie Hills have been mined for siliceous smelter flux and

minor amounts of feldspar and scrap mica.

The red iron oxides and green secondary copper minerals were used as pigments by the indians long before the deposit was discovered by the early European prospectors. The deposit was worked on a small scale by the Spaniards in the 1700's. In 1855, after the Gadsden Purchase, a group of California men formed the first Arizona mining corporation to exploit the high grade, oxidized copper ore. The hand-sorted product was shipped to Yuma by animal transport where it went by boat to Wales, England for smelting. However, that and subsequent early attemps to mine, upgrade, or locally smelt the ore were not economically successful due to the scarcity of water, high transportation costs, or unsuitable, unsound, and sometimes fraudulent metallurgical schemes.

In 1911, Ira Joralemon, a geologist for Calumet and Arizona Mining Company, examined the property of the inactive New Cornelia Copper Company which held most of the mineral rights to the deposit. With Joralemon's favorable recommendation and the backing of John C. Greenway, General Manager of Calumet and Arizona, the property was optioned. A thorough examination was made by geologic mapping, drilling, test pitting, and some underground exploration. A large, low grade, copper carbonate and sulfide deposit was outlined. The subsequent development of a sound, economical leaching process to handle the carbonate ore, the discovery and development of an ample water supply from wells at Childs, the completion of a railroad line to connect with a trunk line at Gila Bend, and the acquisition of all rights to the orebody led to a very successful mining venture. Shipments of high grade, oxidized copper ore from the vein-like deposits in the bordering volcanics began in 1916 and, in 1917, of copper concentrates from open pit mining and the leaching and electrolytic precipitation of the copper carbonate ore. To treat the deeper sulfide ore, a flotation concentrator was put into operation in 1924 and enlarged to handle all production in 1930 when the reserves of carbonate ore were depleted. The new Cornelia Copper Company was absorbed by Calumet and Arizona in 1929, and when the latter company was taken over by the Phelps Dodge Corporation in 1931, the operation became known as the New Cornelia branch of that corporation. In 1950, a copper smelter was built at Ajo to

handle the concentrates previously shipped to outside smelters. Since 1916 and except for a period in the depression years of 1932 and 1933, the New Cornelia mine and plant have been in continuous production, yielding a large share of the copper, gold, and silver coming from Pima County.

The total metal production from the Ajo district, through 1972, would amount to some 350 million tons of ore containing about 2.8 million tons of copper, 19 million ounces of silver, and 1.55 million ounces of gold, for a total value of over 1.5 billion dollars. The gold content of the ore is relatively high for a porphyry-type copper deposit, amounting to about one ounce of gold for each 1.8 tons of copper. The molybdenum content, however, is lower than usual for this type of deposit. Only a few tens of ounces of gold have been recovered from placer deposits, mostly during the early 1930's. Substantial amounts of silica smelter flux and minor shipments of feldspar and scrap mica from the pegmatite deposits complete the mineral output of the district except for sand, gravel, and stone used for construction purposes.

The Ajo district lies along the western edge of known Paleozoic sedimentary formations and Laramide intrusions in southwestern Arizona. The deposit appears to be unique in respect to its somewhat isolated position and mineralization characteristics. A major northwest striking structural and intrusive trend can be inferred but the extension of this trend, which appears to have associated mineralization, is largely obscured by valley alluvium and late volcanics. The possibility that other major metal deposits may occur in the district under deep cover can not be ruled out but, if present, they will be difficult and expensive to find.

AMOLE MINING DISTRICT

The Amole mining district, one of the first established in Arizona, covers the area in and around the Tucson Mountains. This relatively low, ragged, and strongly dissected mountain chain was carved out of uplifted, tilted, and faulted intrusives, volcanics, and sediments ranging in age from Precambrian to Quaternary. Small outcrops of Precambrian schists and Paleozoic quartzite and limestone occur in place along the western flank and exotic blocks of limestone, believed to be Paleozoic in age, are found as included blocks in later intrusives, extrusive, and breccia formations, indicating that Paleozoic beds once covered the area

The main mass of the mountain chain consists of Mesozoic rocks, mainly Jurassic and Cretaceous redbeds and arkose, but also various intrusive and extrusive igneous rocks. A large, Laramide composite granitic to quartz monzonitic stock intruded the northwestern section of the district and the smaller dikes and stocks occurring southward may be related. At the same general time, strong intrusion and extrusion of rhyolite took place in the southern and eastern sections. In the Tertiary and Quaternary there appears to have been additional uplift, erosion, volcanism, and intrusions, as well as block faulting, to present a complex geological setting still not fully understood.

Metalliferous mineralization in the Amole district appears to be related largely to the Laramide and Tertiary intrusions, occurring around the periphery of the large stock or close to Tertiary plugs and dikes. The known deposits are mainly scattered, generally narrow, quartz veins or lenses with sulfides; small, irregular, replacement sulfide bodies in limestone lenses or exotic limestone blocks; and weak dissemination of sulfides in the intrusives. The major economic product of the district has been limestone for cement manufacture. Some basaltic andesite and rhyolite tuff has been used for construction purposes and a small amount of clay has been extracted.

Prospecting for mineral in the Tucson Mountains probably dates back to the founding of the San Xavier Mission in the late 1600's and was intensified after the establishment of the Spanish settlement at Tucson in the early 1770's. Small and scattered surface deposits were crudely worked for precious metals by the Spaniards, Mexicans, and early Americans. The first base metal operations were near Saginaw Hill in 1898. Although sporadic mining attempts continued into the 1900's, most deposits were too limited in size or too low in grade to be worked economically except for periods of high metal prices. The Old Yuma mine has been the major metal producer; considerable silver, lead, copper, and molybdenum ore was taken out intermittently from the late 1800's to 1948. Several hundred small mines and prospects are scattered through the district but in most cases their production was very limited. In recent years mining activities have been limited to the production of limestone and smelter flux, and to exploration for possible porphyry-type copper deposits.

The total estimated and known metal production from the Amole district through 1972 would amount to some 34 thousand tons of ore containing about 265 tons of copper, 335 tons of lead, 197 tons of zinc, 27 thousand ounces of silver, and one thousand ounces of gold. About 17 tons of molybdenum concentrates may have been produced from the Old Yuma mine. The total value of the metal production would be some $229,000. Over 12 million tons of limestone have been quarried for cement manufacture and about 17 thousand tons of silica smelter flux has been shipped.

The Amole district has not been a major, metallic mineral producing area although evidence of low grade, sulfide mineralization is widely distributed. A major structural trend to the northwest appears in the northern part of the district, as indicated by faulting, and Laramide and Tertiary intrusions. The most favorable opportunities for hidden mineral deposits would be along that trend although such deposits, if they exist, may be deeply buried under sediments and volcanics or deeply down faulted in the Avra Valley area.

ARIVACA MINING DISTRICT

The Arivaca mining district, as used in the index, covers the general area of the Las Guias and San Luis Mountains of southern Pima County, to the northwest and southwest, respectively, from the old mining settlement of Arivaca. It would include the area sometimes known as the La Guias mining district. The name Arivaca is probably a Spanish corruption of a Pima Indian word for "little reeds" or "little fence water", describing the swamp vegetation that occurred in Arivaca Creek.

The Las Guias Mountains, named after the Spanish word describing rubble or conglomerate where gold placers may occur, is a moderately low, elongated, dissected, sierra-type range with a central core of a strongly fractured, medium-grained, granitic stock of Laramide age. Some trachytic phases and numerous dikes of granite porphyry, aplite, and black minette occur in it and clusters of lensing quartz veins follow fracture zones. On the flanks, Mesozoic volcanics and sediments were intruded and partly metamorphosed.

The northern part of the San Luis Mountains, named after an early Spanish mine, displays a large, irregularly dis-

sected, cluster of rolling hills and subdued mountains cut in a thick series of folded Cretaceous sedimentary beds partially metamorphosed by a Laramide granitic intrusive. Southward the topography becomes more rugged with higher and steeper mountains and ridges separated by canyons and washes. A large Laramide granitic pluton occurs on the western flank. To the east the intrusive gives way to metamorphosed Mesozoic sediments and overlying Cretaceous volcanics.

The mineral deposits of the Arivaca district consist mainly of irregular, lensing, quartz or quartz-calcite veins containing spotty, and generally weak, base metal sulfides and precious metals and/or tungsten minerals. In the southern and eastern sections of the Las Guias range, the sulfide-bearing veins occur in both the intrusive and bordering metamorphosed sediments and volcanics. In the northwestern sector, tungsten mineralization predominates. In both cases the mineralization is often associated with intrusive dikes. Weathering and oxidation have enriched the gold and silver values near the surface and erosion produced placer deposits of gold and tungsten on the lower slopes and in many washes. In the San Luis Mountains, known mineralization is more scattered and varied. Along Fraguita Wash, south of Arivaca, spotty lead, zinc, and copper sulfides occurred in fissure veins cutting Cretaceous sediments and volcanics. Economic values, mainly in gold and silver, were confined to the enriched, near-surface zone produced by weathering and oxidation. Farther west some spotty base metal and tungsten values are associated with the Laramide intrusives and bordering formations. Over 150 individual mines and prospects have been worked in the Arivaca district but few, such as the old San Luis or Oceanic mine, have produced as much as 100 or more tons of ore. Due to their limited size and the small tonnage produced, most of these workings are not listed in this index.

The Arivaca district was one of the earliest areas in Arizona to be prospected and worked. The first Spanish explorers and settlers, in the late 1600's and early 1700's, extracted gold from the placers and mined the superficially enriched, weathered veins for gold and silver. Intermittent, small-scale mining continued in the succeeding years with reduction works located at Arivaca where water was available. The main deterrents were hostile indian and

bandit raids in the 1800's. The presence of tungsten was recognized in the early 1900's but not mined until World War I. The greatest activity in the district took place from the early 1930's to early 1940's, when at least 100 prospectors and small miners eked out a living from working the gold placers and spotty vein deposits for gold and silver, as well as some tungsten. In 1935 there were over 35 small producing mines and prospects, mostly yielding a few tons of ore for the year. Since 1941 there has been only sporadic mining activity with little or no production.

The total estimated and recorded production from lode mines through 1972 would be some 9,300 tons of ore containing about 5,300 ounces of gold, 45,500 ounces of silver, 115 tons of lead, 36 tons of copper, and 8 tons of zinc. A few thousand ounces of placer gold may have been produced prior to 1900 and about 350 ounces since then. The total estimated and recorded value of the base and precious metal output from the Arivaca district would be about $369,000. Accurate data for the total tungsten production is not available but estimated at 250 tons of tungsten concentrates containing 60 percent WO_3 and having a value of about $400,000.

The future of the Arivaca district as a producer of mineral products is questionable. The apparent mineralization, although widely scattered, is in relatively small, lensing veins with spotty and low values below the enriched surface. Except for the Las Guias tungsten area, no over-all detail study of the geology and mineralization of the district is available. However, the presence of Laramide intrusives, a northwest striking structural and intrusive alignment, and the zonal arrangement of the mineralization suggest that detail geologic mapping and geochemical sampling might reveal favorable loci for deposits hidden under volcanic or sedimentary cover.

BABOQUIVARI MINING DISTRICT

The Baboquivari mining district of south-central Pima County covers the full length of the Baboquivari Mountains northward from the border with Mexico, including the Quinlan Mountains and Kitt Peak at the northern end. Baboquivari is the corruption of the Papago Indian name for "narrow in the middle" which aptly describes this long, narrow, rugged, steep-walled, sinuous range. The serrated crest in the central and southern sections marks the southeastern

boundary of the Papago Indian Reservation. The numerous peaks have special religous significant for the Papagos, especially Kitt Peak, on which a national observatory is located, and the block-shaped tower of Baboquivari Peak. Quinlan and Kitt were names of early, local personalities known to Roskruge, the original surveyor of the area. Low gradient, thinly covered, rock pediments extend outward from the steep mountain walls which are cut by deep erosional coves and reentrants in numerous places. The pediments, locally, are dotted with bands of rugged foothills.

In the central part of the range, the rocks are mainly metamorphosed Cretaceous conglomerates, graywacke, shale, and arkose with interbedded andesite flows and breccia, and some rhyolite tuff. Laramide coarse-grained granitic rocks invaded the older formations and predominate at the north and south ends as well as on both flanks. Numerous, irregular aplite, pegmatite, dacite, latite, and milky quartz dikes, sills, and veins cut the Cretaceous and intrusive rocks in a well-defined, crisscrossing pattern. The only later rock formations are Tertiary bedded conglomerates, and andesite and rhyolite volcanics on the west-central flank. The range is the result of block faulting and the strong, crosscutting, northwest striking faults and wide shear zones, that cut through the north and central areas. This latter structural trend is part of a regional pattern extending from south of Arivaca to at least the Quijotoa Mountains area to the northwest.

The known mineral deposits of the district include many relatively small and spotty occurrences of precious and base metals, molybdenum, tungsten, manganese, fluorine, and beryllium. Some fifty mines and prospects have had recorded production since 1900 but only a very few produced more than 100 tons. A general zoning pattern is apparent with precious and base metals, and molybdenum occurring in the faulted and metamorphosed formations in the central sector and tungsten mineralization mostly to north and south. Gold and silver occur with the spotty occurrence of chalcopyrite, galena, and sphalerite in numerous, lensing quartz and quartz-calcite veins in close association with fault zones and swarms of intrusive dikes and sills. Locally, as at the Allison mine, manganese and iron oxides are the predominant gangue minerals. Strong wall rock alteration is noted along the veins and oxidation and weather-

ing have concentrated gold and silver values near the surface. Some shallow gold placers have been worked along washes and terraces on the pediments below the central zone. The main tungsten mineralization was found along the northwestern foothills where over 17 small mines and prospects are located along a narrow six mile strip. There, spotty scheelite with epidote, garnet, local fluorite, and minor copper oxides occur in widely spaced shears and fractures in metamorphosed Cretaceous sediments intruded by igneous dikes and cut by major fault zones. To the south, the scheelite mineralization is found in a zoisite-bearing quartzite bed in faulted and metamorphosed Cretaceous sediments. Manganese oxides occur throughout much of the district. Locally it is a major gangue mineral but also is found as narrow, shallow, discontinuous coatings along fractures in rhyolite and andesite volcanics. Fluorite and beryllium minerals are associated mainly with tungsten occurrences and also with the pegmatite veins. (Clark, 1956; Balla, 1962; and Meeves, 1966)

The prominent quartz outcrops and enriched surface occurrences of gold attracted the attention of early Spanish and Mexican prospectors but the general inaccessibility of the range delayed mining until the late 1800's. The Allison mine, dating from at least 1890, was the first sizeable operation and has been the major producer of the district. Sporadic mining has continued and in the 1930's, a dozen or more small mines were operated on the weathered outcrops for supergene enriched values. Tungsten and manganese production has been limited to periods of abnormal high prices.

The total estimated and reported production of precious and base metals from the Baboquivari district through 1972 would be some 57,000 tons of ore containing about 14,000 ounces of gold, 173,000 ounces of silver, 122 tons of copper, 12 tons of lead, and a small amount of zinc. About 24 short tons of tungsten concentrates and 200 long tons of manganese ore have come from the district. The total value of base and precious metal production would be some $603,000.

Mineral exploration and development in the Baboquivari district has been spotty and mostly superficial. Since 1955, the western flank within the Papago Indian Reservation has been withdrawn from normal mineral entry. On the eastern

side, however, considerable sulfide mineralization, including molybdenite, is scattered throughout the central zone which suggest possibilities for a hidden porphyry-type deposit along the northwest striking structural trend. A careful, detail geologic mapping program in conjunction with geochemical and geophysical investigations would appear to be warrented.

CABABI (COMOBABI) MINING DISTRICT

The Cababi or Comobabi mining district covers the North and South Comobabi Mountains and the neighboring Ko Vaya Hills, lying in the eastern section of the main Papago Indian Reservation to the North of Sells. Cababi is from the Papago word for "hidden springs", Comobabi or Comobavi from that for "hackberry tree well", and Ko Vaya for the words "badger well". The North Comobabi Mountains are a sierra-type range carved out of a central mass of Laramide granitic to dioritic intrusive. Cretaceous andesitic volcanics cover the western end of the range and metamorphic gneiss and schist of pre-Laramide origin occurs in the southeastern corner. Well-formed, eroded pediments extend outward from the range. The South Comobabi Mountains are a more shapeless mass of eroded peaks and ridges cut from a variety of faulted strips of Cretaceous sediments and andesite volcanics, metamorphic rocks, and Laramide granite and diorite. Scattered intrusive Tertiary dikes and plugs are common. Both the north and south ranges are fault blocks aligned in a general north-west direction but with numerous cross faults. The down-faulted block between them is surfaced by Tertiary sediments and volcanics that have been eroded into rolling hills, ridges, and plains. The Ko Vaya Hills are a collection of ragged, steep-sided, fault block hills cut from thick Cretaceous andesite flows.

The known mineral occurrences consist mainly of relatively small deposits of silver, gold, copper, lead, zinc and tungsten in quartz-fissure veins. Spotty, rich concentrations of gold and silver, as native metals or chlorides, occur near the surface as a result of the oxidation of the sparse base metal sulfides found in depth. The predominant gangue mineral is a coarse-crystalline quartz, often brecciated by later movement along faults and shear zones. Dolomite and minor barite may recement the veins. Traces of molybdenum, vanadium, and other less common metals

have been detected in some deposits. Wall rock alteration is often strong and the andesite flows show sparse disseminated pyrite and base metal mineralization near major fault zones.

The Picacho or Cahuabi mine, dating back to the late 1700's, was the first mine of the district, yielding considerable amounts of precious metals in the early days. Other small but rich gold and silver prospects were worked sporadically throughout the 1800's. Several copper occurrences have been prospected but not developed. The most productive mines have been the old Picacho silver property, the Jaeger gold deposit, and the Little Mary or Steppe lead, silver, and copper mine.

The total estimated and recorded production from the district through 1972 would amount to some 6,500 tons of ore containing about 102,100 ounces of silver, 3,450 ounces of gold, 182 tons of lead, 92 tons of copper, and two tons of zinc. The amount of tungsten produced would be insignificant The total value of the metal production would amount to about $245,000.

The mineral production from the Cababi district has been relatively small and such prospecting and development work that has been done has failed to disclose any major orebody. However, the geologic characteristics in the district are not unfavorable. The South Comobabi range in particular lies along a strong structural and Laramide intrusive trend. Further geologic study and geochemical sampling might well indicate favorable loci for economic mineralization that might be hidden under volcanic or alluvial cover.

CANADA DEL ORO MINING DISTRICT

The Canada del Oro mining district lies along the border of Pima and Pinal Counties at the east end of the Santa Catalina Mountains. Most of the placer and hard rock mining activities of the district took place in Pinal County but some placer operation along Canada del Oro wash did extend into Pima County. The gold-bearing gravel was derived from small and irregular gold-bearing quartz veins in Precambrian granitic rocks at the northwest corner of the mountain range. An estimated 110 ounces of gold, produced sporadically from the early 1700's through the 1930's, may have been recovered in Pima County. The prospects of any additional, sizeable recovery is questionable.

The Catalina or Santa Catalina mining district lies at the south base of the Santa Catalina Mountains in the northern outskirts of Tucson. The steep mountain flank breaks off to a rough but flatter slope along a fault trace separating Catalina gneiss from the Tertiary Pantano Formation and Quaternary outwash alluvium. The gneiss probably was derived from older formations that may have been metamorphosed several times and certainly in Laramide time. The Tertiary Pantano Formation is a conglomerate composed of fragments of older granite, quartzite, limestone volcanics and gneiss. The foothill fault appears to have experienced both normal and reverse movement, producing a wide breccia zone in the gneiss on the footwall side but little disturbance in the Pantano Formation along the hanging wall.

Copper mineralization, mainly chalcopyrite, minor bornite, and oxidized copper minerals, is associated with quartz, pyrite, and minor molybdenite. Known mineralization occurs only in a local area in silicified and propylitized fault breccia and along associated narrow crosscutting quartz veins.

The mineralization was discovered and located in 1906 and developed and mined in 1907 to 1910 and in 1917 and 1918. One mine, the Pontatoc, accounted for the total production of some 5,000 tons of hand sorted ore containing about 207 tons of copper, 2,200 ounces of silver, and one ounce of gold. The total value was about 107 thousand dollars.

The Catalina district is now within a residential area withdrawn from mining entry and it is doubtful if mining could or would be resumed in the Pontatoc mine area.

CERRO COLORADO MINING DISTRICT

The Cerro Colorado mining district, one of the oldest areas of mining activity in Arizona, lies on the southwest flank of the Cerro Colorado Mountains from which it acquired its name. It is in southeastern Pima County just to the northeast of the Arivaca district with which it has had a common history.

The Cerro Colorado Mountains are a relatively small. low, and isolated range carved by erosion from a thick series of Tertiary rhyolite and andesite volcanic flows and

tuffs intruded by Tertiary dioritic plugs. The pediment extending to the southwest is cut on an older complex of Cretaceous volcanics ranging from quartz latite porphyry to various phases of andesite porphyry flows, tuffs, and agglomerates. Andesite porphyry and rhyolite dikes, and the Laramide dioritic intrusives cut the volcanic sequence. Moderate folding, strong fissuring, and extensive jointing is present but no evidence of major faulting is evident.

Numerous mineral occurrences are present but most are small and irregular, consisting of narrow, lensing, structurally controlled, epithermal quartz-fissure veins containing spotty amounts of base-metal sulfides, silver and mercury-bearing tetrahedrite and locally, sparse cinnabar. The mines, such as the major producer, the Cerro Colorado or Heintzelman, were worked for the deeply oxidized and enriched mineralization containing high silver values. Probably hundreds of small surface prospects have been opened up for silver chlorides in the outcrops of small narrow fissure veins but few had any significant development or production. The most notable feature of the district is the high mercury content shown by surface and airborne detectors.

The early Spaniards and Mexican prospectors exploited the surface showings for silver in the 1700's, using Pima and Papago Indian labor, and crude extraction methods. After acquisition of the district by the United States in 1853, Colonel Poston reopened the Cerro Colorado mine for the Sonora Exploring and Mining Company, renaming it the Heintzelman after General Heintzelman, President of the company. It operated only intermittently through the 1860's and 1870's due to hostile indian activities, as was the case for other smaller properties. The ore was treated at a small stamp mill at Arivaca. Since the depression of 1884 there has been little activity in the district except for small operations in the 1920's and 1930's by prospectors looking for small, enriched silver values and at the Mary G. mine.

The total estimated and recorded production from the Cerro Colorado district would probably amount to some 5,000 tons of ore containing about 377,000 ounces of silver, 460 ounces of gold, 16 tons of copper, 32 tons of lead, and less than one ton of zinc, for a total value of $362,000.

The district does not present encouraging indications for major ore deposits. There are many small and widely dis-

persed occurrences of mineralization but the spotty and relatively weak, epithermal character of the deposits, the lack of evidence of any strong structural deformation, and the apparent rapid pinching of mineralized structures at relatively shallow depth suggests that the possibilities for major economic deposits in the district are unfavorable.

CIMARRON MOUNTAINS MINING DISTRICT

The Cimarron Mountains mining district, sometimes referred to as the Salt Well district, embraces the Cimarron and Sheridan Mountains and their surrounding hills. All are within the Papago Indian Reservation, in north central Pima County. Cimarron is a Spanish word for wild or untamed and was used by Mexicans to describe the mountain sheep that reportedly were abundant in the area. The Sheridan Mountains were named after General Philip Sheridan. These ranges form an aligned north-northwest striking group of barren, strongly dissected, relatively low, ragged to rounded mountains and hills eroded out of fault blocks of Precambrian to Quaternary sedimentary, metamorphic, intrusive, and extrusive rocks. Reconnaissance geologic mapping shows a large block of Precambrian schist exposed in the northwestern sector of the Cimarron Mountains. Partly metamorphosed Paleozoic limestones and quartzites occur only as small fault blocks in a narrow divide between the two ranges. The Sheridan Mountains to the south are composed of schist and phyllite and may, in part, represent Mesozoic formations metamorphosed during the Laramide orogeny when a large granitic to dioritic intrusion invaded the area as exposed in the eastern part of the Cimarron Mountains. Tertiary rhyolite and basaltic andesites probably extended over the area at one time and in part still cover older rocks. Subsequent faulting, volcanism, and erosion created the present geologic form and exposures. There appears to be a general northwest striking structural pattern. Extensive pediments extend out on the buried mountain shoulders into the surrounding valley basins where alluvium obscures the actual edges of the fault block mountains.

The known base and precious metal mineralization of the district is sparse, scattered, and generally weak, occuring along faults and fracture zones. Economic values were limited mainly to near-surface, secondarily enriched zones

of gold and silver. The major production from the distric came from replacement deposits of manganese oxides i brecciated, folded, and partly metamorphosed Paleozoi limestone along fault zones and in fault breccia cuttin quartz diorite.

There is no record of mining in the Cimarron Mountai district before the early 1900's and except for manganese there has been only minor sporadic activity since then. The total base and precious metal production would amount to some 120 tons of ore containing about 11 tons of copper, 400 ounces of silver, 80 ounces of gold, and a small amount of lead. The total value would be about $6,000. Manganese production, mainly during war years and in periods of government buying programs, amounted to some 9,500 long tons of ore averaging 35 percent Mn or better and having an estimated value of $250,000.

Although the economic results of mining activities for base and precious metals in the Cimarron Mountains district have not been favorable, no detail geologic study has been made. Favorable geologic conditions appear to be present both in structural features and intrusions, particularly in the Cimarron Mountains area. A careful geologic and geochemical study around the Laramide intrusive might reveal possible loci for economic mineralization, all or in part buried under late volcanics or valley alluvial.

COYOTE MINING DISTRICT

The Coyote mining district covers the Coyote Mountains, a somewhat detached eastern prong of the Quinlan Mountain section of the Baboquivari range. It also includes the foothill area lying to the north of the Coyote and Quinlan Mountains of central Pima County. The northern part of the district lies within the Papago Indian Reservation. The Coyote Mountains are a relatively small, high, sierra-type mountain block with steep and rugged slopes due largely to strong east-west and north-south faulting. The rock mass is mainly a Laramide aplitic to pegmatitic quartz monzonite containing swarms of irregular pegmatitic and aplitic dikes. Large septums and scattered small blocks of marble, lime silicates, gneiss, and schist occur in the intrusive and probably represent metamorphosed remnants of Precambrian through Mesozoic sedimentary and igneous formations that have been engulfed by the intrusive. The low, rolling, down-

aulted foothills to the north are cut in Laramide and Tertiary volcanic and sedimentary formations. There are some indications that Laramide intrusive may underly at least a part of this northern area which also is cut by strong north-south and east-west faults.

The base metal mineralization of the district consists of partly to strongly oxidized copper deposits in irregular and spotty, pyrometasomatic replacement bodies in marmorized limestone in the Coyote Mountains and as disseminations, streaks, and fracture fillings in strongly altered volcancis and arenites along a zone of complex faulting and fissuring in the northern foothills. Minor molybdenite, sphalerite, garnet, epidote, and other lime silicates are associated with the first type and tetrahedrite, schwatzite, cinnabar, quartz, calcite, and epidote accompany the second type in the Roadside mine. There, reportedly, some assays ran as high as 0.79% mercury and 6 ounces of silver per ton. Some low grade manganese material and weak base-metal mineralization occurs along an east-west fault zone in Tertiary rhyolitic volcanics in the foothills north of the Quinlan Mountains.

The first mining activity in the district was probably at the Roadside mine, around 1880. Some early reports suggest that several hundred tons of 6 percent copper and 14 ounce silver was mined but not shipped due to a drop in copper and silver prices. The mine remained closed from the late 1800's to 1920 when it was reopened and further developed. By 1922 mining activity ceased again without any production and the mine remains inactive. The only other active operation in the district was at the Bonanza copper deposits which have been worked intermittently from the early 1900's to 1951. The manganese deposits were worked briefly in 1954 and 1955 when premium prices were in effect.

The copper occurrences in the Coyote Mountains appear to be too spotty and weak to be of commercial value. In the northern foothill area of the district, there are still possibilities of economic copper mineralization along the fault zones under the later volcanic-sedimentary cover. A careful reexamination of this latter area would appear to be warrented although it lies within the Papago Indian Reservation and thus would require special negotiations for exploration rights.

EMPIRE MINING DISTRICT

The Empire mining district covers the general area o: the Empire Mountains, an eastern outlier at the north enc of the Santa Rita Mountains, in east-central Pima County. The name came from a large ranch located in the 1880's. The topography of the range is rugged, extending up to 5,500 feet in elevation with a steep, ragged, western slope extending up from Davidson Canyon; and a more gentle and broad eastward slope and pediment cut by relatively deep, erosional draws and embayments. The exposed rocks of the mountains consist of Precambrian granite and metamorphic formations, Paleozoic limestones and quartzites, and Cretaceous sedimentary and volcanic rocks that have been intruded by Laramide quartz monzonite and granodiorite plutons and dikes. After erosion and the deposition of Tertiary sediments and volcanics, intense deformation took place by doming; folding; and thrust, sheer, and normal faulting, to produce a jumble of large and small, tilted fault blocks. Subsequent erosion has exposed the present geologic setting.

The mineralization is wide spread and of several different types. The most important, economically, has been the irregular, base metal sulfide replacement orebodies and pipes, later deeply oxidized, which occur in Permian limestone fault blocks along structural intersections of faults and fissures. Laramide dikes are often closely associated with the mineralization. The ore minerals are mainly argentiferous lead, zinc, and copper carbonates with subordinate and more local molybdates, vanadates, and sulfides. Ruby silver was found in some oxidized outcrops. In general the orebodies were relatively small and shallow although a few contained sizeable tonnages.

The contact zone between Laramide quartz monzonite and Paleozoic limestone contains small scattered orebodies of copper with minor lead, zinc, and locally, disseminated tungsten but this mineralization is very limited in size and extent. Some minor base metal ore minerals have been found along fissure zones in Paleozoic quartzite and in weak, irregular veins in the central Laramide quartz monzonite stock.

The mineral deposits of the Empire district were discovered as early as the late 1870's and considerable mining of the deposits was carried out in the 1880's and 1890's.

poradic mining on a small scale continued in the early 1900's, increasing appreciably during World War I, dropping off in the early 1920's, and increasing again in the late 1920's. Some wulfenite concentrates were produced for molybdenum during World War I. The major zinc production occurred in the 1940's. Since 1950 there has been little mining activity in the district.

The total estimated and recorded production of the Empire district through 1972 would amount to over 34,000 tons of ore containing about 206,400 ounces of silver, 744 ounces of gold, 8,334 tons of lead, 372 tons of zinc, and 172 tons of copper. About 556 tons of picked ore containing 76 tons of molybdenum, and minor amounts of tungsten ore also were shipped from the district. The total value of the production from the district would be some $1,178,000.

The character of the mineralization, the structural pattern, and the spatial relationship to the regional strong structural and Laramide intrusive trend suggests that the Empire district represents an outer zone on the north side of more intense mineralization. Other small replacement orebodies, similar to those found may still exist but the possibilities of a large porphyry deposit do not appear favorable. However, some of the area is covered by post-Laramide rocks and a careful geochemical examination of the Laramide intrusives might reveal further exploration targets.

GREATERVILLE MINING DISTRICT

The Greaterville mining district is located in the north-central Santa Rita Mountains of southeastern Pima County. Greater was an early settler in the area and gave his name to Greaterville, a thriving settlement at the time the gold placers of that area were being worked. The Santa Rita Mountains narrow in this area, with the crest on the west side from which a rugged, steep, westward slope drops to the pediment plain above Santa Cruz Valley. To the east, the general slope is more gentle but dissected by numerous canyons, gulches, arroyas, and washes extending out into a broad pediment and alluvial plain.

The dominant rock formations of the district are Precambrian granodiorite, schists, and gneiss in the western section and Cretaceous conglomerates and arkosic sandstones in the eastern part. Paleozoic rocks undoubtedly

were present at one time but were eroded away during the Mesozoic era prior to Cretaceous sedimentation. During the Laramide orogenic period, strong folding, faulting, and large and small intrusions of quartz latite porphyry took place as plugs and dikes. Major thrust faulting pushed Cretaceous beds over the Precambrian formations and was accompanied by tear and high angle faulting. The intrusions appear to have been guided by fault planes. In the Tertiary further deformation, and the intrusion by rhyolite porphyry dikes occurred along preexisting structural breaks. Subsequent strong erosion produced the extensive piedmont placer gravel deposits found to the east in the numerous gluches and on terraces between the gulches.

The Laramide intrusion introduced alteration and some mineralization to the invaded rocks. Numerous, small and irregular quartz veinlets occur in the Cretaceous formations and produced a few stronger veins in the intrusive plugs. Quartz predominates but carbonates, barite and base metal sulfides and their oxidation products are sometimes present, generally in weak and variable amounts. Free gold and enriched silver values were found in some surface outcrops. Geochemical sampling (Drewes, 1970) showed relatively strong anomalies for many metallic elements along a northwest-trending zone in the Cretaceous formations, aligned with the general intrusive trend. However, the lode deposits found have been small and weak with the enriched, oxidized outcrops furnishing most of the economic returns. The major share of the mineral production from the district has been from the placer gold deposits along the eastern edge of the mountains, derived from the erosion of the numerous, spotty, gold-bearing quartz veins in the Cretaceous formation.

The lode deposits of the Greaterville district were discovered and prospected as early as the 1870's and some rich gold and silver ore produced from the Yuba and other small mines in 1874. The discovery of the gold placers in 1874 diverted attention from lode mining until the mid-1920's. Most of the placer production was recorded prior to 1886 although some 100 to 250 ounces of gold per year continued to be recorded up to about 1923. Since then a small, irregular, and sporadic placer production has continued with some increase during the depression years of the 1930's. Lode mining has never exceeded a few hundred

ons per year as well as being intermittent. From 1961 through 1972, there has been no recorded output from either placer or lode operations.

The total estimated and recorded production from the Greaterville district through 1972 would amount to some 2,000 tons of lode ore containing about 390 ounces of gold, 13,000 ounces of silver, 170 tons of lead, 20 tons of copper, and 16 tons of zinc. The amount of placer production would be not less than about 29,000 ounces of gold and 6,000 ounces of silver. The total value of all production would be about $650,000, mostly prior to 1900.

The Greaterville district has been carefully mapped and studied in some detail by the U. S. Geological Survey and private companies. Some mineralization and geochemical anomalies exist but as yet no large economic mineral deposits have been discovered. It would appear that the district is not along any major regional mineralized zone and thus chances for a large economic deposit are not favorable.

GROWLER MINING DISTRICT

The Growler mining district lies in the Growler Pass area at the south end of the Growler Mountains in southwestern Pima County. It was named after John Growler, an early prospector in the area. Bates Well, in the pass, was one of the few watering places in this desert country and in the early 1900's supported a small community and ranch. The Growler Mountains and the Bates Mountains to the south are capped by a thick series of Quaternary and Tertiary basaltic volcanic flows, agglomerates, and tuffs which covered the older formations. Erosion in the pass area has uncovered scattered outcrops of Paleozoic quartzite and limestone, metamorphosed Mesozoic rocks, Mesozoic granite, Cretaceous sediments and volcanics and Tertiary sediments and volcanics. Although no strong faulting is shown as a result of reconnaissance mapping, such structural distrubance can be assumed from the jumble of formations exposed. No detail geologic mapping of the district has been reported.

Some scattered mineralization, mostly oxidized copper showings, have been prospected and developed in Paleozoic quartzite and limestone, possibly associated with the Mesozoic intrusive. Some gold has been extracted from weathered fault and fracture zones in various formations. Some

limestone also has been shipped for smelter flux. Only one mine, the Growler, produced more than a few tons of metallic ore.

The Growler district is of note particularly as it offers the most western exposures of Paleozoic formations in southern Arizona. Mining claims are still held in the district and a careful study might still disclose possibilities for economic deposits. Its position within the Organ Pipe Cactus National Monument might become a deterrent to future exploration.

GUNSIGHT MINING DISTRICT

The Gunsight mining district, sometimes referred to as the Meyer district, covers an area in and around the Gunsight Hills at the north end of the Ajo Mountains in west-central Pima County. The district lies in the western part of the Papago Indian Reservation. There are various stories on how the name originated; from a gunsight having been made from native silver found there to the shape of the ridge on the main Gunsight hill. This cluster of low, erosional hills are part of an area of broken and subdued topography, representing an extensive rock pediment thinly covered by alluvium.

The basement rock is a weathered and decomposed Laramide granitic rock that invaded older formations now stripped away except for some small gneiss outcrops to the east. To the north and south, Tertiary basaltic andesite capping obscures the limits of the intrusive and any possible remnants of earlier formations. Strong complex faulting is both apparent and suspected and the intrusive itself exhibits many strong shear zones.

Some, generally weak and spotty, base and precious metal mineralization, with local tungsten and molybdenite, occurs in irregular, lensing, and usually narrow, quartz, calcite, and barite veins and stringers along fissure zones in the intrusive. Quartz predominates as evidenced by the numerous quartz fragments covering the surface. The strong weathering and oxidation has produced small, enriched pockets of gold and silver in the surface outcrops of mineralized zones. The Gunsight mine has been the only major metal producer in the district. In recent years a considerable amount of quartz for silica smelter flux has been mined from pegmatitic-like zones in the intrusive.

The district was first prospected in the late 1860's and early 1870's, soon after the first activity at nearby Ajo. The main production of metallic ores came in the early 1880's when the Gunsight mine yielded high grade silver ore from near surface workings. Since that time, up through 1965, production from several small operations has been limited and intermittent, mainly a small tonnage of high grade gold-silver ore with minor copper and lead, and minor scheelite.

The total metal production from the Gunsight district from estimated and recorded records would amount to some 16,000 tons of ore containing about 100,600 ounces of silver, 400 ounces of gold, 780 tons of lead, and minor copper and zinc. Probably not more than four tons of scheelite ore has been shipped. In recent years considerable silica flux has been mined and shipped from surface operations. The total value of the metal production would be close to $176,000.

No detail geologic study of the Gunsight district is on public record and except for the Gunsight mine, little development work has been done except for the near surface prospecting for precious metals along shear zones in the granitic intrusive. A large part of the district is covered by late volcanics and alluvium which obscures any additional mineralized areas but the geologic factors are not unfavorable. Careful geology study and geochemical investigations might reveal possible loci for economic deposits. Exploration activities would require permission of the Papago Indian authorities.

HELVETIA AND ROSEMONT MINING DISTRICTS

The Helvetia and Rosemont mining districts lie at the northern end of the Santa Rita Mountains to the southeast of Tucson, Pima County. In general, the Helvetia district, named by a local Swiss miner after his homeland, covers the north end and northwestern slope of the range. The Rosemont district, named after an early day miner named Rose, lies on the eastern slope of the range to the east and southeast of the main Helvetia mining area. The boundary between the two districts can not be easily defined geographically or geologically and thus they are treated together.

The northern section of the Santa Rita range is moderately rugged and serrated with a crest over 6,000 feet in elevation.

The broken slope to the west is somewhat steeper than the one to the east and the slopes break into numerous separate foothills resting on an irregular pediment covered in part by alluvial fans, terraces, and alluvial aprons. The dissecting dry gulches radiate out to the north, east, and west.

The geologic make-up of the districts is extremely complex in types of formations and structures as detailed in the quadrangle mapping of Drewes and Finnel of the U. S. Geological Survey and the reports by Drewes. Precambrian schist and granodiorite are unconformably overlain by a thick sequence of Paleozoic marine deposits including quartzite, limestone, shale, and sandstone. Mesozoic volcanics and sediments unconformably overlie the Paleozoic sequence. Strong deformation by folding and faulting took place during the middle to late Mesozoic time and in at least two periods during the Laramide orogeny. Strong thrusting in two divergent directions and igneous intrusions accompanied the deformation. Normal faulting continued almost up to recent time. Strong erosion has carved out the present geologic setting.

The majority of the orebodies of the two districts are of the pyrometasomatic or contact metamorphic type in lime-silicated Paleozoic limestones along or close to the contact with Late Laramide quartz latite porphyry intrusions or along fault zones that furnished channelways for mineralizing solutions from those intrusions. The orebodies that have been mined were generally small and highly irregular in outline, sometimes in the form of pipes along fault or fracture intersections and other times as flat-lying mantos. Ore mineralization often is marked only by assay walls. Copper is the dominant metal but some lead and zinc is usually present. Molybdenum and tungsten are more erratic but locally may be important. Silver values are often high but gold values are uniformly low. Most of these replacement deposits were oxidized to various depths. At the north and south ends of the districts and in the Precambrian intrusive, smaller and weaker base metal mineralization has been prospected in veins and replacement bodies but mining has been limited. This latter mineralization is often associated with quartz or quartz-calcite veins near thrust planes that served as channelways for mineralizing solutions. Some of the intrusive plugs contain disseminated copper mineralization that will be mined as porphyry cop-

per deposits. Partly marmolized limestone has been quarried for lime production and marble has been quarried for roofing stone and decorative purposes.

The mineralization in the Helvetia — Rosemont districts was discovered, and claims staked, as early as the 1870's. Relatively small mining and smelting operations were started in the early 1880's but the drop in metal prices in 1883 closed down the mining activities until the 1890's. About that time, the Rosemont Copper Co. and the Helvetia Copper Co. started operations and continued production into 1901. Again after closing down, mining activity was revived in 1904. Except for a few years in the early 1930's, the districts showed continuous but irregular production up through 1960, with the major output during 1916-1919, 1944-1947, and 1957-1959. Since then there has been very little production from the districts.

The total estimated and recorded base and precious metal production from the Helvetia — Rosemont districts through 1972 would be some 426,000 tons of ore containing about 17,430 tons of copper, 680 tons of zinc, 261 tons of lead, 347,000 ounces of silver, and 1,580 ounces of gold for a total value of about $7,780,000. Some 13 tons of high grade molybdenum concentrates and a few tons of high grade tungsten concentrates came from the Helvetia district. Considerable limestone and marble have been produced for lime and crushed stone for roofing gravel and decorative stone.

The Helvetia — Rosemont districts are well mineralized and have been mapped and prospected in some detail. Porphyry-type copper mineralization has been found in both districts and additional base metal deposits are likely to be found in the favorable structural, intrusive, and mineralized zone, part of a general northwest striking system, that passes through these districts.

HORSESHOE BASIN MINING DISTRICT

The Horseshoe Basin mining district, a small, local, gold placer area on the east side of the Quijotoa Mountains, has been included and described in this index under the Quijotoa mining district.

LAS GUIJAS MINING DISTRICT

The Las Guijas mining district, at the northwestern end of the Las Guijas Mountains, has been included with the

Arivaca mining district in this index.

MONTEZUMA MINING DISTRICT

The Montezuma mining district lies within the Organ Pipe Cactus National Monument in the Puerto Blanco and Sonoyta Mountains of southwestern Pima County. These relatively low ranges, curving northwestward from the Mexican border, are strongly dissected into numerous, scattered, steep-walled, ragged ridges and peaks. The rocks consist of sediments and possibly volcanics that were metamorphosed to schist, phyllite, and gneiss by a Mesozoic granite to quartz diorite intrusion along the Mexican border. A Laramide age intrusive plug invaded the metamorphic rocks in the northern part of the district. Most, if not all, the area was probably covered by Tertiary silicic to andesitic volcanics and Quaternary-Tertiary basaltic volcanics which are now largely eroded away. A strong fault lies along the northern edge of the Puerto Blanco Mountains and a considerable amount of fracturing and shearing is evident in the Mesozoic formations. Scattered and spotty base and precious metal mineralization occurs along fissure veins in the Mesozoic metamorphics and intrusive. Many have been prospected but few have produced more than token amounts of ore, or were developed to any great extent. Most ore produced came from secondary, enriched mineralization near the surface.

The mineral occurrences of the district were first prospected by Spaniards and Mexicans, possibly as early as the late 1700's and some local, superficial pockets of enriched gold and silver may have been extracted. In the present century, mining activity has been very limited and sporadic, mainly in the 1915-1918 period and in 1953-1954. In recent years there has been some exploration activity in the district, such as at Copper Mountain (T15S, R5W, N. Cen. Sec. 36) where some weakly disseminated copper mineralization occurs in a Laramide granitic outcrop.

The total estimated and reported production from the Montezuma district might amount to some 1,300 tons of ore containing about 164,100 ounces of silver, 102 tons of copper, 126 ounces of gold and 8 tons of lead. The total value would have been over $200,000 due to the high value of silver and copper in the ore shipped.

The known mineralization in the Montezuma district ap-

pears to be spotty and except for Copper Mountain appears to be associated with the Mesozoic intrusions rather than the Laramide period of mineralization. However, no detail geologic or mineralogic examination of the district is available and a careful study needs to be made before the ore possibilities of the district can be determined.

OLD BALDY MINING DISTRICT

The Old Baldy mining district, a relatively small area of which only the northern part is in Pima County, lies to the west of the Greaterville district on a west side prong of the Santa Rita Mountains. It was named after Old Baldy Peak to the south in Santa Cruz County. The main topographic features of the area are steep drainage canyons separated by rugged, sharp-sloped ridges. The surface rocks consist of folded and faulted Triassic rhyolite and latite flows, and tuffs, and Cretaceous sediments that have been invaded by a large pluton of Laramide granodiorite and quartz monzonite. Tertiary rhyolite dikes and quartz veins cut the volcanics and intrusive. Most of the district lies within a large fault block.

Spotty and generally weak, base metal mineralization with some local molybdenite occurs along quartz-filled fissures and in quartz veins. Although prospected and superficially developed as early as the 1880's, only one mine has produced more than token amounts of ore. The total estimated and recorded production of the Pima County section of the district would not be more than a few hundred tons of selected copper-silver ore, valued at about $8,000.

The Old Baldy district section in Pima County has been well prospected and the possibilities for economic ore deposits do not appear promising.

ORACLE MINING DISTRICT

The Oracle mining district, also referred to as the Control, Old Hat, or Santa Catalina district, lies on the north slope of the Catalina Mountains to the northeast of Tucson. Only the southern part of the district is in Pima County. The origin of the names came from names of mines, towns, or the mountains. The Old Hat mine was later called the Stratton.

The Santa Catalina Mountains are a massive, high, ragged, sierra-type range with steep flanks and numerous deep

canyons and sharp ridges. Mount Lemmon rises to over 9,000 feet and other peaks are over 8,000 feet in elevation. The north and east flanks are less precipitous than those to the west and south.

The main mass of the range consists of granitic and gneissic rock masses of Precambrian and Laramide age. In the district, the Precambrian intrusive, Late Precambrian quartzite and diabase, Paleozoic quartzites and limestones, and Cretaceous sediments and volcanics were invaded during the Laramide orogeny by a large composite pluton of granitic to quartz dioritic intrusive leaving folded and faulted, engulfed blocks and strips of the earlier formations and causing wide spread metamorphism. The resulting jumble is geologically complex and as yet not fully understood.

The metalliferous mineralization in the Pima County section of the district occurs mainly in and around the Marble Peak area where strong skarn or tactite replacements have developed in the pyrometamorphosed Paleozoic limestones, along with veinlets and disseminations of chalcopyrite, bornite, and locally scheelite. Some spotty galena and sphalerite also occurs, principally around the fringe of the more intense copper zone. Lamprophyre, alaskite and quartz dikes and veins cut both the intrusive and metamorphosed formations and sometimes are closely associated with the sulfide mineralization. Molybdenite occurs mainly in the quartz veins and dikes. The continuity of the copper mineralization has not been established but appears to be localized by the intrusive contact, structural faults and fractures, and by the selective replacement of favorable limestone beds. The Abrigo Formation limestone seems to be especially receptive to skarn development and copper mineralization. Oxidation and enrichment are very minor since erosion has kept pace with any weathering action.

The mineralization in the Marble Peak area was discovered in the early 1900's but the difficult terrain and general inaccessibility discouraged any major mining activity. The Phelps Dodge Copper Co. did considerable develment and exploration work in the Marble Peak area around 1910 but there was no production prior to 1937. In that year, mining was carried out in the Geesman and Daily claim groups, a mill to concentrate the ore was built, and the old timber road to the property improved. Irregular production

continued up to 1950 and since then there has been a small sporadic output, mainly from small lease operations. Tungsten mining was carried out for short periods when high prices prevailed. Since 1970, Continental Materials has been conducting an intense drilling and underground exploration program in the Marble Peak area. A small amount of placer gold is reported to have been taken from Alder Canyon to the east.

The total base and precious metal production from the mines of the Pima section of the Oracle district, up through 1972, has been some 136,000 tons of ore containing about 3,060 tons of copper, 94 tons of lead, 25 tons of zinc, 118,000 ounces of silver, and 287 ounces of gold. Some 100 ounces of placer gold came from small operations along Alder Canyon and about 100 tons of tungsten ore containing about 3 tons of WO_3 has been shipped from the Pima section of district.

The Marble Peak area of the Oracle district appears to be well mineralized and the present development work should indicate the continuity and extent of the copper deposit. From the information being revealed in that work, possibilities are good that other deposits may be found in the district.

PAPAGO (SIERRITA) MINING DISTRICT

The Papago or Sierrita mining district lies on the western flank of the Sierrita Mountains in eastern Pima County. The name comes from the Indian tribe originally inhabiting this area. The western flank is marked by a series of sharp, elongated ridges and isolated knobs that form a foothills area of the main mountain range. An extensive and relatively even pediment and valley alluvium plain extends gently westward and northward to Altar Wash.

Geologically, the district consists of roughly banded strips of partly metamorphosed Paleozoic quartzite, limestone, and dolomite; Mesozoic sediments and volcanics; Mesozoic granitic intrusive; and some offshoots of the large Laramide granitic pluton that makes up a large part of the Sierrita Mountains. These formations have been folded, faulted, and thrusted into a structural complex as revealed in the quadrangle mapping of Drewes and Cooper, 1973.

Spotty argentiferous base metal mineralization, mainly lead, occurs in fracture veins and irregular replacements

in the faulted and folded Paleozoic beds. Oxidation and supergene enrichment produced rich silver values near the surface of the deposits. Copper mineralization generally was minor and locally wulfenite has been found. One minor occurrence of uranium has been reported. At the north end of the district, some fluorspar occurs in shear zones in Mesozoic intrusive. Manganese is a common gangue constituent. Placer gold occurs in some local washes draining mineralized areas.

The district was prospected and some mining was carried out as early as the 1870's, and through the 1880's a considerable amount of enriched silver ore was taken out of the oxidized outcrops of several of the mines by chloriders. There was little activity in the district through the early 1900's until the 1930's and 1940's when numerous deposits yielded small tonnages of lead-silver-copper ores. The Sunshine-Sunrise mine group has been the major producer of the district.

The total estimated and reported production of base and precious metals from the Papago district mines would amount to some 5,000 tons of ore containing some 400 tons of lead, 30,000 ounces of silver, 26 tons of copper, 2 tons of zinc, and 96 ounces of gold. Elsing and Heineman (1936) show $250,000 worth of gold produced from Papago district placers but this amount appears to be excessive for the average gold values in the ores of the district and the size of the placer areas. It is doubtful if more than about 1,000 ounces of placer gold could have been produced in the district. The fluorspar deposits may have produced, at most, about 100 tons of high grade material. The total value of the base and precious mineral production of the Papago district through 1972 may have amounted to some $104,000.

The mineralization in the Papago district is spotty, and relatively weak. Most economic values have occurred in near-surface, supergene enriched deposits. Favorable geologic indications for large base and precious metal deposits do not appear favorable but a careful examination of the district may be warrented, particularly on the pediment to the northwest.

PIMA MINING DISTRICT

The Pima mining district, including the old Mineral Hill, Olive, and Twin Buttes camps, lies along the northeastern

side of the Sierrita Mountains to the south of Tucson. It also includes the more recent, large, open pit mines that have made the district the most important copper producing area of Pima County and the State.

The Sierrita Mountains are a roughly circular, relatively rugged, sierra-type range. The southern part of the district around the Esperanza and Sierrita mines is in a dissected foothills area while the central and northern sections are on extensive pediment cut by shallow washes and containing numerous hills, knobs, and small peaks such as Mineral Hill, Helmet Peak, and Twin Buttes. Valley alluvium extends on to the pediment along the eastern side and may be up to or over 800 feet deep at the location of some open pit mine locations. The pediment mountain shoulder probably extends outward some distance to a major north-south fault along the west side of Santa Cruz Valley.

The complex geology of the district has been studied in considerable detail by the U. S. Geological Survey, private mining companies, and University professors and students. The rocks of the district include formations dating from Precambrian to Recent and are of sedimentary, metamorphic, volcanic, and igneous types. Precambrian granitic rock appears to underlie much of the district. It was overlain by Paleozoic quartzite and limestone and in turn by Cretaceous sediments and volcanics. There is evidence that the area suffered orogenic and intrusive events during the Mesozoic but the record has been masked or obliterated by Laramide intrusions and orogeny as well as major folding and faulting. The Laramide intrusion included diorite, andesite, granodiorite, and quartz monzonite porphyry and followed the earlier deformational period. Uplift and strong erosion produced a thick, Tertiary conglomerate, interbedded with volcanics, that covered much of the area. The final major structural event appears to have been strong thrusting, steep tilting, and secondary faulting and fracturing in the middle to late Tertiary when the block fault mountains were being formed. Late Tertiary to Recent erosion has exposed the present surface.

Ore mineralization appears to be related to the Laramide granodiorite and/or the quartz monzonite porphyry, occurring as disseminations in the intrusive volcanic and sedimentary rocks, as pyrometasomatic and replacement deposits in favorable host rocks, and as fracture and fissure

fillings. The first type has been found and developed in the open pit mines. The main ore minerals are copper sulfides with minor but economically important molybdenite and locally small amounts of zinc and lead mineralization. Only the Esperanza — Sierrita deposit would be classed as a true porphyry type, occurring in a complex intrusive body and associated volcanics. The other open pit deposits, although having disseminated mineralization, have characteristics associated with pyrometasomatic mineralization. The older mines at Mineral Hill, San Xavier, and Twin Buttes were in pyrometasomatic and replacement deposits of copper and/or lead and zinc, often with high silver values, in silicified and/or garnetized Paleozoic limestone associated with strong faults and Laramide intrusives. A third and less important type of base metal mineralization, as found in the Olive Camp and Paymaster areas, were the relatively small, shallow-seated, irregular, fissure veins in faults and fractures in Cretaceous, and Laramide sedimentary and volcanic formations. Oxidation produced enriched gold and silver in the near surface zone. In the Olive-Paymaster area, this mineralization is in the San Xavier thrust sheet which is underlain by Precambrian granite. To the south of Esperanza and to the west, similar quartz-fissure veins occur in volcanics and intrusive.

The supergene enriched outcrops of silver ore in the district were known and worked superficially by the earliest Jesuit Fathers and Spaniards coming into the Tucson basin area but little development or mining was carried out until the late 1800's when the San Xavier Mining and Smelting Company was organized but was unsuccessful in economically treating the ore locally. Small amounts of high grade lead-silver ore was shipped out from numerous shallow mines until the demonetization of silver in 1893. Much of this production was by chloriders. The Mineral Hill copper deposits were developed in the early 1880's and both that deposit and the San Xavier mine were worked intermittently but with only minor success into the early 1900's. Not until 1912, when the San Xavier mine was purchased by the Empire Zinc Company, were the operations sustained for any period of time. The Twin Butte pyrometasomatic deposits came into production in the 1800's and in the early 1900's were developed and mined extensively by the Twin Buttes Mining and Smelting Company and others until the

1950's. Relatively minor mining operations were undertaken in the Esperanza area in the early 1900's. In the 1940's and early 1950's, the Eagle-Picher Mining and Smelting Company did extensive mining and development work at the San Xavier lead-zinc mine. During World War II years many other mines were reopened or explored for metals, including zinc, lead, molybdenite, and scheelite but in general, production was limited.

Revived interest in the Pima district started with the entrance of the Banner Mining Company into the Mineral Hill and Twin Buttes areas in 1950 and the geophysical discovery of the Pima orebody in the same year. Since then other disseminated deposits of the district have been discovered and developed with the result that the district has become the major copper producer in Arizona.

The total estimated and reported base and precious metal production from the Pima district through 1972 would amount to some 370 million tons of ore containing over 2 million tons of copper, 43 thousand tons of lead, 116 thousand tons of zinc, 53.7 thousand ounces of gold, and 312 million ounces of silver. The total value of this ore would be almost 1.9 billion dollars. From the open pit mines, over 33 thousand tons of molybdenum valued at $108.6 million also has been produced.

The Pima district has been studied geologically over many years and the western section of the exposed formations does not hold promise of the discovery of new major orebodies. To the east and north, however, additional orebodies may be present under the alluvial-covered pediment and in the down faulted valley areas but they will be deep and difficult to find.

QUIJOTOA MINING DISTRICT

The Quijotoa mining district encompasses a chain of mountains, named, north to south, the Brownell Mountains, the Sierra Blanca, the Quijotoa Mountains, Ben Navis Mountain, and South Mountain. Quijotoa is a corruption of a Papago term for carrying basket mountain because of the shape like a basket used by the Indians. Brownell was a storekeeper and miner of the early 1900's. Sierra Blanca was named because of the light colored rocks. Ben Nevis was named by Alex McKay, discoverer of a rich silver outcrop, for his homeland in Scotland, and South Mountain is

the southernmost elevation in the chain. The entire group lies within the Papago Indian Reservation.

The topographic features and geology varies between the areas and each is separated from the neighbors by low-lying passes or pediments. The Brownell Mountains consist of a cluster of erosional hills and mountains that are residual remnants of a higher, block-faulted surface. The rocks are Laramide clastic sediments, andesitic to rhyolitic volcanics, and granitic intrusives. A few Tertiary intermediate to mafic plugs and dikes cut the older formations. To the north and east, the mountain breaks off into rolling topography cut on an alluvial-covered pediment. To the west, a wide drainage valley, cut by numerous washes, in Tertiary clastic sediments, separates the Brownell Mountains from the Sierra Blanca range. The latter is an oval group of ragged peaks with steep irregular slopes cut in light-colored metamorphic schist and gneiss, probably metamorphosed most recently in Laramide time. On the west side there is a small fault block containing Paleozoic quartzite and limestone.

To the south, across a relatively narrow pass, is the large typical sierra-type Quijotoa Mountains with a series of peaks and ragged flanks cut by dry washes. The main mass is a fault block of Laramide granitic to quartz dioritic intrusive. Fault blocks of Tertiary silicic volcanics are exposed to the northeast and Tertiary to Quaternary clastic sediments cover the pediment surface on both sides. At the south end of the range, Ben Nevis Mountain stands as a high, narrow, irregular ridge with almost vertical walls. It is an uplifted and much faulted block of intercalated Cretaceous sediments and volcanics, and Tertiary silicic and andesitic volcanics. South Mountain, at the end of the mountain chain, is an oval, steep-walled ridge of purplish-red Tertiary andesite flows with strong horizontal parting and columnar jointing.

Throughout the Quijotoa district there are numerous, scattered, and small deposits of base and precious metals, barite, and minor, rare earth minerals. Locally, high grade and enriched pockets of free gold and silver chlorides have been found, mostly in or adjacent to oxidized and mineralized faults or fracture zones. Quartz, calcite, hematite, manganese oxides, and local barite and fluorite are the gangue minerals. Traces of uranium also have been detect-

ed. The erosion of these pockets have produced placer gold deposits on the pediments.

The early prospecting of the district was carried out by Indians under the guidance of Jesuit and Franciscan Fathers. In 1883, a two year rush was started by the discovery of a rich silver pocket on Ben Nevis Mountain. For a few years there was active prospecting throughout the district but the boom died rapidly with the apparent exhaustion of the rich ore pockets. Although prospecting and development have continued, there has been only a minor production in the district since that time. The gold placers of the Horseshoe Basin and other areas have been worked sporadically by dry methods.

The estimated and reported production of base and precious metals from the Quijotoa district through 1972 would be some 15,600 tons of ore containing about 245 thousand ounces of silver, 11.6 thousand ounces of gold, 61 tons of copper, and 29 tons of lead for a value of about $509 thousand. The amount of placer gold recovered is unknown but may have amounted to a few thousand ounces. Smelter flux was shipped from the small Paleozoic fault block on the west side of the Sierra Blanca and from several oxidized copper deposits in the Brownell Mountains.

The Quijotoa district has diversified geology and mineralization. The Brownell Mountain area, in particular, appears to have favorable geologic conditions for possible, hidden, porphyry copper deposits and would warrent a careful geologic examination.

QUITOBAQUITO MINING DISTRICT

The Quitobaquito mining district covers a small area in the southwestern corner of the Organ Pipe Cactus National Monument of southwestern Pima County. It was named after a spring just within the United States. Although there are several small prospects in the district, there has been no recorded production. The area is covered in the Montezuma district of this index.

REDINGTON MINING DISTRICT

The Redington mining district covers an undefined area on the east slope of the Santa Catalina Mountains above the San Pedro Valley. It was named after the town of Redington near which the Redfield brothers had a ranch. The moun-

tain slope has been dissected by erosion, forming irregular, rough topography consisting of ridges of complexly faulted and folded Paleozoic and Cretaceous sediments bordering the large Laramide intrusive mass of the main mountain area. Generally weak and spotty copper and minor tungsten mineralization has been prospected along fracture zones and in pyrometamorphosed sedimentary and volcanic formations. Only about 90 tons of ore containing 6 tons of copper and 140 ounces of silver are recorded as produced from the district. There are no indications of major metal deposits. Some limestone may be extracted for smelter flux.

RINCON MINING DISTRICT

The Rincon mining district encompasses the southern part and south foothill area of the Rincon Mountains and the Pantano Wash and Cienega Gap between the Rincon Mountains and the Empire and Santa Rita Mountains to the south. The foothill area presents a ragged, strongly and irregularly dissected slope while the gap is an open, rolling plain cut by the channel of Pantano Wash and tributary washes.

At the southwestern and southern end of the mountains, strongly faulted and thrust-faulted Paleozoic and Cretaceous sediments and Laramide granitic intrusive have been moved onto a metamorphic gneiss, probably formed in the Laramide orogeny from pre-Laramide formations. Middle Tertiary Pantano beds, consisting of a thick series of conglomerate, sandstone, mudstone, and argillaceous limestone, with local volcanics, lie largely in the gap area but are a part of the major thrust sheet over the metamorphic gneiss. Subsequent erosion exposed the present jumble of rocks, mantled by Late Tertiary and Quaternary alluvium.

Spotty pockets of lead and copper mineralization occur as replacement deposits in the Paleozoic limestone, or in fissure and fault zones. Some barite veins have been noted also. The district was prospected early but the mineralization found did not lead to any major orebodies. The total metal production through 1972 would not exceed 200 tons of ore containing about 7 tons of copper, 110 ounces of gold, 470 ounces of silver, and 18 tons of lead, for a total value of some $8,000. In recent years a considerable tonnage of clayey material suitable for brick has been extracted from the Pantano Formation near the small railroad settlement of Pantano.

The spotty and generally weak metallic mineralization in the Rincon district does not suggest a well mineralized area. The principal mineral product from the district will continue to be material suitable for making bricks.

ROSEMONT MINING DISTRICT

The Rosemont mining district is included with the Helvetia — Rosemont mining district in this index.

ROSKRUGE MINING DISTRICT

The Roskruge mining district covers the area of the Roskruge Mountains, a curving, irregular range of small, detached but rugged mountains, hills, and buttes extending southward from the Waterman Mountains to the Baboquivari Mountains in east-central Pima County. George Roskruge for whom the mountains were named, was an official surveyor in this area in the late 1800's. Pediments and alluvial flat areas separate and surround the rock exposures.

No Precambrian or Paleozoic rocks are exposed but may underlie the cover of Mesozoic and Teriary sediments and volcanics intruded by small Laramide plutons and partly covered by Laramide volcanics. Later Tertiary intrusions and volcanics are also present. Block faulting and Late Tertiary and Quaternary erosion exposed the present geologic features.

Spotty, scattered, and generally weak mineralization of base and precious metals have been found in the district, mainly along fault and fracture zones cutting Cretaceous and Tertiary sediments and volcanics in close relation to intrusions. Only one mine, the St. Jude, has a recorded production of more than 100 tons of ore.

The total production of base and precious metals from the Roskruge district would be some 380 tons of ore containing about 10,500 ounces of silver, 25 ounces of gold and less than three tons each of copper and lead. The total value would be some $8,300.

The prospects for a major orebody in the Roskruge district do not appear promising but the outcrops of Laramide intrusive on the alluvial covered pediment to the northeast might be investigated for indications of mineralization.

SANTA ROSA MINING DISTRICT

The Santa Rosa mining district covers the relatively low,

Santa Rosa Mountains in north-central Pima County within the Papago Indian Reservation. The origin of the name is uncertain but relates to the Santa Rosa Valley and Gu Achi, an Indian settlement sometimes called Santa Rosa. The elongated and narrow, north-south mountains are of the sierra type with strongly eroded, steep-walled slopes cut in Laramide granitic intrusives and metamorphic schist and phyllite cut by Laramide dikes and plugs. The range resulted from block faulting and also is cut by strong northwest striking faults. Alluvial-covered pediments extend outward from the range.

Oxidized base and precious metal mineralization has been prospected and mined on a small scale in shear and fault zones but the total production from the district has been only some 200 tons of ore containing about nine tons of copper, 3.5 tons of lead, 1,300 ounces of silver, and 60 ounces of gold for a total value of some $7.5 thousand.

There is no record of any detail study of the geology and mineralization of the Santa Rosa district. Although apparently not heavily mineralized, a careful study might reveal possibilities for favorable economic deposits. Negotiations with the Papago Indians would be required to explore, develop, or mine within the Reservation.

SILVER BELL MINING DISTRICT

The Silver Bell mining district, one of the more important producing areas of Pima County, covers the Silver Bell and West Silver Bell Mountains in the north-central part of the County. The origin of the name is uncertain. These mountains and hills form a rugged, northwesterly-aligned range with some detached, erosional peaks extending to the north. A narrow erosional valley separates the group from the Waterman Mountains to the south.

The district exhibits complex geologic formations and structure with faulted blocks of rocks ranging in age and types from Precambrian schist and gneiss to Quaternary volcanics and alluvium. The area of major economic interest lies in a relatively narrow band along the southwest flank of the Silver Bell Mountains. There, a thick series of Paleozoic quartz and limestones, and Mesozoic arkosic and clastic sediments have been strongly deformed, displaced by strong northwest faults, and invaded by a series of Laramide and Tertiary intrusive stocks, dikes, and sills.

To the north and west, Precambrian and/or Cretaceous to Quaternary volcanics and sediments are the major formations. The mountains are surrounded by pediments covered by various thicknesses of alluvium.

The ore mineralization of the district consists mainly of base and precious metal occurrences. These may be supergene enriched copper deposits in fractured and altered Laramide intrusives; disseminated copper, lead, and zinc mineralization in pyrometasomatized Paleozoic pendants in Laramide intrusives; replacement mantos, pods, and lenses in pyrometasomatized Paleozoic limestone; and spotty copper oxides, molybdates, and manganese oxides in limy Permian and Cretaceous sediments. Copper mineralization predominates in the deposits except in the western part of the strongly mineralized zone where replacement bodies of zinc and lead with minor copper have been mined. Gold, silver, and molybdenum are important accessory metals in the ore zones.

Although known and originally prospected at an early date, probably for precious metals, the first copper mining operation was at the Old Boot, later called the Mammoth, mine where native copper, with good silver values, was produced as early as 1873. The extension of the transcontinent railway near the district in 1851, led to increased activity with the production of black copper by the Huachuca Mining and Smelting Company. Production was sporadic in following years, depending on the market price, but several additional deposits were opened up for production. The major sustained development and mining of the early period was carried out by the Imperial Copper Company from 1902 to 1911, with a smelter constructed at Sasco a short distance northwest of the mining areas. American Smelting and Refining Company leased the property and smelter from the bankrupt Imperial Copper Company in 1916 and leasors operated in the district subsequently until all the major copper properties of the district were acquired by American Smelting and Refining Company over a period of years. In 1948, the latter company started checking the earlier drilling results of the previous operators and in 1952 started open pit operations which have continued to the present time. The only other major producer of the district has been the Atlas mine, operated sporadically since the early 1900's, from which most of the zinc production came in the late 1940's through

the early 1960's.

The total estimated and reported production of base and precious metals from the Silver Bell district, through 1972, would be over 61 million tons of ore containing about 504 thousand tons of copper, 24 thousand tons of zinc, 900 tons of lead, 1,500 ounces of silver, and over 5 million ounces of silver. The total value would be about $367 million. Some 2,765 tons of molybdenum oxide have been produced from the open pit operations.

The Silver Bell district lies along an extensive northwest-striking zone of favorable geologic conditions including a long existing, strong break in the earth's crust along which Laramide and Tertiary intrusives invaded the surface rocks. Parts of this zone are covered by volcanics and alluvium but deeply buried or covered orebodies may yet be found along this favorable trend.

WATERMAN MINING DISTRICT

The Waterman mining district, sometimes called the Silver Hill district, named after the mountains it covers and an official of an early mining company operating in the range, lies to the south of the Silver Bell district. The small, rugged hogback-type, and broken range consists of resistant, erosional remnants of Paleozoic formations thrust upward and deformed by high angle faults. The exposed rocks range in age from Cambrian through Cretaceous sediments with some erosional remnants of Cretaceous volcanics and Tertiary volcanics and sediments on the flanking pediments.

The mineralization consists of vein-like deposits and small replacements of base metal carbonates and sulfides along fault and fracture zones in the steeply folded and badly faulted Paleozoic formations. Some oxidized and generally weak copper, lead, and zinc mineralization has been found in the Cretaceous sediments and isolated Paleozoic fault blocks extending southward from the main range.

The mineralization was found and prospected in the late 1800's but has been worked only sporadically since, mainly in the Indiana — Arizona mine area at the north end of the range and the Silver Hill mine at the south end. Lead and zinc were the principal metals produced at the Indiana — Arizona while the production at the Silver Hill mine was mainly copper.

The total production of base and precious metals from the Waterman district would be some 25,000 tons of ore containing about 750 tons of copper, 780 tons of lead, 490 tons of zinc, 106 ounces of gold, and 129,600 ounces of silver. The total value of the ore would be about $12,000.

The mineralization in the Waterman district appears to be subsidiary to that of the Silver Bell district and the character of the geology does not suggest that any new, large orebody will be found.

WHETSTONE MINING DISTRICT

The Whetstone mining district covers the Whetstone Mountains along the Pima-Cochise County border and only part of the western flank is in Pima County. This flank is a rough erosional slope cut by numerous canyons. To the north, faulted and folded, Paleozoic and Cretaceous sediments lie on Precambrian granite while to the south less faulted but folded Cretaceous sediments with some volcanics are intruded by a series of northwest-striking Tertiary intrusives.

The only known mineralization within the Pima section of the Whetstone district is spotty, mostly oxidized, copper mineralization in the Cretaceous sediments in association with faults and the intrusives. About 2,000 tons of ore containing about 20 tons of copper and 1,000 ounces of silver valued at $12,000 has been produced from the Pima section of the Whetstone district.

The southern part of the Whetstone district lies along the southeastern extension of a major structural, intrusive, and mineralization alignment and might deserve more careful study for possible ore deposits.

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)
Agua Dulce	(3 tons)	(230 lbs)	—	—	2	(9 ozs)	($86)
Ajo	350,015	5,659,953	—	—	1,548,253	189,918	1,524,723
Amole	34	529	670	375	1,010	272	289
Arivaca	9	72	230	17	5,620	455	210
Baboquivari	57	244	24	(316 lbs)	13,850	1,735	603
Cababi	6	184	364	3	3,450	1,021	245
Canada del Oro	—	—	—	—	110	—	436
Catalina	5	415	—	—	1	22	107
Cerro Colorado	5	33	63	1	463	3,767	362
Cimarron	(118 tons)	21	2	—	80	5	6
Coyote	(712 tons)	140	—	—	21	12	31
Empire	34	344	16,671	515	744	2,064	1,178
Greaterville	2	39	343	32	28,838	1,866	650
Growler	(51 tons)	12	—	—	2	2	2

Gunsight	16	32	1,552	(229 lbs)	397	1,006	176
Helvetia-Rosemont	426	34,860	521	1,360	1,581	3,469	7,776
Montezuma	1	205	16	—	126	1,641	213
Old Baldy	(206 tons)	37	—	—	2	10	8
Oracle	136	6,117	188	50	387	1,181	861
Papago	5	52	790	2	1,100	301	104
Pima	369,707	4,119,854	85,195	232,953	53,720	311,936	1,884,887
Quijotoa	16	132	58	—	11,616	2,325	509
Redington	(91 tons)	12	—	—	—	1	2
Rincon	(193 tons)	14	36	—	112	5	8
Roskruge	(377 tons)	5	5	—	23	105	8
Santa Rosa	(206 tons)	18	7	—	60	13	8
Silver Bell	61,200	1,008,839	1,804	48,087	1,490	52,942	367,067
Waterman	25	1,502	1,563	978	106	1,296	655
Whetstone	2	40	—	—	—	10	12
Miscellaneous	2	175	143	4	170	1,032	61
Total	781,705	10,833,880 (5,416,940 tons)	110,245 (55,122 tons)	284,377 (142,189 tons)	1,673,334	578,412	3,791,197

TABLE 2
INDEX OF MINING PROPERTY NAMES

NAME	DISTRICT
Abbie Waterman mine (see Indiana-Arizona mine group)	Waterman
Aguajito gold placer (see Ash Creek and Pascola Canyon gold placers)	Papago
Ajax mine group	Arivaca
Ajo Consolidated mine	Ajo
Ajo Cornelia mine	Ajo
Ajo Gunsight mine	Gunsight
Akron mine (see Jaeger mine)	Cababi
Albatross mine	Arivaca
Allison mine	Baboquivari
Alpha mine	Pima
Amado mine group	Arivaca
Amargosa mine (see New Years Eve mine)	Pima
American mine (see Old Dike mine)	Helvetia-Rosemont
Amole group (see Palo Verde and Papago Queen mines)	Amole
Anderson mine (see Conglomerate mine)	Greaterville
Andrada Marble quarry	Helvetia-Rosemont
Andrada mine	Helvetia-Rosemont
Andrade mine (see California mine)	Empire
Annette mine (see Olivette and Annette mines)	Pima
Apache group (see Leatherwood mine group)	Old Hat
Aquinaldo mine group	Papago
Arivaca gold placers	Arivaca
Arivaca King mine	Arivaca
Arizona mine (see Pellegrin mine)	Amole
Arizona Buttes group (see Minnie mine)	Pima
Arizona Comstock lode (see Comstock mine group)	Greaterville
Arizona Consolidated mine	Amole
Arizona Molybdenum mine	Baboquivari
Arizona No. 3 mine	Pima
Arizona Tucson mine (see Ivy May mine)	Amole
Arrastra mine	Greaterville
Ash Creek and Pascola Canyon gold placers	Papago
Atlas mine	Silver Bell
Baboquivari mine	Baboquivari
Backbone mine	Arivaca
Backbone mine (see Eclipse mine group)	Helvetia-Rosemont
Badger mine	Cababi
Ballas mine area	Quijotoa
Ballas Silver-Lead mine (see Ballas mine area)	Quijotoa
Banes claims (see Gold Bullion mine)	Baboquivari
Banner mine group	Papago
Battle Axe mine	Amole
Bee Hive mine	Amole
Ben Lomand mines	Quijotoa

Table 2, Cont.

NAME	DISTRICT
Berkley mine	Baboquivari
Bernice mine group (see Cimarron mine group)	Montezuma
Beuhman mine (see New York mine)	Helvetia-Rosemont
Big Banana mine	Baboquivari
Big Johnny and Little Johnny mines	Papago
Big Juanita mine group	Baboquivari
Black Bear mine (see Jean E group)	Coyote
Black Bess mine group	Gunsight
Black Diamond group (see Baboquivari mine)	Baboquivari
Black Diamond group	Cimarron Mts.
Black Diamond mine (see Montana mine)	Empire
Black Dragon mine group	Baboquivari
Black Gold mine group	Arivaca
Black Hawk group	Coyote
Black Horse shaft (see Copper World mine)	Helvetia-Rosemont
Black Horse mine (see C. & H. mine group)	Helvetia-Rosemont
Black Jack mine	Cimarron Mts.
Black Prince mine	Quijotoa
Black Princess mine	Cerro Colorado
Blow Out mine	Helvetia-Rosemont
Blue Jay-Good Friday mines	Helvetia-Rosemont
Bluff mine group	Old Hat
Bonanza mine	Coyote
Bonanza Park mine (see Isabel mine)	Amole
Border mine	Arivaca
Boston Gulch (see Greaterville placer deposits)	Greaterville
Broad Top mine	Helvetia-Rosemont
Brownell mine	Quijotoa
Buckhorn mine	Greaterville
Buena Vista mine group	Arivaca
Bulldozer mine	Helvetia-Rosemont
Bullion Bar mine group	Gunsight
Burro mine (see Indiana-Arizona mine group)	Waterman
By Chance mine	Quijotoa
C. & H. mine group	Helvetia-Rosemont
Cababi or Cobabi mine (see Picacho mine)	Cababi
Cahuabi mine (see Picacho mine)	Cababi
California mine	Empire
Camden mine (see Prosperity mine group)	Pima
Cara Vaca mine	Quijotoa
Carboloy mine group (see Vindicator mine group)	Arivaca
Carbonate group (see Indiana-Arizona mine group)	Waterman
Cardigan mine	Ajo
Carlo and Eclipse mines	Waterman
Century-Chief group (see Brownell mine)	Quijotoa
Cerro Colorado mine	Cerro Colorado
Chance mine (see Allison mine)	Baboquivari
Chapman mine (see Arivaca King mine)	Arivaca

Table 2, Cont.

NAME	DISTRICT
Chicago mine (see Oregon Copper, Chicago, and Coconino mines)	Helvetia-Rosemont
Chief mine	Empire
Chispa Gulch (see Greaterville placer deposits)	Greaterville
Christenson-Lane mine group	Helvetia-Rosemont
Cimarron mine group	Montezuma
Clum Clanny mine	Helvetia-Rosemont
Coconino mine (see Oregon Copper, Chicago, and Coconino mines)	Helvetia-Rosemont
Colorado Clark mine (see Silver Shield mine)	Cerro Colorado
Colorado Gulch (see Greaterville placer deposits)	Greaterville
Columbia mine	Amole
Columbia mine (see Peach mine)	Helvetia-Rosemont
Columbia mine group	Cababi
Comobabi and Crusader mines	Cababi
Comstock mine group	Greaterville
Conejo (Cottontail) mine	Arivaca
Conglomerate mine	Greaterville
Contact mine	Arivaca
Contention mine	Pima
Cooncan mine (see Cunguian mine)	Cababi
Copper Alex mine group (see C. & H. mine group)	Helvetia-Rosemont
Copper Bell mine	Amole
Copper Butte mine	Pima
Copper Duke mine (see Tip Top mine group)	Helvetia-Rosemont
Copper Glance mine	Pima
Copper Hill group (see Growler mine)	Growler
Copper King group (see Copper Bell and Copper King)	Amole
Copper King mine	Amole
Copper King mine	Pima
Copper Mountain mine	Empire
Copper Plate mine	Whetstone
Copper Squaw mine	Quijotoa
Copper World mine	Helvetia-Rosemon
Corda Bros. group (see Olivette and Annette mines)	Pima
Corregedor mine	Old Hat
Costello group (see Esperanza mine group)	Pima
Cottontail mine (see Conejo (Cottontail) mine)	Arivaca
Cowboy mine	Pima
Coyote mine (see C. & H. mine group)	Helvetia-Rosemon
Coyote Hole prospect	Cababi
Crown claims Nos. 1 & 2	Helvetia-Rosemon
Crown King and Tiger mine groups (see Esperanza mine group)	Pima
Crusader mine (see Columbia and Crusader mines)	Cababi

Table 2, Cont.

NAME	DISTRICT
Cube Iron mine (see Morgan mine group)	Quijotoa
Cunquian mine	Cababi
Cuprite mine group	Helvetia-Rosemont
Curtis mine	Helvetia-Rosemont
Cushing mine (see Franklin, Cushing, and Marion mine group)	Helvetia-Rosemont
C W T mine	Pima
Daily mine	Old Hat
Daisy mine	Pima
Dan mine (see Elgin mine group)	Helvetia-Rosemont
Daylight-Narragansett mine group	Helvetia-Rosemont
Desert Lode mine	Cababi
Dimple mine group	Helvetia-Rosemont
Dogtown mine (see Arizona No. 3 mine)	Pima
Durzano gulch gold placer (see Las Guias gold placers)	Arivaca
Dutchess mine (see Emperor and Dutchess mines)	Cababi
East Pima mine (see Mission mine)	Pima
Easter mine group	Arivaca
Eclipse mine (see Carlo and Eclipse mines)	Waterman
Eclipse mine group	Helvetia-Rosemont
Edna J. placer	Baboquivari
Edwards mine	Arivaca
Eisenhauer group (see Palo Verde mine)	Pima
Eldon mine (see Eclipse mine group)	Helvetia-Rosemont
Elgin mine group	Helvetia-Rosemont
Elgin mine (see Emmett and Elgin mine)	Baboquivari
Elsie mine (see Prosperity mine group)	Pima
El Tiro mine	Silver Bell
El Tiro open pit (see Silver Bell mine)	Silver Bell
Emmett and Elgin mine	Baboquivari
Emperor and Dutchess mines	Cababi
Empire Gulch (see Greaterville placer deposits)	Greaterville
Empire mine (see Lilly, Saguaro, and Empire mines)	Gunsight
Enzenberg mine	Greaterville
Esperanza mine group (see Good Enough mine)	Arivaca
Esperanza mine group	Pima
Esperanza and West Esperanza open pit mines)	Pima
Exile mine (see King-Exile mine group)	Helvetia-Rosemont
Fairview mine	Helvetia-Rosemont
Falls claim	Helvetia-Rosemont
Faro Bank group (see high Card mine)	Cababi
Forty-nine (49) mine	Empire
Franklin, Cushing, and Marion mine group	Helvetia-Rosemont
Franklin group (see South San Xavier mine group)	Pima
Fresnel mine (see Allison mine)	Baboquivari
Fries group (see Alpha mine)	Pima
Geesman mine group	Old Hat

Table 2, Cont.

NAME	DISTRICT
General mine (see Elgin mine group)	Helvetia-Rosemon
General Electric mines (see Las Guias mines group)	Arivaca
Giant mine	Baboquivari
Gnome King mine (see Ajax mine group)	Arivaca
Golconda placers (see Horseshoe gold placers)	Quijotoa
Gold Bullion mine	Baboquivari
Gold Coin mine (see Silver Hill mine)	Cerro Colorado
Gold King mine	Baboquivari
Golden Fleece mine (see Keystone mine)	Pima
Golden Gate mine group	Helvetia-Rosemon
Golden Star mine (see Buena Vista mine group)	Arivaca
Gold Hill mine (see Papago Queen mine)	Amole
Gold King mine	Baboquivari
Gold Rim and Rebecca mines (see Buena Vista mine group)	Arivaca
Good Enough mine group	Arivaca
Good Friday mine (see Blue Jay-Good Friday mines)	Helvetia-Rosemon
Gopher mine	Empire
Gould mine	Amole
Graham Gulch (see Greaterville placer deposits)	Greaterville
Grand lode (see Las Guias mine group)	Arivaca
Grand Mountain mine (see Giant mine)	Baboquivari
Graveyard mine	Empire
Greaterville placer deposit	Greaterville
Greenfield State Lease (see Lesjimfre claims)	Baboquivari
Green mine (see Sherwood mine)	Cababi
Green Monument mine (see C. & H. mine group)	Helvetia-Rosemont
Grey Copper mine (see South San Xavier mine group)	Pima
Growler mine	Growler
Guadalupe mine group (see M. C. M. mine group)	Arivaca
Gunsight mine	Gunsight
Hancock mine	Greaterville
Harshaw Gulch (see Greaterville placer deposits)	Greaterville
Hartman-Homestake mines	Old Hat
Hayward's Sulfide mine (see Pauline mine)	Helvetia-Rosemont
Heavy Weight mine	Helvetia-Rosemont
Heintzelman mine (see Cerro Colorado mine)	Cerro Colorado
Helena mine	Helvetia-Rosemont
Helmet Peak group (see Prosperity mine group)	Pima
High Card mine	Cababi
High Hill mine	Pima
Hilo mine (see Daylight-Naragansett mines)	Helvetia-Rosemont
Hiltano group (see Chief, Prince, Gopher, etc.)	Empire
Hilton mine	Empire
Hilton Tungsten claims	Empire

Table 2, Cont.

NAME	DISTRICT
Homestake mine (see Indians-Arizona mine group)	Waterman
Horseshoe gold placers	Quijotoa
Hughes group (see Esperanza mine group)	Pima
Hughes Gulch (see Greaterville placer deposits)	Greaterville
Hughes mine group (see Banner mine group)	Papago
Hump mine (see Aquinaldo mine group)	Papago
Immense lodes (see Las Guias mine group)	Arivaca
Imperial mine (see Mammoth mine)	Silver Bell
Index group (see Brownell mine)	Quijotoa
Indiana-Arizona mine group	Waterman
Indian Club mine (see Isle Royal mine group)	Helvetia-Rosemont
Iowana mine	Baboquivari
Iron Mask mine (see Jackson mine group)	Old Baldy
Isabel mine	Amole
Isabella mine	Cimarron Mts.
Isle Royal mine group	Helvetia-Rosemont
Ivy May mine	Amole
Jackson mine group	Old Baldy
Jaeger mine	Cababi
Jean E group	Coyote
Jerome #2 mine	Empire
Jezebel mine	Baboquivari
Josephine mine (see Arizona Consolidated mine)	Amole
Juanita #9 (see Sparks mine)	Baboquivari
Jupiter mine	Baboquivari
Justice, Red Top, and La Plata mines	Empire
Kentucky Gulch (see Greaterville placer deposits)	Greaterville
Keystone mine	Pima
King-Exile mine group	Helvetia-Rosemont
Korn Kob prospect	Redington
La Plata mine (see Justice, Red Top, and La Plata mines)	Empire
Las Guias gold placers	Arivaca
Las Guijas mine group	Arivaca
Las Guijas tungsten placers	Arivaca
Last Chance claim group (see Gold Bullion mine)	Baboquivari
Lavery mine	Empire
Lead Carbonate mine	Empire
Leader mine	Helvetia-Rosemont
Leatherwood mine group	Old Hat
Lesjimfre claims	Baboquivari
Liberty mine	Cerro Colorado
Light Weight mine (see Heavy Weight mine)	Helvetia-Rosemont
Lilly, Saguaro, and Empire mines	Gunsight
Lincoln mine group	Papago
Little Chief mine	Gunsight
Little Dave mine (see Isle Royal mine group)	Helvetia-Rosemont

Table 2, Cont.

NAME	DISTRICT
Little Helvetia mine (see Tip Top mine group)	Helvetia-Rosemon
Little Johnny mine (see Big Johnny and Little Johnny mines)	Papago
Little Mary mine	Cababi
Lone Mountain mine	Empire
Lone Valley mine group	Pima
Long Shot mine group	Arivaca
Los Pozos Gulch (see Greaterville placer deposits)	Greaterville
Lost Boy mine	Helvetia-Rosemon
Louden mine (see Peach mine)	Helvetia-Rosemon
Louisiana Gulch (see Greaterville placer deposits)	Greaterville
Lucido claim group	Cababi
Lucky Strike mine	Gunsight
Magnet Copper group (see Esperanza mine group)	Pima
Magonigal mine	Silver Bell
Mammoth mine	Silver Bell
Manganese King group	Cimarron Mts.
Mann mine (see California mine)	Empire
Man's Dream mine	Quijotoa
Marconi mine group	Pima
Marion mine (see Franklin, Cushing, and Marion mine group)	Helvetia-Rosemont
Mary E mine (See Mary G mine)	Cerro Colorado
Mary G mine	Cerro Colorado
McKay mine (see Ben Lomand mines)	Quijotoa
M. C. M. mine group	Arivaca
Mildren mine group	Cababi
Milton mine group (see Cimarron mine group)	Montezuma
Mineral Hill mine	Pima
Minnie mine	Pima
Mission mine	Pima
Mocking Bird mine group	Quijotoa
Mohawk mine	Helvetia-Rosemont
Montana mine	Empire
Monte Cristo mine	Cimarron Mts.
Montizona mine	Cimarron Mts.
Moore mine	Arivaca
Morgan mine group	Quijotoa
Morningstar mine (see St. Louis mine)	Greaterville
Mother Lode mine (see Edwards mine)	Arivaca
Mountain King mine (see Enzenberg mine)	Greaterville
Mountain Lion group (see Bullion Bar mine group)	Gunsight
Muheim-Grafen mine	Helvetia-Rosemont
Napoleon mine (see Papago Chief mine)	Baboquivari
Naragansett mine (see Daylight-Naragansett mines)	Helvetia-Rosemont

Table 2, Cont.

NAME	DISTRICT
Naragansett Bay mine (see Daylight-Naragansett mines)	Helvetia-Rosemont
Nevada mine (see C. & H. mine group)	Helvetia-Rosemont
New Colorado mine	Cerro Colorado
New Cornelia (Ajo) mine	Ajo
New Dragoon (see Yellow Star mine)	Baboquivari
New Gunsight mine (see Surprise mine)	Gunsight
Newman mine	Helvetia-Rosemont
New Olivette mine (see Olivette and Annette mines)	Pima
New Years Eve mine	Pima
New York mine	Helvetia-Rosemont
Nigger Gulch (see Greaterville placer deposits)	Greaterville
North Star mine (see Contention mine)	Pima
Noscut mine (see Dimple mine group)	Helvetia-Rosemont
Oceanic mine	Arivaca
Olcutt mine (see Eclipse mine group)	Helvetia-Rosemont
Old Bat mine (see Old Mission mine)	Amole
Old Boot mine (see Mammoth mine)	Silver Bell
Old Bucket mine (see Contact mine)	Arivaca
Old Dick mine	Helvetia-Rosemont
Old Frijole mine (see Silver Spur mine)	Helvetia-Rosemont
Old Hat mine (see Stratton mine)	Old Hat
Old Mission mine	Amole
Old Padre mine (see Pellegrin mine)	Amole
Old Pap mine	Helvetia-Rosemont
Old Pueblo mine	Amole
Old Put mine	Helvetia-Rosemont
Old Timer mine	Cababi
Old Yuma mine	Amole
Olive mine (see Olivette and Annette mines)	Pima
Olivette and Annette mines	Pima
Olympia mine group (see Banner mine group)	Papago
Omega and Omega Extension mines	Helvetia-Rosemont
Omega Extension mine (see Omega and Omega Extension mines)	Helvetia-Rosemont
Ophir Gulch (see Greaterville placer deposits)	Greaterville
Oregon Copper, Chicago, and Coconino mines)	Helvetia-Rosemont
Oreona mine (see Amado mine group)	Arivaca
Oro Grande mine	Cimarron Mts.
Owasko mine (see Black Horse mine)	Helvetia-Rosemont
Oxide mine	Silver Bell
Oxide open pit (see Silver Bell mine)	Silver Bell
Pack Rat group (see Mocking Bird mine group)	Quijotoa
Paddy Woods mine (see Indiana-Arizona mine group	Waterman
Palo Verde mine	Amole
Palo Verde mine	Pima

Table 2, Cont.

NAME	DISTRICT
Papago gold placers (see Ash Creek and Pascola Canyon gold placers)	Papago
Papago mine	Agua Dulce
Papago Chief mine	Baboquivari
Papago Queen mine	Amole
Pascola Canyon gold placer (see Ash Creek and Pascola Canyon gold placers)	Papago
Pauline mine	Helvetia-Rosemont
Paymaster mine group	Pima
Peach mine	Helvetia-Rosemont
Peer and Peerless group	Quijotoa
Pellegrin mine	Amole
Pesqueria Gulch gold placers (see Las Guias gold placers	Arivaca
Picacho mine	Cababi
Pickwick mine	Helvetia-Rosemont
Pilot mine	Helvetia-Rosemont
Pima group (see Alpha mine)	Pima
Pima open pit mine	Pima
Plumed Knight mine group	Pima
Pontotoc mine	Catalina
Prince mine	Empire
Princess group (see Mary G mine)	Cerro Colorado
Prosperity mine group	Pima
Providence mine (see Lincoln mine group)	Papago
Purcell mine (see Aquinaldo mine group)	Papago
Quebec mine	Greaterville
Quien Sabe mine (see Old Pueblo mine)	Amole
Quijotoa gold placers (see Horseshoe gold placers	Quijotoa
Rebecca mine (see Buena Vists mine group)	Arivaca
Red and Black Chief group (see Baboquivari mine)	Baboquivari
Red Carbonate mine (see New Years Eve mine)	Pima
Red Cloud mine	Empire
Red Oxide group (see San Xavier Extension mine)	Pima
Red Rock group (see El Tiro mine)	Silver Bell
Red Top mine (see Justice, Red Top, and La Plata mines)	Empire
Reilly Lode (see Sherwood mine)	Cababi
Rich Hill mine group	Pima
Ridley mine	Helvetia-Rosemon
Roadside mine	Coyote
Rosebud mine (see Amado mine group)	Arivaca
Rosemont group (see Franklin, Cushing, and Marion mine group)	Helvetia-Rosemon
Rusty Red mine (see Contact mine)	Arivaca
Saginaw mine	Amole
Saginaw Hill mine (see Papago Queen mine)	Amole

Table 2, Cont.

NAME	DISTRICT
Saguaro mine (see Lilly, Saguaro, and Empire mines)	Gunsight
St. Francis mine (see Roadside mine)	Coyote
St. Jude mine	Roskruge
St. Louis Gulch (see Greaterville placer deposits)	Greaterville
St. Louis mine	Greaterville
St. Patrick mine	Quijotoa
San Antonio mine	Ajo
San Juan mine	Baboquivari
San Luis mine (see Oceanic mine)	Arivaca
San Luis Wash gold placers	Arivaca
San Luis Wash tungsten placers	Arivaca
Santa Margarita mine (see Ivy May mine)	Amole
Santa Rita limestone quarry	Helvetia-Rosemont
San Xavier Extension mine	Pima
San Xavier mine	Pima
San Xavier Unit open pit	Pima
Saratoga mine (see Sweet Bye and Bye mine)	Helvetia-Rosemont
Senator Morgan mine group	Pima
Serasio group (see Lone Valley mine group)	Pima
Sherwood mine	Cababi
Sierrita open pit mine	Pima
Silver Bell mine	Silver Bell
Silver Crown mine	Arivaca
Silver Dollar mine	Cababi
Silver Giant mine	Cababi
Silver Helmet mine	Pima
Silver Hill mine	Cerro Colorado
Silver Hill mine group	Waterman
Silver Lead mine group	Silver Bell
Silver Queen mine	Cababi
Silver Queen mine (see Cerro Colorado mine)	Cerro Colorado
Silver Screen mine (see Ballas mine area)	Quijotoa
Silver Shield mine	Cerro Colorado
Silver Spur mine	Helvetia-Rosemont
Snyder group (see Crown King and Tiger mine groups; Esperanza mine group; and New Years Eve mine)	Pima
Snyder Hill prospect	Amole
Soto mine group (see Good Enough mine)	Arivaca
Southern Cross mine	Helvetia-Rosemont
South San Xavier mine group	Pima
Sparks mine	Baboquivari
S R K mine (see Bonanza mine)	Coyote
Starr mine (see Pellegrin mine)	Amole
State of Maine group (see State of Maine, Chief, Jerome #2, etc.)	Empire
State of Maine mine	Empire
Stella Maris No. 1 mine	Cimarron Mts.

Table 2, Cont.

NAME	DISTRICT
Stella Maris No. 2 mine	Cimarron Mts.
Steppe mine (see Little Mary mine)	Cababi
Sterling mine (see Oro Grande mine)	Cimarron Mts.
Stewart-Fernstrom mine group (see Vindicator mine group)	Arivaca
Stratton mine	Old Hat
Submarine group (see Black Bess mine group)	Gunsight
Sucker Gulch (see Greaterville placer deposits)	Greaterville
Sulfide Lead-Zinc mines	Helvetia-Rosemont
Sun-Gold Mining Co. (see Sun-Gold mine)	Cababi
Sunrise mine (see Sunshine and Sunrise mines)	Papago
Sunset Limited mine group	Gunsight
Sunset mine group	Silver Bell
Sunshine mine (see San Antonio mine)	Ajo
Sunshine and Sunrise mines	Papago
Surprise mine	Gunsight
Sweet Bye and Bye mine	Helvetia-Rosemont
Sweet group (see Pickwick mine)	Helvetia-Rosemont
Sweetwater mine (see Isabel mine)	Amole
Taylor X claims	Old Hat
Tellurium claim group (see Gold Bullion mine)	Baboquivari
Tiger mine (see Amado mine group)	Arivaca
Tiger mine (see Crown King and Tiger mine groups; and Esperanza mine group)	Pima
Tip Top mine group	Helvetia-Rosemont
Tit-for-Tat mine (see Prosperity mine group)	Pima
Tom Rigg mine (see Contact mine)	Arivaca
Total Wreck mine	Empire
Triangle mine (see Eclipse mine group)	Helvetia-Rosemont
Tungsten King mine (see Silver Dollar mine)	Cababi
Tunquepata or Tunquita mine (see Border mine)	Arivaca
Twin Buttes open pit mine	Pima
Twin Hill Prospect	Amole
Twin Peaks quarry	Amole
Uncle Sam mine (see Arizona Consolidated mine)	Amole
Union mine (see Mammoth mine)	Silver Bell
U. S. Grant mine (see Gold Gate mine group)	Helvetia-Rosemont
Ventana mine group	Baboquivari
Venus group (see Minnie mine)	Pima
Verde mine group (see Cimarron mine group)	Montezuma
Verde Queen mine	Empire
Victoria group (see Paymaster mine group)	Pima
Victoria mine	Montezuma
Vindicator mine group	Arivaca
V. O. mine (see By Chance mine)	Quijotoa
Vulcan mine group	Pima
Wakefield group (see San Xavier Extension mine)	Pima
Weldon mine	Quijotoa

Table 2, Cont.

NAME	DISTRICT
West Esperanza open pit mine (see Esperanza and West Esperanza open pit mines)	Pima
Wheeler-Perry group (see Esperanza mine group)	Pima
Whipperwell mine (see Amado mine group)	Arivaca
Whitcomb mine	Pima
Wisconsin mine (see Buckhorn mine)	Greaterville
Wonder mine group (see Sunset Limited mine group)	Gunsight
Yellow Astor mine (see Sunset Limited mine group)	Gunsight
Yellow Bird mine (see Lincoln mine group)	Papago
Yellow Star mine	Baboquivari
York mine (see Daylight-Naragansett mines)	Helvetia-Rosemont
Young America mine (see Oxide mine)	Silver Bell
Yuba mine	Greaterville

TABLE 3
INDEX OF MINING PROPERTY OPERATORS

NAME	PROPERTY	DISTRICT
Ace Mining Co.	Carlo and Eclipse mines	Waterman
Adams	Hartman-Homestake mines	Old Hat
Adams & Saxby	Total Wreck mine	Empire
Ajax Mining Co.	Ajax mine group	Arivaca
Ajo Consolidated Copper Co.	Ajo Consolidated mine	Ajo
Ajo Cornelia Copper Co.	Ajo Cornelia mine	Ajo
Ajo Gunsight Mining Co.	Ajo Gunsight mine	Gunsight
Ajo Mines Corporation	Black Prince mine	Quijotoa
Ajo-Papago Gold Mining Co.	Black Bess mine group	Gunsight
Akron Gold Mining Co.	Badger; Jaeger mines	Cababi
Alba Mines, Inc.	Amado mine group	Arivaca
Albatross Gold Mining Co.	Albatross mine	Arivaca
Albert Steinfeld Co.	Mammoth mine	Silver Bell
Allison Bros. & Wicks	Allison mine	Baboquivari
Allison Gold Mining Co.	Allison mine	Baboquivari
Allison Steel Co.	King-Exile mine group	Helvetia-Rosemont
Alpha Copper Co.	Alpha mine	Pima
Amado	Papago Chief mine	Baboquivari
Amado Mining Co.	Amado mine group	Arivaca
Amargosa Molybdenum & Copper Co.	High Hill mine	Pima
Amargosa Molybdenum Co.	New Years Eve mine	Pima
American Smelting & Refining Co.	Tip Top mine group	Helvetia-Rosemont
	Contention; Minnie; Mission mine; San Xavier Unit open pit; Senator Morgan mine group	Pima
	El Tiro; Mammoth; Oxide mines	Silver Bell
	Silver Bell mine	Silver Bell
Amuran Mining Co.	Contention; Copper Glance; Copper Queen mines	Pima
Anaconda Co.	Twin Buttes open pit mine	Pima

Anderson	Contact mine	Arivaca
	Sherwood mine	Cababi
	Olivette; Annette mines	Pima
Andrada Marble Co.	Andrada Marble quarry	Helvetia-Rosemont
Andrade	Monte Cristo mine	Cimarron Mts.
	California mine	Empire
	Pauline mine	Helvetia-Rosemont
	Copper Squaw mine	Quijotoa
Anglin	Lost Boy mine	Helvetia-Rosemont
Aquinaldo Mining Co.	Aquinaldo mine group	Papago
Aricu Mining Co.	Blow Out mine	Helvetia-Rosemont
Arivaca Gold Mining & Milling Co.	Ajax mine group	Arivaca
Arivaca Mining Co.	Amado mine group	Arivaca
Arizona Comstock Mining Co.	Comstock mine group	Greaterville
Arizona Consolidated Mining Co.	Arizona Consolidated mine	Amole
Arizona Copper Bell Mining Co.	Silver Hill mine group	Waterman
Arizona Copper Mining & Trading Co.	Ajo Consolidated; New Cornelia (Ajo) mines	Ajo
Arizona Copper Mining Co.	Arizona Consolidated mine	Amole
Arizona Copper Mines, Inc.	Corregedor; Daily mines; Geesman; Leatherwood mine groups	Old Hat
Arizona Jupiter Mines, Inc.	Jupiter mine	Baboquivari
Arizona Lead & Copper Co.	Forty-nine (49) mine	Empire
Arizona Lead Mines Co.	Sunshine; Sunrise mines	Papago
Arizona Materials and Service Co.	Black Dragon mine group	Baboquivari
Arizona Mining Co.	Ventana mine group	Baboquivari
Arizona Mining & Refining Co.	Golden Gate mine group	Helvetia-Rosemont
Arizona Mission Mines Co.	Pellegrin mine	Amole
Arizona Molybdenum Co.	Arizona Molybdenum mine	Baboquivari
Arizona Paymaster Mining Co.	Paymaster mine group	Pima
Arizona Portland Cement Co., Div. of California Portland Cement Co.	Twin Peak quarry	Amole
Arizona Tonopah Mining & Milling Co.	Bee Hive mine	Amole
Arizona Tucson Copper Co.	Ivy May mine	Amole
Associated Mining & Milling Co.	Whitcomb mine	Pima

Table 3, Cont.

NAME	PROPERTY	DISTRICT
Atlas Mines, Inc.	Atlas mine	Silver Bell
Atlas Mining Co.	Atlas mine	Silver Bell
Atwood	Silver Crown mine	Arivaca
Avery	Border mine group	Arivaca
Ayers	Mary G mine	Cerro Colorado
Azurite Copper & Gold Co.	Mineral Hill mine	Pima
Baboquivari Gold Placer Co.	Edna J. placer	Baboquivari
Backbone Mining Co.	Backbone mine	Arivaca
Baker	Cerro Colorado mine	Cerro Colorado
Ballestreras	San Antonio mine	Ajo
Banner Mining Co.	Contention; Copper Glance; Copper Queen; Daisy; Mineral Hill; Palo Verde mines	Pima
Banner-Sierrita Mining Co.	Banner mine group	Papago
Barbre	Silver Spur mine	Helvetia-Rosemont
Barnsdall Corporation	Mineral Hill mine	Pima
Bartlett	Picacho; Silver Queen mines	Cababi
Baxter	Copper Glance; Copper King; Copper Queen mines; Senator Morgan mine group	Pima
Beals	Gold King mine	Baboquivari
Beard & Allen	Copper Bell mine	Amole
Beids Mining	Little Mary mine	Cababi
Bell	Growler mine	Growler
Ben Lomand Mines	Ben Lomand mines	Quijotoa
Bennett	Daylight-Narragansett mines	Helvetia-Rosemont
Bent & Shields	Iowana mine	Baboquivari
Black Bess Consolidated Gold Mining Co.	Black Bess mine group	Gunsight
Black Bess Mining Co.	Black Bess mine group	Gunsight
Black Dragon Mining Co.	Black Dragon mine group	Baboquivari
Black Prince Metal Production Co.	Black Prince mine	Quijotoa
Blanche Rose Mining Co.	Crown King & Tiger; Esperanza mine groups	Pima

Blankenship	Copper World; Leader; Old Dick mines	Helvetia-Rosemont
Bledsoe	Mary G mine	Cerro Colorado
Bonanza Park Mining Co.	Isabel mine	Amole
Boston Gold-Copper Co.	Growler mine	Growler
Boyd & Torrey	Conejo (Cottontail) mine	Arivaca
Bradford Development Co.	California mine	Empire
Bradley	Lilly, Saguaro, and Empire mines	Gunsight
Bramwell & Sullivan	Sunset Limited mine group	Gunsight
Brickta	St. Jude mine	Roskruge
Brooks	Sulfide Lead-Zinc mines	Helvetia-Rosemont
Brouse	Easter mine group	Arivaca
Brown	Big Juanita mine group	Baboquivari
	Daylight-Narragansett mines	Helvetia-Rosemont
Brownell Arizona Mining & Smelting Co.	Brownell mine	Quijotoa
Bruce	Carlo & Eclipse mines	Waterman
B. S. & K. Mining Co.	Atlas mine	Silver Bell
Buckeye State Mining & Milling Co.	Bee Hive mine	Amole
Bulldozer Mines Co.	Bulldozer mine	Helvetia-Rosemont
Bullion Bar Mining & Development Co.	Bullion Bar mine group	Gunsight
Burney	Leader mine	Helvetia-Rosemont
Burris & Sons	Long Shot mine group	Arivaca
Bush-Baxter Mining Co.	Contention; Copper Butte; Copper Glance; Minnie mines	Pima
Bustamonte	Papago Chief mine	Baboquivari
	Picacho mine	Cababi
Butler	Gunsight mine	Gunsight
Buttes Copper Co.	Minnie mine	Pima
Byfield Mining & Milling Co.	Conejo (Cottontail); Silver Crown mines	Arivaca
Byrd	Silver Hill mine group	Waterman
Cababi Mining Co.	Picacho mine	Cababi
Calloway	By Chance; Man's Dream mines	Quijotoa
Calumet & Arizona Copper Co.	Ajo Consolidated; New Cornelia (Ajo) mines	Ajo
Calvillo	Bonanza mine	Coyote
Calzona Mining & Milling Co.	Arivaca King mine	Arivaca

Table 3, Cont.

NAME	PROPERTY	DISTRICT
Cambell & Vreeland	Copper King mine	Amole
Cardiello	Crown claims Nos. 1 & 2	Helvetia-Rosemont
Cardiello & Serasio	Blow Out mine	Helvetia-Rosemont
Cardigan Copper Co.	Cardigan mine	Ajo
Carlson	Vindicator mine group	Arivaca
Carlson, Fernstrom, and Cummings	Lesjimfre claims	Baboquivari
Carpenter	St Jude mine	Roskruge
Carrillo	Carlo & Eclipse mines	Waterman
Carter	Contact mine	Arivaca
Carthage Silver Mining Co.	Gunsight mine	Gunsight
Casey	Easter mine group	Arivaca
Catalina Consolidated Copper Co.	Daily mine; Geesman; Leatherwood mine groups	Old Hat
Catalina Mining Co.	Battle Axe mine	Amole
Cates	Contact mine	Arivaca
Cerro Colorado Mining & Milling Co.	Cerro Colorado mine	Cerro Colorado
Cerro Cristo Mines Co.	Cerro Colorado mine	Cerro Colorado
Chamrod	Bulldozer mine; Tip Top mine group	Helvetia-Rosemont
Chavez	Berkley mine	Baboquivari
Chemical Process Copper Company	El Tiro mine	Silver Bell
Chesterfield Copper Co.	Crown King & Tiger; Esperanza mine groups	Pima
Childs	Brownell; By Chance mines	Quijotoa
Childs et al	Cardigan mine	Ajo
Chilson	Elgin; King-Exile mine groups; Newman; Old Dick; Oregon Copper, Chicago, and Coconino; Southern Cross mines	Helvetia-Rosemont
	Plumed Knight mine group; San Xavier Extension mine	Pima
Chilson & Green	Peach mine	Helvetia-Rosemont
Choate	Picacho mine	Cababi

Cinderra Mining & Engineering Co., Inc.	Giant mine	Baboquivari
Cleveland-Arizona Mining Co.	El Tiro mine	Silver Bell
Cleveland Tungsten Co.	Vindicator mine group	Arivaca
Clum & Walker	Clum Clanny mine	Helvetia-Rosemont
Collins	C. & H. prospect	Helvetia-Rosemont
Col. Randolph	Old Yuma mine	Amole
Colonia Copper Co.	Growler mine	Growler
Columbia Copper Co.	Columbia mine	Amole
Combs	Bluff mine group	Old Hat
Comobabi Copper Co.	Comobabi and Crusader mines	Cababi
Como-Pima Mining Co.	Little Mary mine	Cababi
Comstock Mines Co.	Comstock mine group	Greaterville
Conard	Edna J. placer	Baboquivari
Consolidated Arizona Mine & Milling Co.	Cerro Colorado mine	Cerro Colorado
Continental Copper, Inc.	Daily mine; Geesman mine group	Old Hat
Continental Materials Corp.	C W T mine	Pima
Contreras	Silver Lead mine group	Silver Bell
Control Mines Co.	Daily mine; Geesman; Leatherwood mine groups	Old Hat
Control Mines, Inc.	Daily mine; Geesman; Leatherwood mine groups	Old Hat
Cooley	Copper Squaw mine	Quijotoa
Coplen	Big Banana mine; Black Dragon mine group; Giant; San Juan; Yellow Star mines	Baboquivari
Coplen & O'Brien	Coyote Hole prospect	Cababi
Copper King Co.	Mineral Hill mine	Pima
Copper Ridge Mining Co.	Ajo Cornelia mine	Ajo
Copper Star Mining Co.	Plumed Knight mine group	Pima
Cornelia Copper Co.	New Cornelia (Ajo) mine	Ajo
Corzelius	Blue Jay-Good Friday mines	Helvetia-Rosemont
Costello	High Hill mine	Pima
Cotton & Flynn	Silver Hill mine	Cerro Colorado
Covered Wells Copper Co.	St. Patrick mine	Quijotoa
Cowboy Mining & Smelting Co.	Cowboy mine	Pima

Table 3, Cont.

NAME	PROPERTY	DISTRICT
Cummings	Border mine group	Arivaca
	Lesjimfre claims	Baboquivari
Cuprite Mining & Smelting Co.	Cuprite mine group	Helvetia-Rosemont
D. & P. Mining Co.	Silver Spur mine; Tip Top mine group	Helvetia-Rosemont
Daily Arizona Copper Co.	Daily mine	Old Hat
Daily Mines Co.	Daily mine	Old Hat
Daylight Mining Co.	King-Exile mine group	Helvetia-Rosemont
Del Rio Minerals	Bulldozer mine	Helvetia-Rosemont
Dement & Schley	Montana mine	Empire
Denning Mining Co.	Little Chief mine	Gunsight
Desert Gold Mining Co.	Jaeger mine; Lucido claim group	Cababi
De Silva & Allinio	Stella Maris No. 1; Stella Maris No. 2 mines	Cimarron Mts.
Dick & Sullivan	Chief mine	Empire
Dinnerly	Jupiter mine	Baboquivari
Don Lieberman Enterprises, Inc.	Easter; Good Enough mine groups	Arivaca
Draham Enterprises	Moore mine	Arivaca
Drake Mining Co.	Black Hawk; Jean E groups	Coyote
Driggs	Justice, Red Top, and La Plata; Red Cloud mines	Empire
Dubernac Mining Co.	Lone Mountain mine	Empire
Duffy	Sherwood mine	Cababi
Dunn	Mildren mine group	Cababi
Duval Corporation	Esperanza open pit mines	Pima
Duval Sierrita Corporation	Sierrita open pit mine	Pima
Duval Sulphur & Potash Company	Esperanza open pit mines	Pima
Eagle Picher Mining & Smelting Co.	San Xavier mine; South San Xavier mine group	Pima
Eastern Pacific Mining & Milling Co.	State of Maine mine	Empire
Ehrenberg	Picacho mine	Cababi
Elgin Mining Co.	Elgin mine group	Helvetia-Rosemont
Elliot	Fairview mine	Helvetia-Rosemont

El Oro Mining Co.	Greaterville placer deposits	Greaterville
El Oro Mining & Milling Co.	Allison mine	Baboquivari
Elston Esperanza Co.	Esperanza mine group	Pima
El Tiro Copper Co.	El Tiro mine	Silver Bell
El Tiro Leasing Co.	El Tiro mine	Silver Bell
Emperor & Dutchess Mines Co.	Emperor and Dutchess mines	Cababi
Emperor Copper Company	Mineral Hill mine	Pima
Empire Mining & Development Co.	Total Wreck mine	Empire
Empire Zinc Company	San Xavier mine; South San Xavier mine group	Pima
Falk	Silver Shield mine	Cerro Colorado
Fernald & Scott	Gunsight mine	Gunsight
Fernstrom	Lesjimfre claims	Baboquivari
Fernstrom Mining Co.	Black Gold; Las Guijas mine groups; San Luis Wash tungsten placers; Vindicator mine group	Arivaca
Ferrell & Gow	Growler mine	Growler
F. H. & R. Mining Co.	Vindicator mine group	Arivaca
Finlyson	Border mine group	Arivaca
Fisher Mining Co.	Gunsight mine	Gunsight
Flynn	Jupiter mine	Baboquivari
Forbes	Tip Top mine group	Helvetia-Rosemont
Foy	Contention; Copper Butte; Copper Glance; Copper King; Copper Queen mines	Pima
Francis	Jezebel; Yellow Star mines	Baboquivari
Francis Hagerman Mining Co.	Banner mine group	Papago
Fullerton	Long Shot mine group	Arivaca
Gardner & Young	Total Wreck mine	Empire
Gastellum	New Years Eve mine	Pima
General Electric Co.	Las Guijas mine group	Arivaca
General Mines, Ltd.	New Years Eve mine	Pima
Glance Mining Co.	Contention; Copper Glance mines	Pima
Glasscock, C. G.	Big Banana mine	Baboquivari
Gold Bar Mining Co.	Allison mine	Baboquivari
Gold Bullion Consolidated Mining Co.	Gold Bullion mine	Baboquivari
Gold Bullion Mines Co.	Gold Bullion mine	Baboquivari

Table 3, Cont.

NAME	PROPERTY	DISTRICT
Gold King Mining & Development Co.	Gold King mine	Baboquivari
Golden Crown Mining Co.	Indiana-Arizona mine group	Waterman
Good Friday Mining Co.	Blue Jay-Good Friday mines	Helvetia-Rosemont
Goodsill & Carry Bros.	Mary G mine	Cerro Colorado
Goon	Buena Vista mine group	Arivaca
Gordon	Magonigal mine	Silver Bell
Gorman	Old Dick mine	Helvetia-Rosemont
Gould Copper Mining Co.	Gould mine	Amole
Graham & Dickey	Gunsight mine	Gunsight
Grant	Sulfide Lead-Zinc mines	Helvetia-Rosemont
Graybill	Dimple claim group	Helvetia-Rosemont
Greaterville Dredge Gold Mining Co.	Greaterville placer deposits	Greaterville
Great Northern Exploration Co., Inc.	Prosperity mine group	Pima
Green & Owen	Newman mine	Helvetia-Rosemont
Greer	Sunset Limited mine group	Gunsight
Griffith	Yellow Star mine	Baboquivari
Grijalba	Papago Chief mine	Baboquivari
Grindell	Lead Carbonate mine	Empire
Griscom Mining Co.	Papago Chief mine	Baboquivari
Growler Copper Co.	Growler mine	Growler
Guadalupe Mining Co.	M. C. M. mine group	Arivaca
Gunsight Detroit Mining & Milling Co.	Bullion Bar mine group	Gunsight
Gunsight Gold & Tungsten Mining Co.	Sunset Limited mine group	Gunsight
Gunsight Mining Co.	Gunsight; Surprise mines	Gunsight
Hadsell	Mocking Bird mine group	Quijotoa
Halbert	Golden Gate mine group	Helvetia-Rosemont
Hampton	Lost Boy mine	Helvetia-Rosemont
Hardy	Little Mary mine	Cababi
Hart & Weigel	Silver Spur mine	Helvetia-Rosemont
Hartley	Sunset mine group	Silver Bell

Hedderman	Cunquian; Desert Lode mines	Cababi
Hedrick	Morgan mine group	Quijotoa
Helldorado Gold & Silver Mining Corp.	Mocking Bird mine group	Quijotoa
Helmet Peak Mining & Milling Co.	Prosperity mine group	Pima
Helvetia Copper Co.	Black Horse shaft; Copper World mine; Elgin mine group; Heavy Weight mine; Isle Royal mine group; Leader; Old Dick; Pilot mines	Helvetia-Rosemont
Helvetia Copper Co. of Arizona	Black Horse shaft; Copper World mine; Elgin mine group; Heavy Weight mine; Isle Royal mine group; Leader; Old Dick mines	Helvetia-Rosemont
Helvetia Mining & Milling Co.	Leader mine	Helvetia-Rosemont
Helvetia Mining Trust	Elgin mine group	Helvetia-Rosemont
Helvetia Oil Company	Old Dick mine	Helvetia-Rosemont
Hermosa Copper Co.	Ivy May mine	Amole
Herring	C. & H. prospect	Helvetia-Rosemont
Hickey	Berkley mine	Baboquivari
Hill	Buckhorn mine	Greaterville
	Bluff mine group	Old Hat
	Arizona No. 3 mine	Pima
Hilton	Chief; Forty-nine; Gopher; Graveyard; Hilton; Jerome #2; Justice, Red Top and La Plata; Lead Carbonate; Lone Mountain; Prince; Red Cloud; State of Maine; Verde Queen mines	Empire
Hilzinger	Marconi mine group	Pima
Hines	Dimple claim group	Helvetia-Rosemont
H. M. Mining Co.	By Chance mine	Quijotoa
Hoff	Forty-nine mine	Empire
Holderness	Daylight-Narragansett mines	Helvetia-Rosemont
Holliday	Arrastra mine	Greaterville
	Golden Gate mine group	Helvetia-Rosemont
Holmes & Padres	High Card mine	Cababi
Huachuca Mining & Smelting Co.	Mammoth mine	Silver Bell
Hughes & Peterson	Naragansett mine group	Helvetia-Rosemont
Humpel	C. & H. prospect	Helvetia-Rosemont

Table 3, Cont.

NAME	PROPERTY	DISTRICT
Hunnell	Golden Gate mine group	Helvetia-Rosemont
Hurlbut	Comstock mine group	Greaterville
Hurlbut & Christman	Quebec mine	Greaterville
Imperial Copper Co.	Mammoth mine	Silver Bell
Imperial Gold Mining Co.	Horseshoe gold placers	Quijotoa
Indiana-Arizona Copper Co.	Indiana-Arizona mine group	Waterman
Indiana-Arizona Development Co.	Indiana-Arizona mine group	Waterman
Indiana-Arizona Mining Co.	Indiana-Arizona mine group	Waterman
International Mines, Inc.	Copper Plate mine	Whetstone
International Ore Separation Co.	Old Yuma mine	Amole
	Indiana-Arizona mine group	Waterman
Iowa Mining & Development Co.	Blue Jay-Good Friday mines	Helvetia-Rosemont
Iowana Mines, Inc.	Iowana mine	Baboquivari
Isabella Mines Co.	Isabella mine	Cimarron Mts.
Ish	Oceanic mine	Arivaca
Jacobs	Arivaca King mine	Arivaca
	Hilton mine	Empire
Jaeger	Badger; Jaeger mines; Lucido claim group	Cababi
Jaeger & Halstead	Picacho mine	Cababi
Jarnigan	San Luis Wash tungsten placers	Arivaca
Jarnagin	Dimple claim group	Helvetia-Rosemont
Jones	Sunset Limited mine group	Gunsight
	Sweet Bye and Bye mine	Helvetia-Rosemont
Jones & Clyne	Comstock mine group	Greaterville
Julian Merger Mines, Inc.	Ballas mine area	Quijotoa
Kerr	Bonanza mine	Coyote
Klosset	Sunshine and Sunrise mines	Papago
Knight	Victoria mine	Montezuma
	Cara Vaca mine; Morgan mine group	Quijotoa
Knox-Arizona Copper Mining Co.	Indiana-Arizona mine group	Waterman

Kyriak & Bartlett	Silver Dollar mine	Cababi
L. & R.	Comstock mine group	Greaterville
L. B. D. M. Mining Co.	Columbia mine	Amole
Lamp	Jupiter mine	Baboquivari
Larrymade Mines Co.	Morgan mine group	Quijotoa
Larrys	Jupiter mine	Baboquivari
Lauterback	Silver Spur mine	Helvetia-Rosemont
Lauterback & Murphy	Curtis mine	Helvetia-Rosemont
Leda Mines Consolidated	M. C. M. mine group	Arivaca
Lemas	Good Enough mine group	Arivaca
Leonard	Sherwood mine	Cababi
	Christenson-Lane mine group	Helvetia-Rosemont
Levy	Victoria mine	Montezuma
Lewisohn Copper Co.	Broad Top; Daylight-Naragansett mines; Falls claim	Helvetia-Rosemont
Lewisohn Estate	Franklin, Cushing, and Marion; King-Exile mine groups; Mohawk; Newman; Peach; Southern Cross mines	Helvetia-Rosemont
Liberty Mining & Smelting Co.	Liberty mine	Cerro Colorado
Liberty Silver Mines Co.	St. Louis mine	Greaterville
Lim	Buena Vista mine group	Arivaca
Lincoln Consolidated Mining Co.	Lincoln mine group	Papago
Long	Growler mine	Growler
Louden Mining Co.	Peach mine	Helvetia-Rosemont
Lowell	Border mine group	Arivaca
	Silver Hill mine	Cerro Colorado
Luofboro & Nelson	Silver Queen mine	Cababi
Luper	Copper Squaw mine	Quijotoa
MacFarlane	Newman mine	Helvetia-Rosemont
	Silver Hill mine	Cerro Colorado
McCarthy	Long Shot mine group	Arivaca
McCaughy	Mildren mine group	Cababi
McCaughy	Mildren mine group	Cababi
McCleary	Pickwick mine	Helvetia-Rosemont

Table 3, Cont.

NAME	PROPERTY	DISTRICT
McFarland	Sweet Bye and Bye mine	Helvetia-Rosemont
McFarland & Hullinger	Elgin mine group	Helvetia-Rosemont
McFarlane & Hullinger	Battle Axe; Old Pueblo mines	Amole
	San Xavier mine	Pima
McGee	Keystone mine	Pima
McKay	Omega and Omega Extension mines	Helvetia-Rosemont
McMahon	Gopher mine	Empire
	New York mine	Helvetia-Rosemont
McNatt	Monte Cristo mine	Cimarron Mts.
Maffeo	Franklin, Cushing and Marion mines; King-Exile mine group	Helvetia-Rosemont
Magnate Copper Co.	Crown King and Tiger; Esperanza mine groups	Pima
Manganese King Mining Co.	Manganese King group	Cimarron Mts.
Manhattan Company	Horseshoe gold placers	Quijotoa
Manzo, Death, & Mitchell	Bonanza mine	Coyote
Martinez	St. Louis mine	Greaterville
Mary G Mining Co.	Mary G mine	Cerro Colorado
Mary Leasing Co.	Mary G mine	Cerro Colorado
Mattingly	Tip Top mine group	Helvetia-Rosemont
Maxwell	High Card mine	Cababi
May	Comobabi and Crusader mines	Cababi
M. C. M. Mining & Milling Co.	M. C. M. mine group	Arivaca
Medd	Little Mary mine	Cababi
Michigan-Arizona Development Co.	Black Horse shaft; Copper World mine; Elgin mine group; Heavy Weight mine; Isle Royal mine group; Leader; Old Dick mines	Helvetia-Rosemont
Middleton Mines, Inc.	Forty-nine mine	Empire
Midland Copper Co.	Conglomerate mine	Greaterville
	Contention; Copper Glance; Copper King; Copper Queen mines	Pima

Mildren Mining Co.	Mildren mine group	Cababi
Mile Wide Copper Co.	Columbia; Copper Bell; Copper King mines	Amole
Milton — Sturges	Cimarron mine group	Montezuma
Mineral Hill Consolidated Copper Co.	Mineral Hill mine; Plumed Knight mine group	Pima
Mineral Hill Mining Co.	Mineral Hill mine	Pima
Minerals & Metals Corp.	Ridley mine	Helvetia-Rosemont
Mitchell	Silver Shield mine	Cerro Colorado
Molybdenum, Inc.	Leader mine	Helvetia-Rosemont
Montana-Arizona Mining Co.	Cimarron mine group	Montezuma
Montizona Copper Co.	Montizona mine	Cimarron Mts.
Moore	Gold Bullion mine	Baboquivari
Mountain States Uranium Co.	San Juan mine	Baboquivari
Muheim	Muheim-Graften mine	Helvetia-Rosemont
Myers	Sunset Limited mine group	Gunsight
Myers, Clark, & Rowe Co.	San Xavier mine	Pima
Nail	Golden Gate mine group	Helvetia-Rosemont
Naragansett Mines (Copper) Co.	Daylight-Narragansett mines	Helvetia-Rosemont
New Cornelia Copper Co.	Ajo Consolidated; New Cornelia (Ajo) mines	Ajo
New Cornelia Division of Phelps Dodge Corp.	Ajo Consolidated; New Cornelia (Ajo) mines	Ajo
New Venture Placer Mining Co.	Las Guijas gold placers	Arivaca
New York Copper Co.	New York mine	Helvetia-Rosemont
Noche & Yacuma	Copper Plate mine	Whetstone
Noscut Mining Co.	Dimple mine group	Helvetia-Rosemont
Oceanic Gold Mining Co.	Oceanic mine	Arivaca
O'dell & Mears	Papago Chief mine	Baboquivari
Ohio Arizona Copper Company	Silver Hill mine group	Waterman
Old Gold Mining Co.	Allison mine	Baboquivari
Old Hickory Copper Co.	Jackson mine group	Old Baldy
Old Pueblo Mining & Milling Co.	Old Pueblo mine	Amole
Olive Camp Mining Co.	Olivette and Annette mines	Pima
Omega Copper Co.	Omega and Omega Extension mines	Helvetia-Rosemont
Ore Metal & Engineering Corporation	Las Guijas mine group	Arivaca
Oreona Mining Co.	Ajax; Amado mine groups	Arivaca
Ortega	Victoria mine	Montezuma

Table 3, Cont.

NAME	PROPERTY	DISTRICT
Otey & Forney	St. Louis mine	Greaterville
Owens	Bulldozer mine	Helvetia-Rosemont
Oxide Copper Company	Oxide mine	Silver Bell
Francisco Padres	Picacho mine	Cababi
Pallanes	Buckhorn mine	Greaterville
Paly & Anderson	High Hill mine	Pima
Papago Chief Mines	Papago Chief mine	Baboquivari
Papago Copper Company	Columbia mine group	Cababi
Papago Mining Co.	Papago mine	Aqua Dulce
Papago Queen Mining Co.	Papago Queen mine	Amole
Parber	Jackson mine group	Old Baldy
Paymaster Consolidated Mining Co.	Paymaster mine group	Pima
Paymaster Mining Company	Paymaster mine group	Pima
Paymaster Silver & Lead Co.	Paymaster mine group	Pima
Pellegrin	Old Mission; Pellegrin mines	Amole
Pemberton	Lone Valley mine group; Silver Helmet mine	Pima
Pettijohn & Kennedy	Black Diamond group	Cimarron Mts.
Phelps Dodge Corporation	Conglomerate mine	Greaterville
	Geesman; Leatherwood mine groups	Old Hat
Picacho Mines, Inc.	Cunquian; Old Timer mines	Cababi
Picacho Mining Co	Picacho mine	Cababi
Pidgett	Comobabi and Crusader mines	Cababi
Pike	Esperanza mine group	Pima
Pima County Mining & Smelting Co.	Mammoth mine	Silver Bell
Pima Mining Co.	Alpha; Daisy mines; Pima open pit mine	Pima
Pioneer Smelting Co.	Gould mine	Amole
	Plumed Knight mine group	Pima
Plumed Knight Leasing Co.	Plumed Knight mine group	Pima
Pontotoc Copper Company	Pontotoc mine	Catalina
Powers	Sweet Bye and Bye mine	Helvetia-Rosemont

Producer Mining & Smelting Co.	Brownell mine	Quijotoa
Prosperity Smelting & Mining Co.	Prosperity mine group	Pima
Pumice Corporation of Arizona	San Antonio mine	Ajo
Purcell	Sunshine & Sunrise mines	Papago
Quebec Consolidated Mining Co.	Quebec mine	Greaterville
Rainey	Bulldozer mine	Helvetia-Rosemont
Ramsdall	Daylight-Narragansett mines	Helvetia-Rosemont
	Pontotoc mine	Catalina
Ramsdell Mines Co.	Sunshine and Sunrise mines	Papago
Ramsey	Golden Gate mine group	Helvetia-Rosemont
Randolph & Huntington	Roadside mine	Coyote
Redhead	Picacho mine	Cababi
Reilly Mines Co.	Old Yuma mine	Amole
Rendall Ore Reduction Co.	Ajo Consolidated mine	Ajo
Rescue Copper Co.	Ajo Consolidated; New Cornelia (Ajo) mines	Ajo
Rhads & Holmes	Silver Giant mine	Cababi
Rich Hill Mining Co.	Rich Hill mine group	Pima
Riddle	Gold King mine	Baboquivari
Roberts	Mary G mine	Cerro Colorado
Robinson	Emmett and Elgin mine	Baboquivari
Rogers	Little Mary mine	Cababi
Rosemont Copper Co.	King-Exile mine group; Mohawk; Old Pap; Old Put; Oregon Copper, Chicago, and Coconino; Peach mines	Helvetia-Rosemont
Rosemont Development Co.	King -Exile mine group; Mohawk; Oregon Copper, Chicago, and Coconino; Peach mines	
Rosemont Mines, Inc.	Omega and Omega Extension mines	Helvetia-Rosemont
Rowcroft	M. C. M. mine group	Arivaca
Rudolph	Old Timer mine	Cababi
Rutledge	Silver Crown mine	Arivaca
Saginaw Mining Co.	Ivy May; Palo Verde; Papago Queen; Saginaw mines	Amole
St Louis Copper Co.	Ajo Consolidated; New Cornelia (Ajo) mines	Ajo
St. Louis Mines, Inc.	St. Louis mine	Greaterville

Table 3, Cont.

NAME	PROPERTY	DISTRICT
St. Louis Smelting & Refining Co.	Forty-nine mine	Empire
Sands	Lucky Strike mine	Gunsight
Sanford	Leatherwood mine group	Old Hat
San Luis Mining Co.	Oceanic mine	Arivaca
San Antonio Mine Co.	San Antonio mine	Ajo
Santa Rita Mining Co., Limestone Division	Santa Rita limestone quarry	Helvetia-Rosemont
Santa Rita Mining Co.	Copper World mine	Helvetia-Rosemont
Santa Rita Water & Mining Co.	Greaterville placer deposits	Greaterville
San Xavier Extension Mining Co.	San Xavier Extension mine	Pima
San Xavier Mining & Smelting Co.	San Xavier mine	Pima
Schley	Forty-nine; Total Wreck mines	Empire
	Green Monument mine	Helvetia-Rosemont
Schley & Dement	California mine	Empire
Schwartz	Good Enough mine group	Arivaca
Scott	Mohawk mine	Helvetia-Rosemont
Scott & Hyde	Peach mine	Helvetia-Rosemont
Selim Franklin	South San Xavier mine group	Pima
Serasio	Lone Valley mine group	Pima
Shafer Mining & Milling Co.	Sunshine and Sunrise mines	Papago
Shanklin	Hartman-Homestake mines	Old Hat
Shannon Mines, Inc.	Giant mine	Baboquivari
Sherwood Copper Co.	Sherwood mine	Cababi
Siebert	Berkley mine	Baboquivari
Sierra Mining & Ranching Co.	Tip Top mine group	Helvetia-Rosemont
Sierrita Mining & Ranching Co.	Cowboy; Keystone mines	Pima
Silver Bell Mining Company	Mammoth mine	Silver Bell
Silver Colorado Mining Corporation of Am.	New Colorado mine	Cerro Colorado
Silver Hill Consolidated Copper Co.	Silver Hill mine group	Waterman
Silver Hill Mines Co.	Silver Hill mine group	Waterman
Silver Queen Consolidated Mining Co.	Silver Queen mine	Cababi

Silverta Mining & Milling Co.	Lincoln mine group	Papago
Simmons	Oceanic mine	Arivaca
Snyder Mining & Milling Co.	Conglomerate mine	Greaterville
Snyder	Cerro Colorado mine	Cerro Colorado
	New Years Eve mine	Pima
	Silver Hill mine group	Waterman
Sonora Exploration & Mining Co.	Cerro Colorado mine	Cerro Colorado
Soto	Buena Vista; Good Enough mine groups	Arivaca
Southern Arizona Mining Co.	Pickwick mine	Helvetia-Rosemont
South San Xavier Copper Co.	South San Xavier mine group	Pima
Southwestern Ore Corp.	Las Guijas mine group	Arivaca
Southwest Metal Mines, Inc.	Ivy May mine	Amole
Sowles	Mildren mine group	Cababi
Sparks	Surprise mine	Gunsight
Standard Tungsten Corp.	Yellow Star mine	Baboquivari
	Taylor X claims	Old Hat
Steinfeld	Cerro Colorado mine	Cerro Colorado
Steinfeld & Co.	Daylight-Narragansett mines; Eclipse mine group	Helvetia-Rosemont
Stephens-Harford Mines, Inc.	Morgan mine group	Quijotoa
Stepp Bros.	Little Mary mine	Cababi
Stetson Co.	Greaterville placer deposits	Greaterville
Stockwell & Cummings	Easter mine group	Arivaca
Stratton Consolidated Copper Co.	Stratton mine	Old Hat
Stratton Copper Co.	Stratton mine	Old Hat
Strong & Harris	Papago Queen mine	Amole
Struckmeyer, Young, Price & Dorsey	Manganese King group	Cimarron Mts.
Sullivan	Copper Mountain mine	Empire
Sullivan	Lilly, Saguaro, and Empire mines	Gunsight
Sullivan & Pantano	Gopher mine	Empire
Sun-Gold Mining Co.	Sun Gold mine	Cababi
Swastika Copper & Silver Mining Co.	Rich Hill mine group	Pima
Swastika Mines Co.	Rich Hill mine group	Pima
Sweetwater Mining Co.	Isabel mine	Amole

Table 3, Cont.

NAME	PROPERTY	DISTRICT
Taggert & Drunzer	Blue Jay-Good Friday mines	Helvetia-Rosemont
Talcott	Black Dragon mine group	Baboquivari
Taylor	Comobabi and Crusader mines	Cababi
	Taylor X claims	Old Hat
	Senator Morgan mine group	Pima
Taylor & Gorman	San Juan mine	Baboquivari
Texas-Arizona Copper Co.	Pontotoc mine	Catalina
The Richard M. & M. Co.	Buena Vista mine group	Arivaca
Thornel Co., Inc.	Arizona No. 3 mine	Pima
Thornton	Jezebel mine	Baboquivari
Tideland Oil Company	Big Banana mine	Baboquivari
Tip Top Copper Co.	Bulldozer mine; Tip Top mine group	Helvetia-Rosemont
Tip Top Mining Co.	Tip Top mine group	Helvetia-Rosemont
Tombstone Mining Co. of Arizona	Allison mine	Baboquivari
Tom Reed Gold Mines	Allison mine	Baboquivari
Tong	Jerome #2; State of Maine mines	Empire
Torres	Total Wreck mine	Empire
Torrey & Roper	Silver Crown mine	Arivaca
Tucson Arizona Copper Co.	Palo Verde; Papago Queen; Saginaw mines	Amole
Tucson Consolidated Copper Co.	Old Pueblo mine	Amole
Tucson Ore Milling Co.	Old Yuma mine	Amole
	Hilton mine	Empire
Tucson Transfer Co.	California mine	Empire
Tuete	Dimple claim group	Helvetia-Rosemont
Tungsten Alloys Corp.	Las Guijas mine group	Arivaca
Tungsten Mining Corp.	Las Guijas mine group	Arivaca
Turner	Mary G mine	Cerro Colorado
Turners	Sunset Limited mine group	Gunsight
Twin Buttes Mining & Smelting Co.	Contention; Copper Butte; Copper Glance; Copper King; Copper Queen mines; Senator Morgan mine group	Pima

Udall	Black Princess; Cerro Colorado mines	Cerro Colorado
U. S. Magnetite Co.	Chief mine	Empire
Vail	Total Wreck mine	Empire
Ventana Mining Co.	Ventana mine group	Baboquivari
Verde Queen Mining Co.	Verde Queen mine	Empire
Verduzco	Papago Chief mine	Baboquivari
Vinetz	Tip Top mine group	Helvetia-Rosemont
Vogel Mining Co.	Amado mine group	Arivaca
Vulcan Consolidated Mining Co.	Vulcan mine group	Pima
Vulcan Copper & Zinc Mining Co.	Vulcan mine group	Pima
Vulcan Mining Co.	Vulcan mine group	Pima
Walsh	Arivaca King; Backbone mines	Arivaca
Waterman Mountains Mining Co.	Indiana-Arizona mine group	Waterman
Wayne Developing Co.	Mildren mine group	Cababi
Weideman	Columbia mine group	Cababi
Weldon Gold & Copper Co.	Weldon mine	Quijotoa
Wells	Corregedor mine	Old Hat
Westbrook & DeRhodes	Oro Grande mine	Cimarron Mts.
Western American Mines Co.	El Tiro mine	Silver Bell
Western Minerals Corp.	Indiana-Arizona mine group	Waterman
Whitcomb & Associates	Las Guijas mine group	Arivaça
Whitcomb Mining & Milling Co.	Whitcomb mine	Pima
Whitney	Vindicator mine group	Arivaca
Williams	Border mine group	Arivaca
	Jaeger mine	Cababi
	El Tiro mine	Silver Bell
Wilson	Lost Boy mine	Helvetia-Rosemont
	High Hill mine	Pima
Wilson Mining, Inc.	Daylight-Narragansett mines	Helvetia-Rosemont
Withers	Little Mary mine	Cababi
Workman	Mary G mine	Cerro Colorado
Worsley	Mary G mine	Cerro Colorado
Wright Mines & Development Co.	Gold King mine	Baboquivari
Yellow Bird Silver Mines	Lincoln mine group	Papago
Zappia	Good Enough mine group	Arivaca
Zeckendorf	Omega and Omega Extension mines	Helvetia-Rosemont

TABLE 4
INDEX OF MINING PROPERTY

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
I. Agua Dulce District (Agua Dulce Mtns., O'Neil Hills)	15S-16S	9W-10W	----	Au, Ag-, Cu-	Weak and spotty copper silver mineralization, sometimes with gold values enriched at the surface, along fissures or basic dikes cutting Mesozoic granite and gneiss.	Several small, shallow prospect pits and shafts. Very minor production. Most work done was at Papago mine, in protracted T15S, R10W, NE ¼ sec. 26.	Bryan, 1925, p. 194 ABM file data
II. Ajo District (Little Ajo Mtns. and Chico Shunie Hills)	12S-13S	6W-7W	----	Cu, Ag, Au, silica, feldspar, mica (Mo, Zn)	1. Copper, silver, and gold mineralization on fracture planes and disseminated in brecciated Laramide intrusive and adjacent Cretaceous volcanics. Some local high grade, narrow, irregular vein-like deposits in volcanics and spotty occurrences near fault zones in volcanics and intrusive. Erratic secondary copper mineralization in fanglomerate. 2. Pegmatite veins and masses in Mesozoic granitic intrusive. 3. Spotty, irregular gold placers.	Predominantly open pit mining. Small irregular production of high grade oxidized copper ore from about 1854 to 1917 and almost continuously thereafter from open pit operations. Total production thru 1972 would amount to some 350 million tons of ore containing about 2.8 million tons of copper, 19 million ounces of silver and 1.55 million ounces of gold. Considerable silica flux and some feldspar and scrap mica also produced.	Lakes, 1900 Joralemon, 1914, 1915 Bryan, 1925 Gilluly, 1937, 1938, 1942, 1946 Romslo & Robinson, 1952 ABM file data
1. Ajo Consolidated mine (Arizona Copper Mining & Trading Co., St. Louis Copper Co., Rescue Copper Co., Rendall Ore Reduction Co., Ajo Consolidated Copper Co., New Cornelia Copper Co., Calumet & Arizona Copper Co., New Cornelia Div., Phelps Dodge Corp.)	12S	6W	W ½ 26	Cu, Ag, Au	Spotty and irregular vein-like bodies of high grade copper carbonates, chalcocite, and copper sulfides along fractures in Cretaceous volcanics. Disseminated copper mineralization in and along faulted tongue of Laramide quartz monzonite intrusive.	Early selective surface and underground mining of some 10,000 tons of high grade copper ore prior to 1917 when taken over and included thereafter in New Cornelia open pit operation.	Joralemon, 1914 Gilluly, 1946 ABM file data
2. Ajo Cornelia mine (Ajo Cornelia Copper Co., Copper Ridge Mng. Co.)	12S	6W	SW ¼ 26 SE ¼ 27	Cu, Ag, Au-	Lenticular deposit of erratic copper carbonates and minor chalcocite in steeply dipping Tertiary fanglomerate with interfingering volcanics.	Shallow shaft workings. About 40 tons of high grade copper ore produced in 1917.	Mines and Copper Handbook, 1918 Mines Handbook, 1922 ABM file data
3. Cardigan mine (Cardigan Copper Co., Childs, et al)	12S	6W	SW ¼ 28	Cu, Ag, Au-	Narrow, irregular veins containing quartz, specularite, epidote, barite, ankerite, and spotty copper oxides, carbonates and sulfides in altered Cretaceous volcanics near a major fault zone.	Shallow shaft and surface operations. Some 1,000 tons of hand picked copper ore produced intermittently from 1917-1926, averaging about 4% Cu and 10 oz.	Mines and Copper Handbook, 1920 Gilluly, 1946 ABM file data

4. New Cornelia (Ajo) mine (Arizona Copper Mining & Trading Co., St. Louis Copper Co., Rescue Copper Co., Cornelia Copper Co., New Cornelia Copper Co., Calumet & Arizona Copper Co., New Cornelia Div., Phelps Dodge Corp.)	12S	6W	SE ¼ 22 SW ¼ 23 NW ¼ 26 NE ¼ 27	Cu, Ag, Au (Mo, Zn)	Veinlets, seams, and disseminations of chalcopyrite, bornite, and minor pyrite, oxidized in upper part to carbonates, silicates, and minor chalcocite, deposited in fractured and faulted, altered Laramide quartz monzonite and bordering quartz diorite facies and often in close association with irregular pegmatite zones in the intrusive. Mineralization extends into bordering intruded and altered Cretaceous volcanics. Minor spotty molybdenite and sphalerite.	Open pit operation. Total production from 1917 through 1972 amounts to some 350 million tons averaging about 0.8% Cu, 0.05 oz. Ag/T, and 0.004 oz. Au/T. Higher grade ore in early years and greater tonnage of lower grade in more recent years.	Joralemon, 1914 DeKalb, 1918 Greenway, 1920 Allen, A. W., 1922 Richard, 1923, 1925 Ingham & Barr, 1932 Stewart, L. A., 1933 Gilluly, 1937, 1938, 1942, 1946, 1952 Hardwick, 1960 Dixon, 1966 May, 1968 ABM file data
5. San Antonio mine (Sunshine; Pumice Corp. of Arizona, Ballestreras, San Antonio Mine Co.)	13S	7W	No. Cen. 2 E Cen. 11 Protracted	Silica flux, feldspar, scrap mica	Irregular pegmatite dikes and masses in Mesozoic granitic intrusive.	Open pits. Small lots of scrap mica and feldspar recovered. Several tens of thousand tons of silica flux shipped to smelter.	Wilson & Roseveare, 1949 USBM Min. Yearbook, 1963 Keith, 1969, p. 344-345, 347, 415-416 Moore, 1969, p. 401, 402 ABM file data
III. Amole District (Tucson Mtns.)	12S-15S	11E-13E		Cu, Pb, Zn, Ag, Au, Mo (V), Limestone, silica flux	1. Scattered, usually small, irregular, quartz-fissure veins containing spotty base metal sulfides with gold and silver values. Also relatively small contact metamorphic and replacement deposits of partly oxidized base metal sulfides, locally containing molybdenum and vanadium minerals. Veins cut complex series of altered and deformed Cretaceous volcanics while contact metamorphic and replacement deposits are in limestone lenses in the volcanics or in erratic blocks of Paleozoic (?) limestone engulfed in later volcanics or intrusives and usually associated with igneous dikes. 2. Weakly disseminated copper mineralization in fractured and altered Laramide intrusive and bordering volcanics. 3. Folded and faulted Paleozoic limestones. 4. Quartz rich zones in volcanics containing weak and spotty copper mineralization.	Mostly relatively shallow shafts, tunnels, and open cuts. One major limestone quarry for cement manufacture. Sporadic production since prior to 1900 of some 34 thousand tons of ore containing about 260 tons Cu, 335 tons Pb, 187 tons Zn, 27,000 oz. Ag, 1,000 oz. Au, and 17 tons of Mo concentrates. Over 14 million tons of limestone used for cement manufacture. Some silica smelter flux produced.	Jenkins & Wilson, 1920 Allen, M. A., 1920 Brown, 1939 Coulson, 1950 Britt, 1955 Bennett, 1957 Whitney, 1957 Colby, 1958 Imswiler, 1959 Kinnison, 1958, 1959 Greenstein, 1961 Bickerman, 1962 Mayo, 1963, 1968 Mayo & McCullough, 1964 McCoy, 1964 Horton, 1965 Knight, 1967 ABM file data
1. Arizona Consolidated mine (Uncle Sam, Josephine, etc.; Arizona Consolidated Mng. Co., Arizona Copper Mng. Co.)	13S	12E	No. Cen. 7 W ½ 8 NW ¼ 17	Cu, Ag, Au-	Spotty copper carbonates, oxides, silicates, and sulfides along strongly altered shear zones and fractures in chloritized and silicified Cretaceous andesite and in blocks of dolomite cut by porphyry dikes.	Relatively shallow shafts and tunnels. Intermittent production in early 1900's of some 1,100 tons of ore averaging about 0.7% Cu, 2.6 oz. Au/T and a trace of gold. Probably shipped as smelter flux.	Copper Handbook, 1905, 1909 USGS Min. Res., 1905 Jenkins & Wilson, p. 6, Pl. I ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
2. Battle Axe mine (Catalina Mng. Co., McFarland & Hullinger)	14S	13E	SE ¼ 18 NE ¼ 19	Silica flux, Cu-, Ag-, Au-	Closely spaced, irregular quartz veins along intense shear zones, containing weak and spotty copper oxides and silicates, in altered Cretaceous andesite flows.	Open cut workings. Over 14,000 tons of smelter flux containing a few tenth's of a percent Cu and traces of Ag and Au shipped out in 1969 and 1970.	ABM file data
3. Bee Hive mine (Arizona-Tonopah Mng. & Mllg. Co., Buckeye State Mng. & Mllg. Co.)	15S	13E	SW ¼ 5 NE ¼ 7	Cu, Pb, Ag, Au-	1. Weakly disseminated pyrite and chalcopyrite in unaltered Cretaceous rhyolite. 2. Spotty chrysocolla, malachite, and partly oxidized galena with quartz in a fracture zone in silicified Cretaceous arkose.	Relatively shallow shafts, adits, and pits. The small tonnage produced in 1925 and 1929 averaged about 4.5% Cu, 1.5% Pb and 12 oz. Ag.	Allen, M. A., 1920 Mines Handbook, 1922, 1925, 1926 Kinnison, 1958, p. 96-98, 110-111 ABM file data
4. Columbia mine (Columbia Copper Co., Mile Wide Copper Co., L. B. D. M. Mng. Co.)	13S	12E	SE ¼ 30	Cu, Ag	Copper carbonates and sulfides in irregular, small, replacement bodies along fracture zones in limestone lenses in Cretaceous arkose close to Laramide intrusive dike.	Shallow workings. In 1954 some 130 tons of ore produced, averaging about 2% Cu and 0.4 oz. Ag/T.	ABM file data
5. Copper Bell mine (Copper King group; Mile Wide Copper Co., Beard & Allen)	13S	12E	SE ¼ 30	Cu, Ag, Au-	Spotty copper carbonates and sulfides in irregular, small replacement bodies along fracture zones in limestone lenses in Cretaceous arkose close to a Laramide intrusive dike.	360 foot shaft and underground workings. Worked in 1937 and 1956, producing some 90 tons of ore averaging about 4.6% Cu, 1.1 oz. Ag/T and a trace of Au.	ABM file data
6. Copper King mine (Copper King group; Mile Wide Copper Co., Cambell & Vreeland)	13S	12E	No. Cen. 31	Cu, Ag, Au-	Copper carbonates, chalcopyrite, and pyrite with amphibole and garnet in small replacement bodies, controlled largely by fracture intersections, in limestone lenses in Cretaceous arkose. Much faulting and fracturing and intrusion by Laramide quartz monzonite dikes.	400 foot incline shaft and underground workings. Active mainly in 1917-1918 and in 1943. Total production was some 1,400 tons of ore averaging about 6% Cu, 0.5 oz. Ag/T and a trace of Au.	Mines and Copper Handbook, 1918 Jenkins & Wilson, 1920 ABM file data
7. Gould mine (Gould Copper Mng. Co., Pioneer Smltg. Co.)	13S	12E	W. Cen. 31	Cu, Ag	Copper sulfides, pyrite and minor copper carbonates with quartz, epidote, and garnet in contact metamorphosed limestone lenses in Cretaceous arkose where cut by a fissure zone and intruded by Laramide quartz latite dikes.	350 foot shaft, tunnels, and underground workings. Produced intermittently from 1907 to 1912 and in 1940. Total production was some 1,500 tons of ore averaging about 2% Cu, and 0.1 oz. Ag/T.	Copper Handbook, 1907, 1908 Jenkins & Wilson, 1920, p. 6, 16, Pl. I ABM file data
8. Isabel mine (Bonanza Park, Sweetwater; Bonanza Park Mng. Co., Sweetwater Mng. Co.)	13S	12E	SW ¼ 28 NW ¼ 33	Pb, Cu, Ag	Partly oxidized lead and copper sulfides in irregular bodies in metamorphosed and distorted, exotic Paleozoic (?) limestone blocks in sheared and fractured Cretaceous volcanics. Local Laramide dike intrusions.	Shallow shafts and open cuts. Worked in 1919 and 1962. Total production was some 170 tons of ore averaging about 3% Pb, 1% Cu, and 2 oz. Ag/T.	USGS Min. Res. 1919 Jenkins & Wilson, 1920, p. 6, 16, Pl. I ABM file data

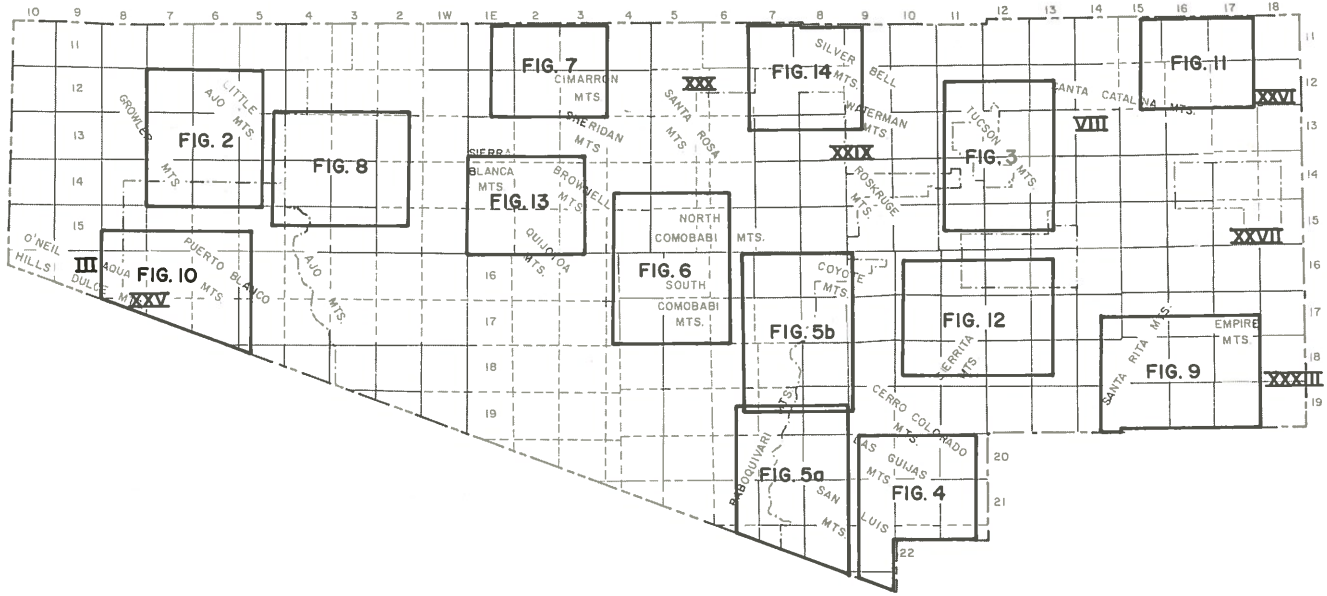
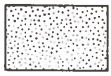
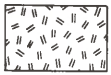


Figure 1. Index map to Mining Districts in Pima County.

EXPLANATION

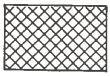


Quaternary-Tertiary alluvium (Qs, QTs, Ts)



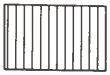
Quaternary-Tertiary volcanics (Qs, QTv, Tv)

Tertiary intrusives (Ti)

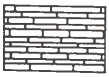


Tertiary sedimentaries and volcanics (Ts, Tsv, Tv)

Mesozoic and Laramide intrusives (Mi, Li)



Mesozoic and Laramide sedimentaries, volcanics, and metamorphics (Ms, Mv, Msv, Mm, Ls, Lv, Lsv, Lm)



Paleozoic sedimentaries (P)

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

Explanation of Geologic Symbols

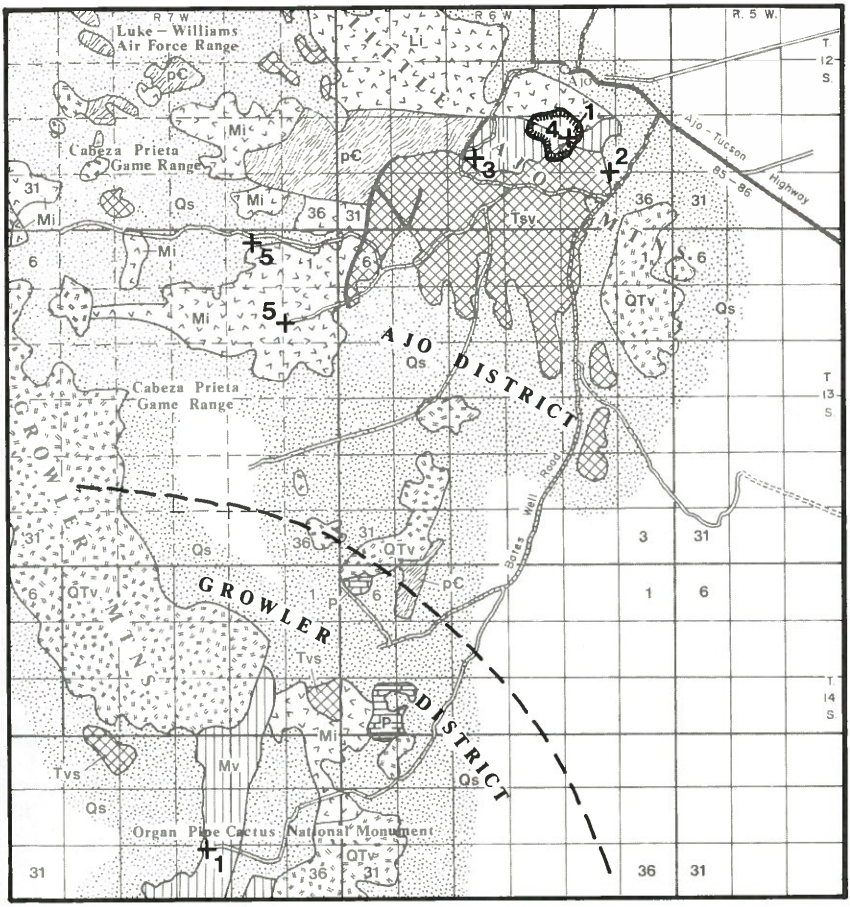


Figure 2. Ajo and Growler Districts.
(Bold numbers refer to mining properties listed in Table 4).

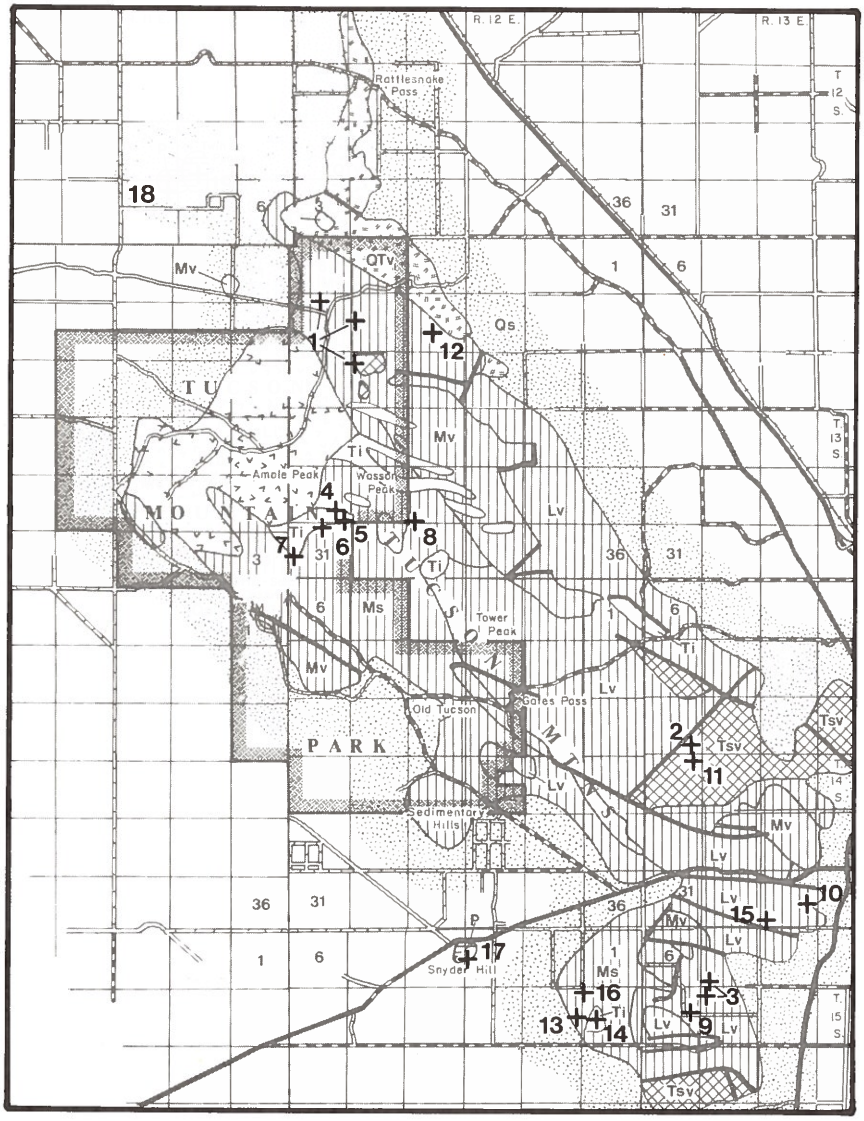


Figure 3. Amole District.
(Bold numbers refer to mining properties listed in Table 4).

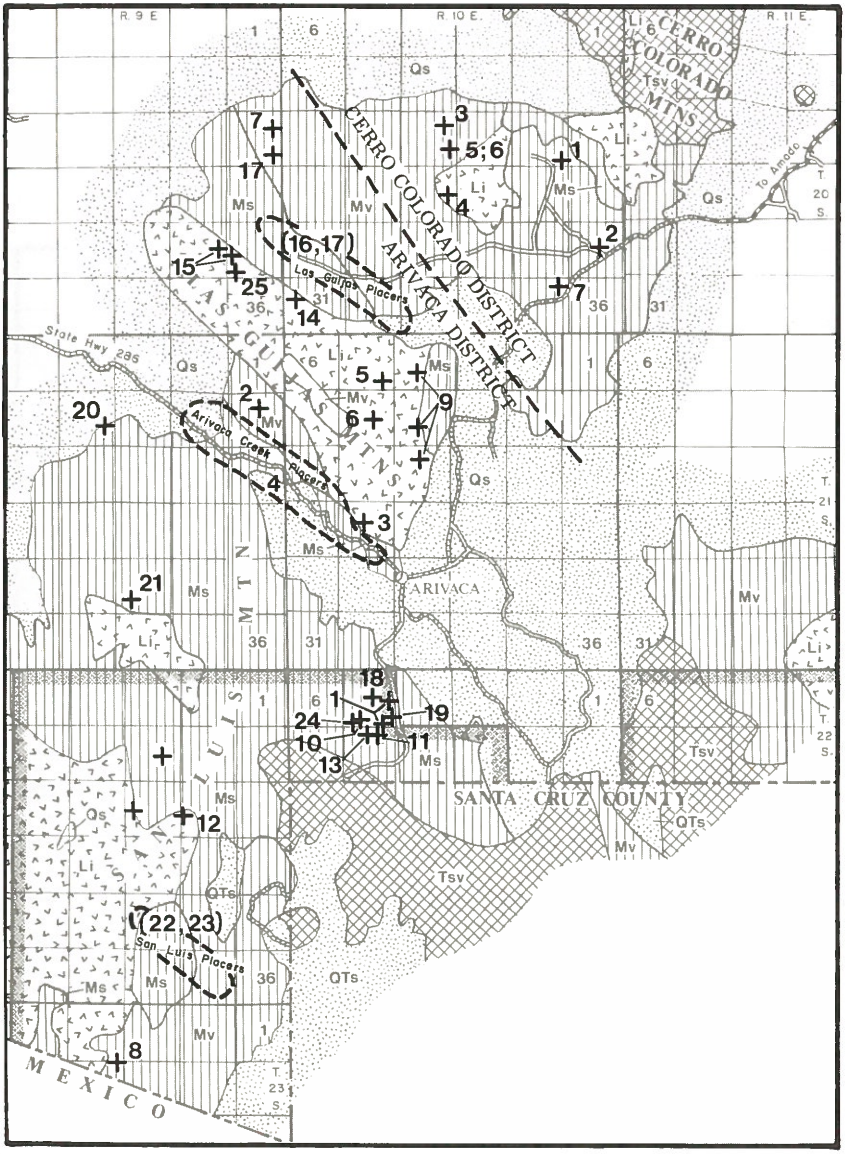


Figure 4. Arivaca and Cerro Colorado Districts. (Bold numbers refer to mining properties listed in Table 4).

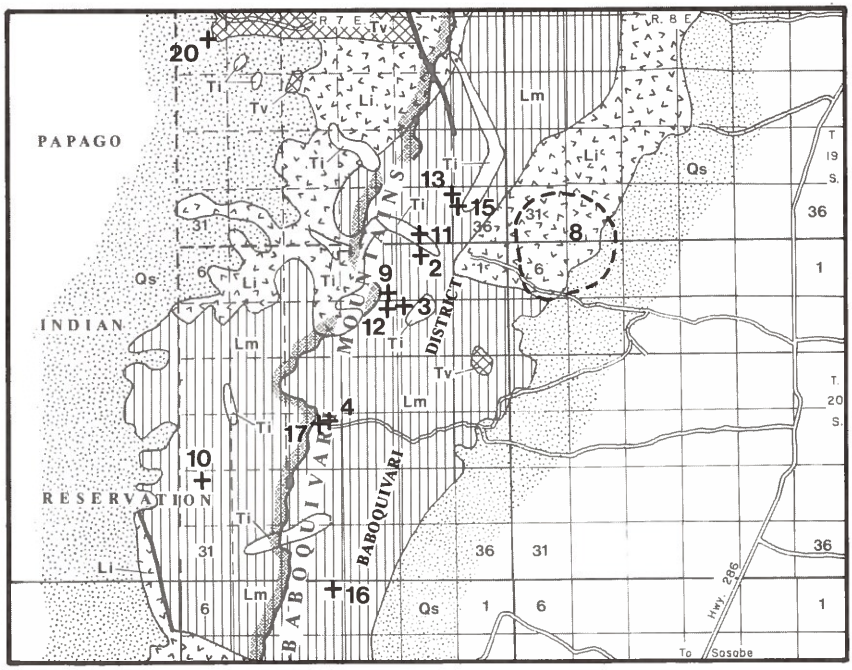


Figure 5A. Baboquivari District, South Section. (Bold numbers refer to mining properties listed in Table 4).

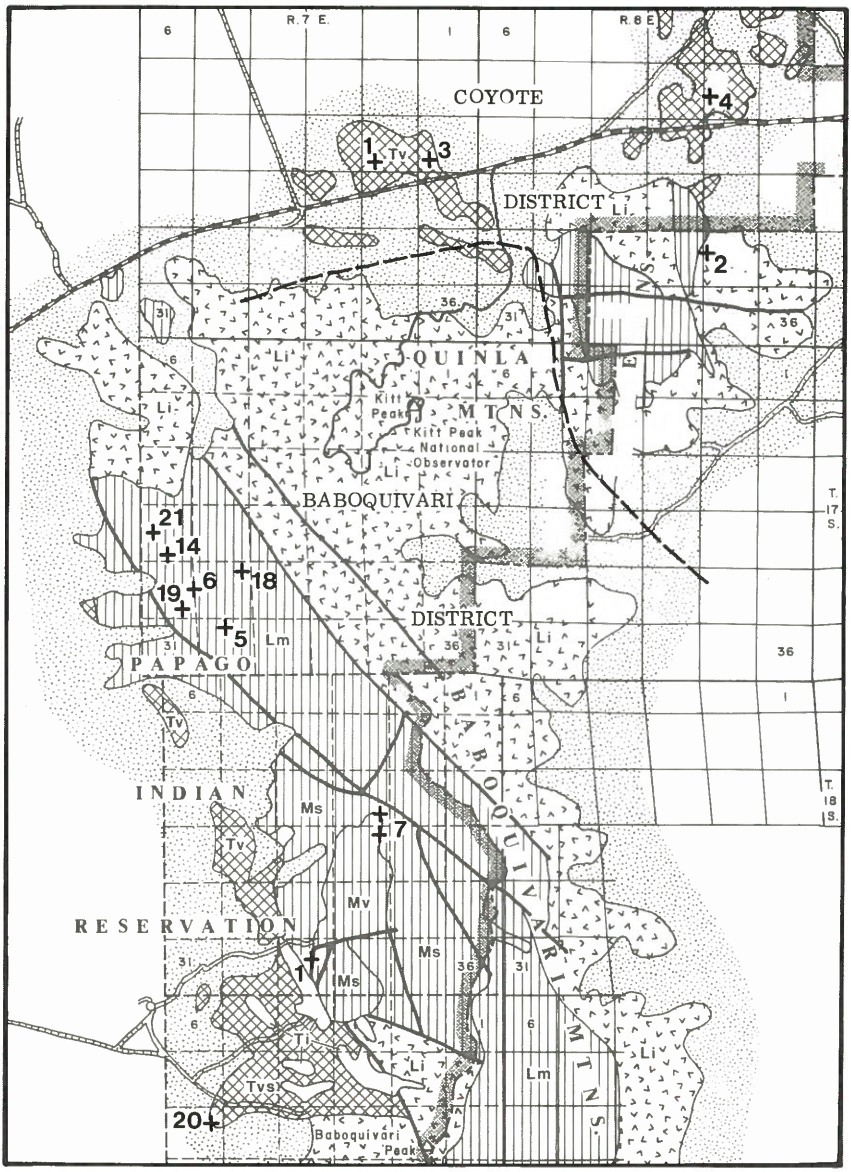


Figure 5B. Baboquivari and Coyote Districts, North Section. (Bold numbers refer to mining properties listed in Table 4).

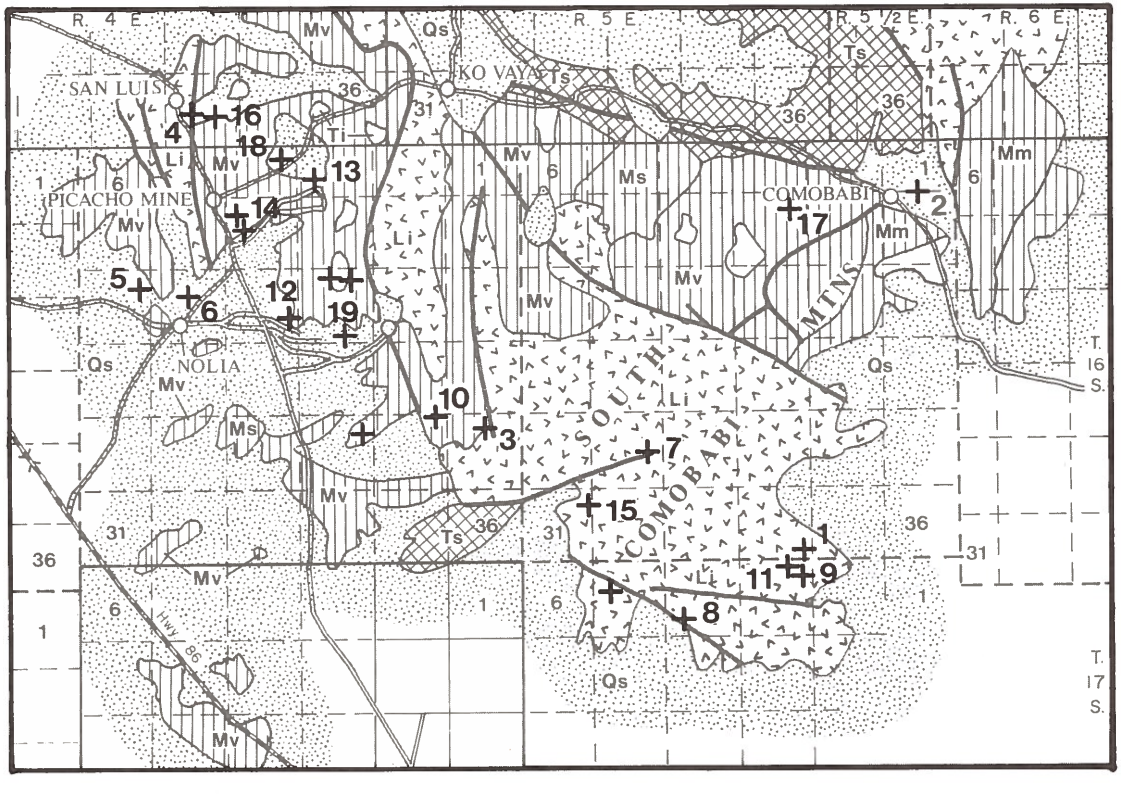


Figure 6. Cababi District.
(Bold numbers refer to mining properties listed in Table 4).

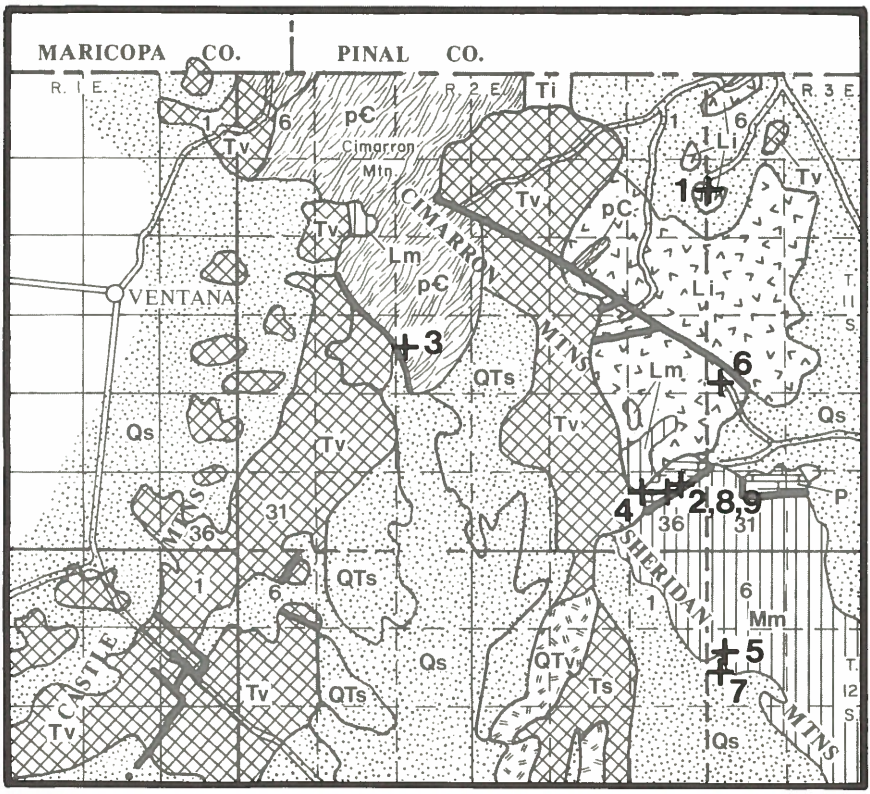


Figure 7. Cimarron Mountain District.
(Bold numbers refer to mining properties listed in Table 4).

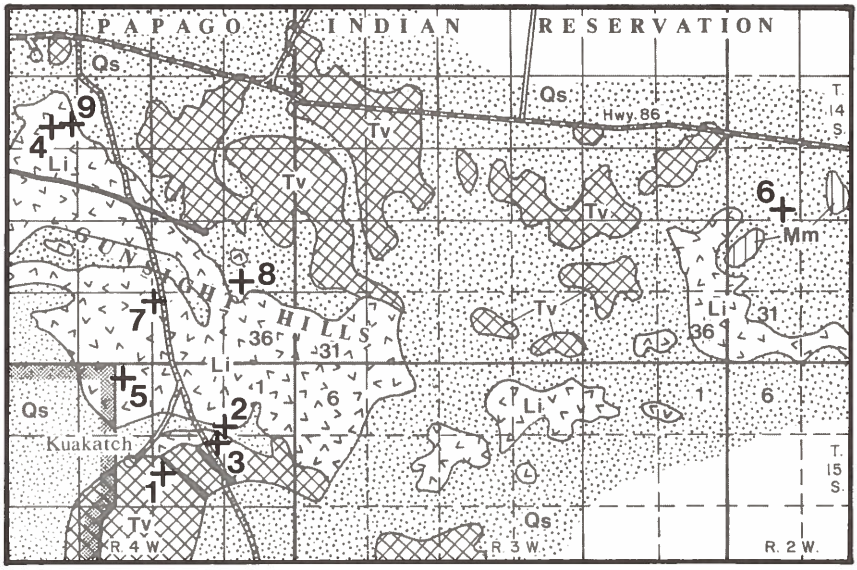


Figure 8. Gunsight District.
(Bold numbers refer to mining properties listed in Table 4).

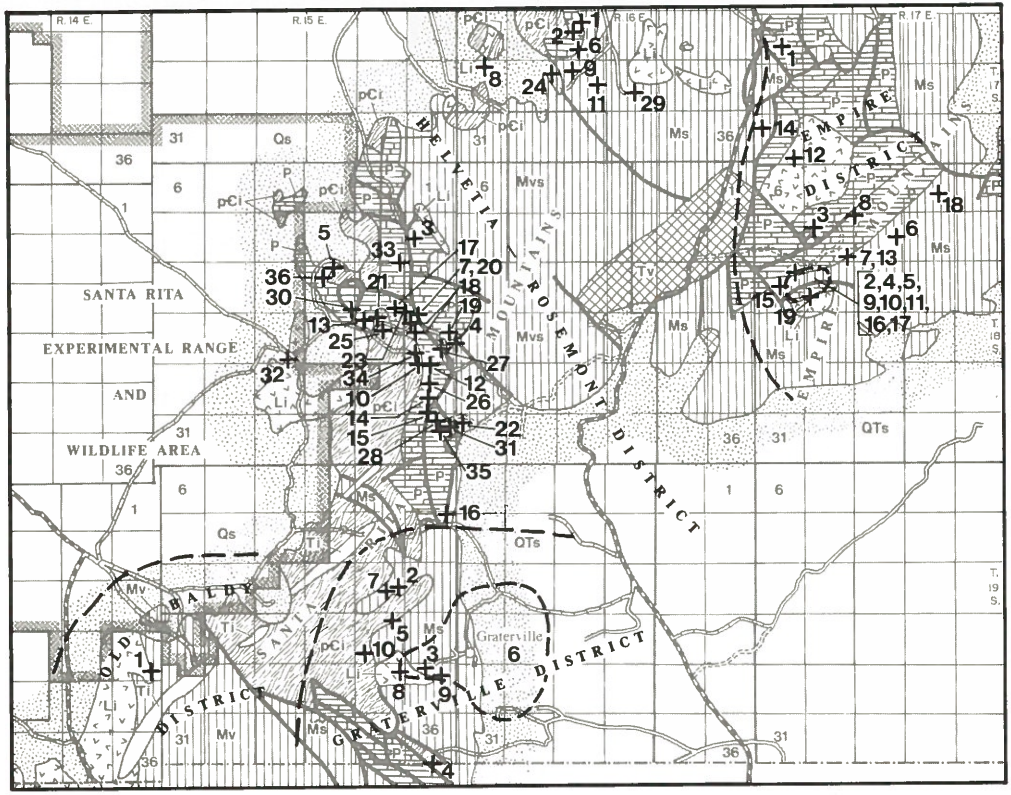


Figure 9. Helvetia-Rosemont, Empire, Greaterville, and Old Baldy Districts. (Bold numbers refer to mining properties listed in Table 4).

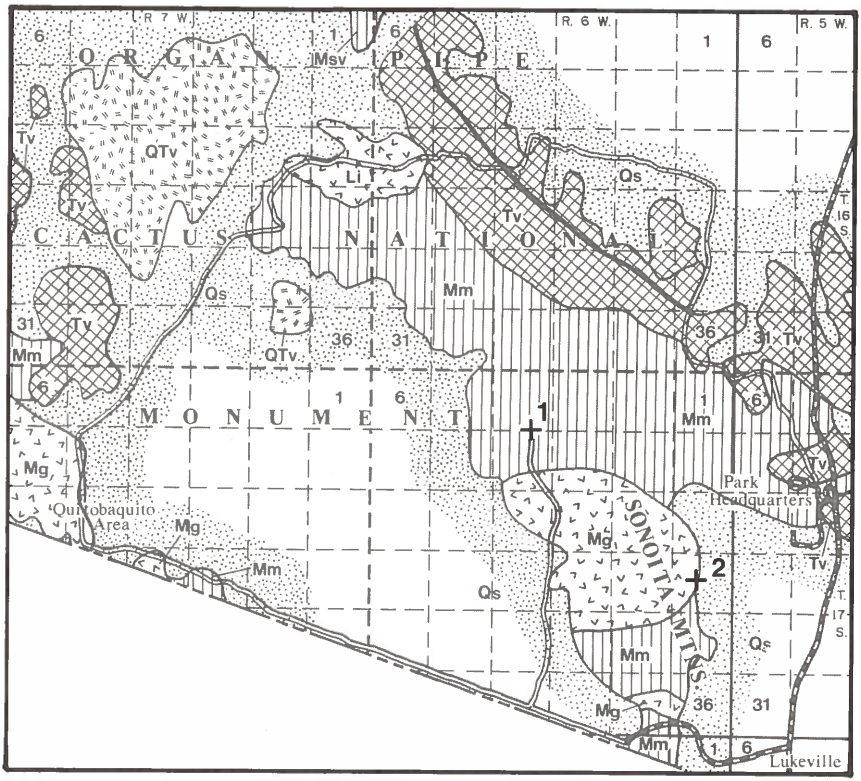


Figure 10. Montezuma District.
(Bold numbers refer to mining properties listed in Table 4).

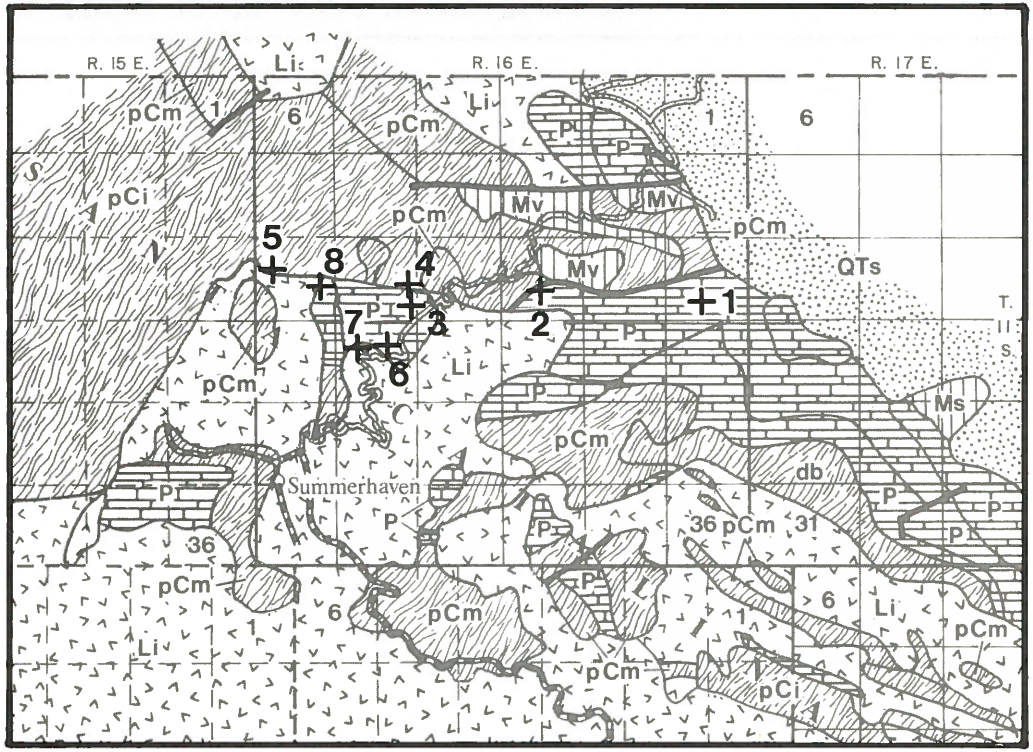


Figure 11. Oracle District.
(Bold numbers refer to mining properties listed in Table 4).

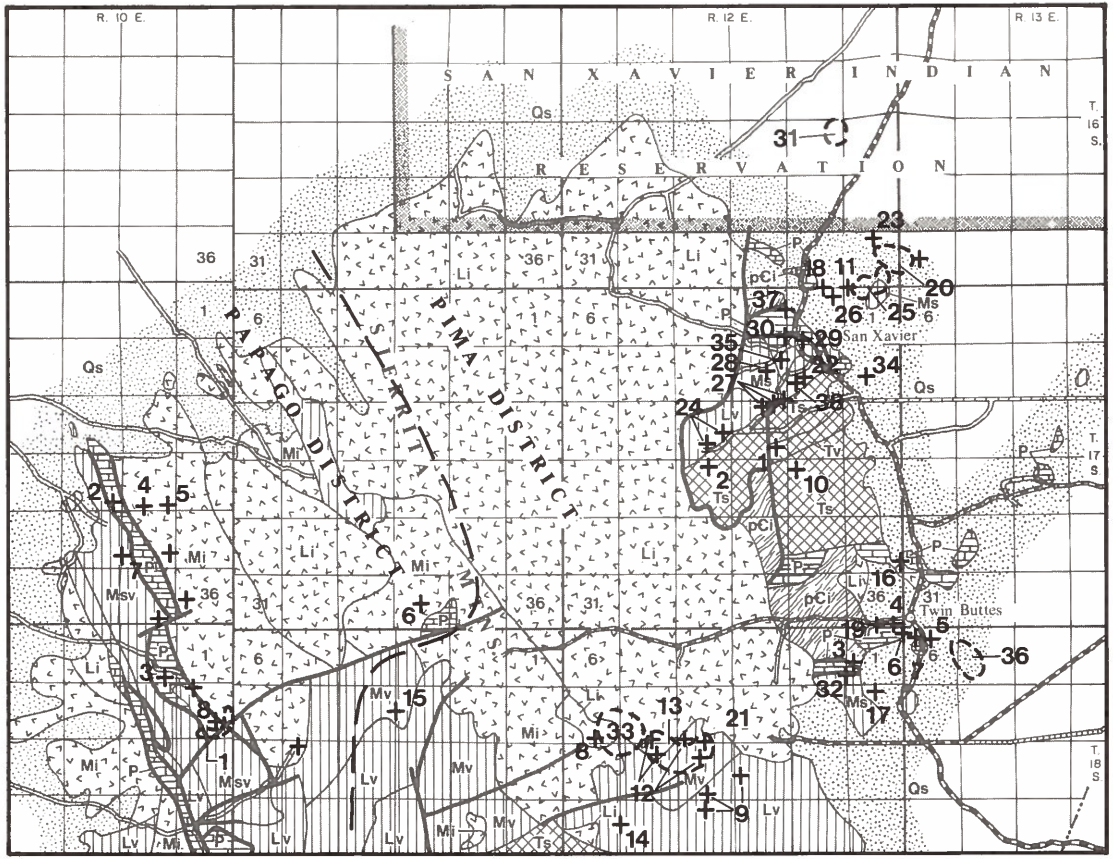


Figure 12. Pima and Papago Districts.
(Bold numbers refer to mining properties listed in Table 4).

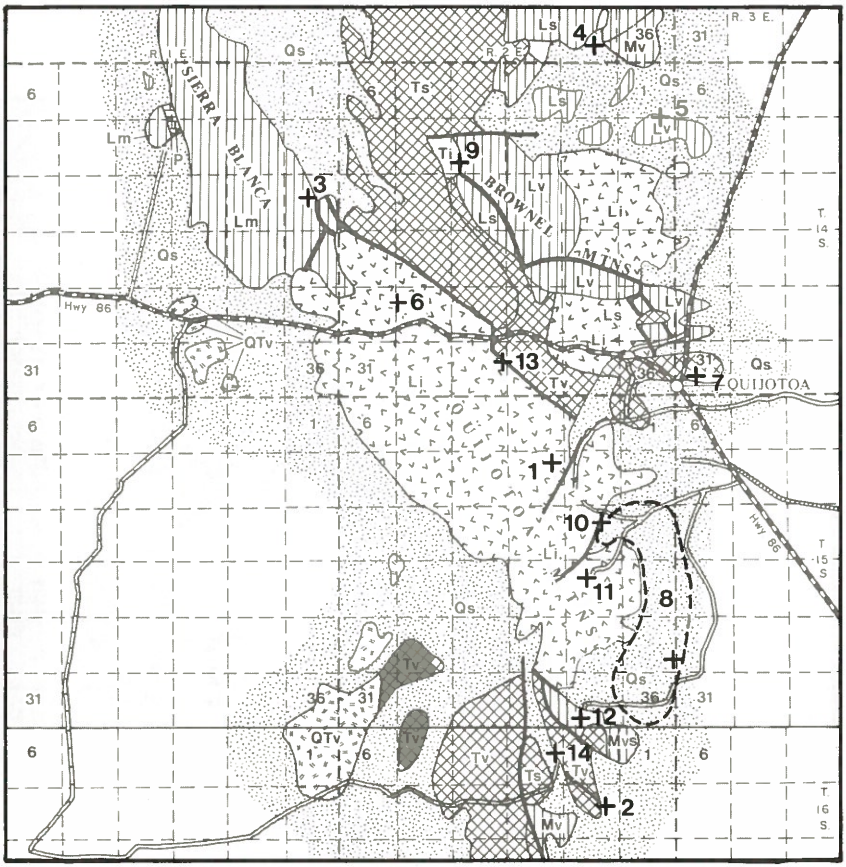


Figure 13. Quijotoa District.
(Bold numbers refer to mining properties listed in Table 4).

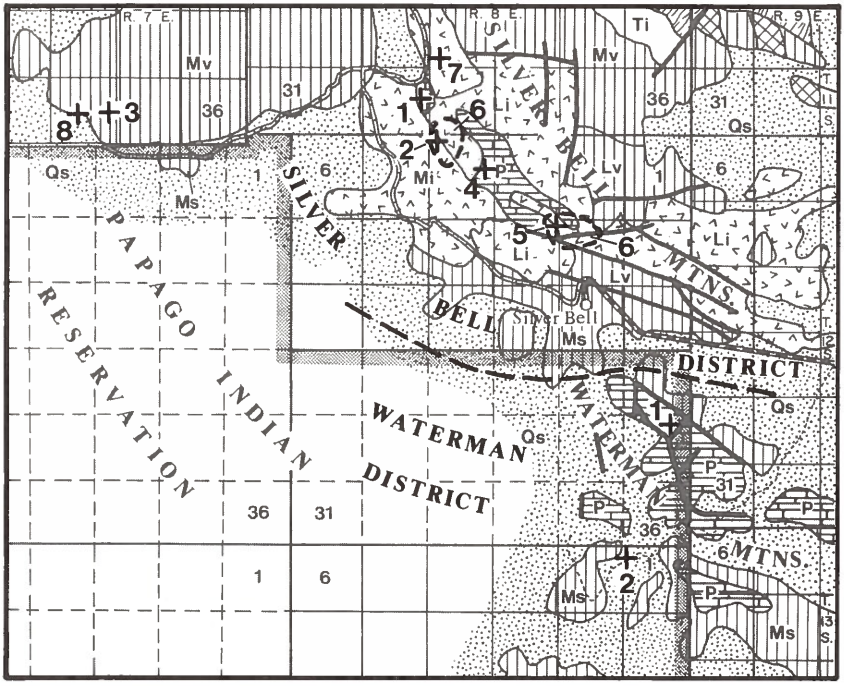


Figure 14. Silver Bell and Waterman Districts. (Bold numbers refer to mining properties listed in Table 4).

NOTES

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
9. Ivy May mine (Arizona Tucson, Santa Margarita; Saginaw Mng. Co., Hermosa Copper Co., Arizona Tucson Copper Co., Southwest Metal Mines, Inc.)	15S	13E	E. Cen. 7	Cu, Pb, Ag, Au	Partly oxidized copper and lead sulfides with pyrite in small masses and lenses associated with intersecting quartz veins cutting bleached and altered Cretaceous andesite, arkose, and rhyolite close to a Laramide granite porphyry intrusion.	750 foot shaft and underground workings. Mined first in 1890's and sporadically from 1920 to 1950. Total production estimated at 500 tons averaging 4% Cu, 0.2% Pb, 1.3 oz. Ag/T, and 0.1 oz. Au/T.	Allen, M. A., 1920, p. 22-23 Jenkins & Wilson, p. 6, Pl. I Mines Handbook, 1922 Kinnison, 1958, p. 95-97, 99, 111-112 ABM file data
10. Old Mission mine (Old Bat; Pellegrin)	14S	13E	E. Cen. 33	Cu, Ag, Pb, Au (Ba)	Copper oxides, cerusite, argentite, cerargerite, barite, hematite, and jasper in a narrow fissure vein of massive manganiferous siderite in Cretaceous rhyolite.	Adit and tunnel workings. Sporadic production in 1920-21, 1923, and 1937-1938. Total production has been some 150 tons of ore averaging about 1% Cu, 0.3% Pb, 10 oz. Ag/T, and 0.1 oz. Au/T.	Jenkins & Wilson, 1920, p. 6, Pl. I Kinnison, 1958, p. 101, 112-113 ABM file data
11. Old Pueblo mine (Quien Sabe; Old Pueblo Mng. & Mllg. Co., Tucson Consolidated Copper Co., McFarland & Hullinger)	14S	13E	NE ¼ 19	Cu, Ag, Au-	Pockets of copper silicates and chalcocite in banded, drusy, lensing quartz veins cutting slightly altered Cretaceous andesite.	517 foot shaft, tunnels and open cuts. Sporadic production in 1907-1909 and 1936 totaled some 67 tons averaging about 5% Cu, 1.2 oz. Ag/T and 0.04 oz. Au/T. In 1969-1970 production included with Battle Axe mine.	Copper Handbook, 1907, 1912-1913 Jenkins & Wilson, 1920, p. 6, Pl. I Kinnison, 1958, p. 94, 100, 103-104, 115-116 ABM file data
12. Old Yuma mine (Col. Randolph, International Ore Separation Co., Reilly Mines Co., Tucson Ore Mllg. Co.)	13S	12E	Cen. 9	Pb, Cu, Zn, Mo, Ag, Au (V)	Partly oxidized base metal sulfides with spotty wulfenite and vanadinite, and quartz and calcite gangue, in a steeply dipping, lensing, and faulted orebody along a fracture zone cutting Cretaceous andesite and associated with a Laramide porphyritic intrusive.	Shaft and underground workings. Produced sporadically from 1916 through 1947, with a total of some 5,700 tons of ore averaging about 4% Pb, 1% Cu, 0.6% Zn, 0.3% Mo, 1 oz. Ag/T and 0.1 oz. Au/T.	Jenkins & Wilson, 1920, p. 6, 16-17, Pl. I ABM file data
13. Palo Verde mine (Amole group; Saginaw Mng. Co., Tucson Arizona Copper Co.)	15S	12E	E Cen. 11	Zn, Pb, Cu, Ag, Au	Slightly oxidized sphalerite, galena, chalcopyrite and pyrite in irregular quartzose, vein-like replacement deposits in limestone lenses in Cretaceous arkose and also along the contact zone of arkose and Laramide intrusive granitic porphyry. Associated with strong fault gouge and brecciation.	Incline shaft and underground workings. Worked intermittently from 1918 through 1954. Total production amounted to some 2,300 tons of ore averaging about 13% Zn, 2.2% Pb, 0.7% Cu, 2.5 oz. Ag/T and 0.06 oz. Au/T.	Allen, M. A., 1920, p. 20-21 Kinnison, 1958, p. 95, 98-99, 101-102, 104-105, 107-109 ABM file data
14. Papago Queen mine (Saginaw Hill, Gold Hill, Amole group; Saginaw Mng. Co., Papago Queen Mng. Co., Tucson Arizona Copper Co., Strong & Harris)	15S	12E	W. Cen. 12	Cu, Ag, Au (Mo)	Disseminated cuprite and malachite with minor molybdenum oxides in quartz veins and along fractures in a weakly altered, brecciated, and mineralized Laramide (?) porphyry stock.	Tunnel and open cut. Sporadic production of copper ore from 1917 to 1934 and of smelter flux in 1956 through 1959. Total output was some 3,700 tons averaging about 1% Cu and 0.5 oz. Ag/T.	Allen, M. A., 1920, p. 21 Kinnison, 1958, p. 109-110 ABM file data

15. Pellegrin mine (Arizona, Old Padre, Starr; Pellegrin, Arizona Mission Mines Co.)	14S	13E	SW ¼ 33	Pb, Cu, Ag, Au	Spotty oxidized lead and copper mineralization along a fracture zone in Cretaceous rhyolite.	Shallow shafts, tunnels, and open pits. Worked sporadically from 1918 through 1938, producing some 71 tons averaging about 3% Pb, 2% Cu, 6 oz. Ag/T and 0.2 oz. Au/T.	Jenkins & Wilson, 1938, p. 6, Pl. I ABM file data
16. Saginaw mine (Saginaw Mng. Co., Tucson Arizona Copper Co.)	15S	12E	NE ¼ 11 NW 12	Cu-, Zn-, Pb-, Ag-, Au-	Sparse, spotty, partly oxidized, base metal sulfides along fissure zones in limestone lenses in silicified Cretaceous arkose.	Shafts, pits, and minor underground workings. Worked prior to 1900 with a possible 100 tons of low grade ore produced.	Allen, M. A., 1920, p. 20 Jenkins & Wilson, p. 6, Pl. I Tenny, 1927-1929 Kinnison, 1958, p. 93, 102, 107 ABM file data
17. Snyder Hill prospect	15S	12E	W. Cen. 3	Pb, Ag, Au	Small local replacement pocket of argentiferous galena, silver halides, and barite in Permian limestone.	Shallow pit. In 1922 produced some 15 tons of picked ore averaging about 5% Pb, 301 oz. Ag/T, and 0.01 oz. Au/T.	ABM file data
18. Twin Hill prospect	12S	11E	NE ¼ 34	Pb, Zn, Ag	Small lense of lead-zinc carbonate as replacement in Paleozoic limestone near a Laramide granitic intrusive.	Shallow workings. In 1944 some 40 tons of ore averaging about 4% Pb, 4% Zn, and 1 oz. Ag/T was produced.	ABM file data
19. Twin Peaks quarry (Arizona Portland Cement Co., Division of California Portland Cement Co.)	12S	11E	So. Cen. 26	Limestone and shale	Folded and faulted Mississippian Escabrosa and Pennsylvanian-Permian Naco Group limestones.	Quarry operation. More than 14 million tons of rock mined for cement manufacture.	Wilson & Roseveare, 1949, p. 13 Keith, 1969, p. 389, 390, 397 ABM file data
IV. Arivaca District (Las Guijas and San Luis Mtns.)	20S-23S	9E-10E	----	Au, Ag, Pb, W, Cu, Zn (Hg, F)	1. Spotty base and precious metal mineralization in irregular quartz and quartz-calcite fissure veins cutting partly metamorphosed Cretaceous sandstone, shale, conglomerate, minor limestone, and volcanics. Oxidation and enrichment by surface weathering produced local, high-grade gold and silver pockets. 2. Irregular quartz-filled fissure veins with spotty tungsten and base metal sulfides in Laramide granitic intrusive. 3. Small scattered gold and tungsten placer deposits.	Over 100 small mines and prospects have been worked since Spanish Colonial times but no large sustained operations. Estimated and recorded production would amount to some 9,300 tons of ore containing about 3,600 oz. gold, 45,500 oz. silver 115 tons of lead, 36 tons of copper, 9 tons of zinc, and 250 tons of tungsten concentrates.	Wilson, 1941, p. 37-39 Dale et alia, 1960, p. 98-105 Wilson, 1961, p. 78-80 ABM file data
1. Ajax mine group (Arivaca Gold Mng. & Mllg. Co., Ajax Mng. Co., Oreona Mng. Co.)	22S	10E	E. Cen. & SE ¼ 5	Au, Ag, Pb, Zn, Cu-	Argentiferous and auriferous galena, sphalerite, minor chalcopyrite, and pyrite in irregular, lensing quartz-fissure veins cutting metamorphosed Cretaceous sedimentary formations. Oxidized near the surface with enrichment of gold and silver.	Shallow shafts, tunnels, and open cuts. From 1927 thru 1941 produced some 200 tons of ore averaging about 0.6 oz. Au/T, 15 oz. Ag/T, 0.7% Cu, and 4% Pb. Considerable Zn not recovered.	ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
2. Albatross mine (Gnome King; Albatross Gold Mines)	21S	9E	NE¼ 12	Ag, Au, Pb, Zn, Cu-	Irregular lenses of argentiferous and auriferous galena, sphalerite and minor chalcopyrite in quart-filled fissure veins cutting Laramide granitic intrusive. Oxidation and enrichment near surface.	Tunnel and shaft workings. Sporadic production in 1930's and 1940's with small tonnage of ore produced, averaging about 0.3 oz. Au/T, 11 oz. Ag/T, 0.5% Cu and 7% Pb. Zn not recovered.	ABM file data
3. Amado mine group (Rosebud, Oreona, Whipperwell, Tiger; Amado Mng. Co., Oreona Mng. Co., Alba Mines, Inc., Vogel Mng. Co., Arivaca Mng. Co.)	21S	10E	No. Cen. 20	Au, Ag, Pb, Zn, Cu-	Spotty argentiferous and auriferous galena, sphalerite, minor chalcopyrite, and pyrite in irregular quartz veins on fractures in Laramide granitic intrusive. Oxidation and enrichment near the surface.	Shaft and tunnel operations. Worked mainly from 1921 thru 1956 producing some 1,400 tons of ore averaging about 0.5 oz. Au/T, 6 oz. Ag/T, trace Cu, 4% Pb and 1% Zn.	ABM file data
4. Arivaca Creek gold placers	21S	NW¼ 10 NE¼ 9		Au, Ag-	Placer gravels with irregularly distributed, finely divided gold with few nuggets on pediment slopes, and in various gulches and washes at or near true or false bedrock. Considerable clay.	Small scattered workings with dry washers used except when water available. Probably a few 1,000 ozs. of gold with minor silver produced, 1750 to 1900, and some 100 ozs. since that time.	Wilson, 1961, p. 78-80
5. Arivaca King mine (Chapman; Calzona Mng. & Mllg. Co., Jacobs, Walsh)	21S	10E	SE¼ 5	Au, Ag, Pb-, Zn-, Cu-	Irregular quartz veins along fissures with oxidized, weak, and spotty base metal sulfides along fissures cutting Laramide granitic intrusive. Near surface enrichment of gold and silver.	Relatively shallow workings. In 1931-1934, and 1936 produced a total of some 65 tons of ore averaging about 0.8 oz. Au/T, 1 oz. Ag/T, trace Cu, and 1% Pb.	ABM file data
6. Backbone mine (Backbone Mng. Co., Walsh)	21S	10E	Cen. 8	Au, Ag, Pb, Zn-, Cu-	Irregular quartz-fissure lenses with spotty auriferous and argentiferous galena, sphalerite, and chalcopyrite in Laramide granitic intrusive. Near surface enrichment of gold and silver by oxidation and weathering.	Shaft workings. From 1930's into 1940's produced some 140 tons of ore averaging about 0.5 oz. Au/T, 0.8 oz. Ag/T, trace Cu and 1% Pb. Zn not recovered.	ABM file data
7. Black Gold mine group (Fernstrom)	20S	9E	NW¼ 13	W, Au-, Ag-, Pb-, Zn-, Cu-	Small, spotty, irregular oreshoots containing wolframite and minor scheelite, pyrite, galena, sphalerite, and chalcopyrite in a lensing and branching quartz-fissure vein cutting Cretaceous andesite.	Shallow shaft and adit workings. In late 1930's some 10,000 lbs. of picked tungsten concentrates produced.	Wilson, 1941, p. 39 Dale et alia, 1960, p. 104 ABM file data
8. Border mine group (Tunquepata or Tunquita; Williams, Aver, Finlyson, Lowell, Cummings)	23S	9E	SE¼ 4 NE¼ 9	Au, Ag	Weathered and oxidized quartz vein with free gold and silver chlorides (?) near the surface in a fissure zone in Cretaceous andesite near a Laramide granitic intrusive.	Shallow workings. Intermittent production from 1930 to 1941. Some 195 tons of ore shipped, averaging about 0.9 oz. Au/T, some Pb and Cu, and about 50 tons of WO_3 ore in 1939	ABM file data

9. Lucky Vista mine group (Golden Star, Gold Rim, Rebecca, etc.; Goon, Lim, Soto, The Richard M. & M. Co.)	21S	10E	4, 9, & 16	Ag, Au, Cu-, Pb-, Zn-	Numerous, scattered, oxidized and weathered, irregular quartz-fissure veins containing spotty base metal sulfides, in Laramide granitic intrusive. Near surface enrichment.	Shallow workings. In 1930's produced some 400 tons of ore averaging about 0.60 oz. Au and 7 oz. Ag/T, 0.4% Cu and 0.2% Pb.	ABM file data
10. Coñejo (Cottontail) mine (Boyd & Torrey, Byfield Mng. & Mllg. Co.)	22S	10E	SE¼ 5	Au, Ag, Pb-, Zn-, Cu-	Oxidized and weathered, spotty, base metal sulfides with some free gold near the surface, in a irregular, lensing quartz-fissure vein cutting metamorphosed Cretaceous sedimentary formations.	Shaft and open cut workings. In 1938-1939 produced some 300 tons of ore averaging about 0.2 oz. Au and 0.4 oz. Ag/T, trace Cu and 0.4% Pb. Probably sold as smelter flux.	ABM file data
11. Contact mine (Old Bucket, Rusty Red, Tom Rigg; Cates, Carter, Anderson)	22S	10E	No. Cen. 8	Au, Ag, Pb, Zn-, Cu-	Oxidized and weathered, irregular quartz-fissure veins with spotty base metal sulfides, cutting metamorphosed Cretaceous sedimentary formations.	Shaft and open cut operations. Probably worked prior to 1900 and in 1934-1939, producing some 100 or more tons of ore averaging about 0.5 oz. Au and 2 oz. Ag/T, 0.3% Cu and 3% Pb. Zn not recovered.	ABM file data
12. Easter mine group (Brouse, Stockwell & Cummings, Casey, Don Lieberman Enterprises, Inc.)	22S	9E	W. Cen. 14 E. Cen. 15	Au, Ag, W, Cu, Pb-, Zn-	Series of narrow and discontinuous, oxidized and weathered, quartz-fissure veins containing sparse base metal sulfides, spotty scheelite and minor free gold, cutting Laramide granitic intrusive near contact with Cretaceous sediments and volcanics.	Pits, trenches and open cuts. In 1939-1942 produced some 15 tons of ore averaging about 1.5 oz. Au and 4.5 oz. Ag/T. 2.3% Cu and a trace Pb. In 1951-1952 some 2,700 lbs. of hand picked, high grade tungsten ore and concentrates produced.	Dale et alia, 1960, p. 104-105 ABM file data
13. Edwards mine (Mother Lode)	22S	10E	No. Cen. 8	Au, Ag, Cu, Pb-, Zn-	Oxidized and weathered quartz lenses with free gold and silver chlorides (?) near surface and spotty base metal sulfides in depth, along fracture zones in metamorphosed Cretaceous sedimentary formations.	Shaft and tunnel operations. Worked prior to 1900 and intermittently 1928-1940, producing over 100 tons of ore averaging 4 oz. Au and 14 oz. Ag/T, 1.6% Cu and 0.6% Pb.	ABM file data
14. Good Enough mine group (Soto and Esperanza groups; Soto, Schwartz, Don Lieberman Enterprises, Inc., Lemas, Zappia	20S	10E	NW¼ 31	W, Au, Ag, Cu-, Pb-	Quartz lenses containing irregularly scattered wolframite and minor scheelite, and sparse oxidized copper and lead mineralization, with free gold in weathered surface areas, in fracture zones in Cretaceous volcanic breccia.	Tunnel operations. Worked originally for gold and silver prior to 1900 and sporadically for tungsten in 1940's and 1950's. Probably produced some 50 tons of Au, Ag and Cu ore and over 40,000 lbs. of WO_3 concentrates.	Wilson, 1941, p. 39 Dale et alia, 1960, p. 99-100 Sheikh, 1966, 1970 ABM file data
15. Las Guias mine group (Immense lodes, Grand lodes, General Electric; Whitcomb & Assoc., Tungsten Alloys Corp., Ore Metal & Engineering Corp., Southwestern Ore Corp., General Electric Co., Tungsten Mng. Corp., Fernstrom Mng. Co.)	20S	9E	W½ 25 E½ 26	W, Au-, Ag-, Cu-, Pb-, Zn-, Mn-, F-	Irregular, lensing quartz-fissure veins containing wolframite, hubnerite, and scheelite with minor chalcopyrite, bornite, pyrite, galena, sphalerite and magnetite and their oxidation products. Enrichment of gold in weathered surface. Psilomelane and fluorite also present. Veins occur in sericitized and fractured Laramide granitic intrusive and in Cretaceous volcanic breccia. Sometimes associated with basic dikes.	Tunnel, pit and open cut operations. Originally worked prior to 1900 for gold and silver and intermittently since WW I for tungsten. About 2,000 tons of gold-silver-copper ore and over 155,000 lbs. of WO_3 concentrates are estimated to have been produced.	Wilson, 1941, p. 37-39 Dale et alia, 1961, p. 102-104 Sheikh, 1966, 1970 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
16. La Guijas, gold placers (Durzano and Pesqueria gulches; New Venture Placer Mng. Co.)	20S 20S 21S	9E 10E 10E	25 30, 31, & 32 5	Au, Ag-, Hg-	Generally very fine gold with few nuggets in gravels on pediment slopes, old terraces or "mesas", and in various gulches and washes along Las Guias Wash at or near true or false bedrock. Often admixed with clay.	Dry and wet placer operations from prior to 1900. Reworked intermittently in 1930's and early 1940's. Total production estimated at about 1,000 oz. Au with some Ag.	Willis, 1915, p. 10 Allen, M. A., 1922, p. 10-11 Wilson, 1961, p. 78-80 ABM file data
17. Las Guias tungsten placers	20S	9E	12, 23, 24, 25	W	Wolframite and scheelite, with quartz, in alluvium and stream gravels below tungsten-bearing quartz veins and lenses in the Las Guias Mountains and the Black Gold area to the north.	Dry and wet placer operations. A few tons of wolframite concentrates produced, mainly during WW I.	Wilson, 1941, p. 39 Dale et alia, 1960, p. 105
18. Long Shot mine group (McCarthy, Fullerton, Burris & Sons)	22S	10E	Cen. 5	Ag, Au, Pb, Cu, Zn-	Irregular quartz-fissure zone with partly oxidized base metal sulfides in metamorphosed Cretaceous sedimentary formations.	Shaft workings. Intermittent production since early 1900's of some 100 tons of ore averaging about 21 oz. Ag/T, 5% Pb, 1% Cu and trace Au.	ABM file data
19. M. C. M. mine group (Guadalupe group; MCM Mng. & Mllg. Co., Rowcroft, Guadalupe Mng. Co., Leda Mines Consolidated)	22S	10E	SE¼ 5	Ag, Pb, Zn, Cu, Au-	Partly oxidized argentiferous galena, chalcopyrite, sphalerite, and pyrite in lensing quartz-fissure veins cutting metamorphosed Cretaceous sedimentary formations.	Relatively shallow operations worked intermittently from prior to 1900 to 1933, producing some 100 or more tons of ore averaging about 63 oz. Ag/T, 1 oz. Au/T, 10% Pb and 4% Cu.	ABM file data
20. Moore mine (Draham Enterprises)	21S	9E	NE¼ 9	Cu, Ag, Au	Oxidized copper mineralization in fractured Cretaceous sediments.	Open pit and leaching operation. In 1967 produced over 100 tons of ore averaging about 2% Cu, 4 oz. Ag/T and trace Au.	ABM file data
21. Oceanic mine (San Luis; Oceanic Gold Mng. Co., Ish, San Luis Mng. Co., Simmons)	21S	9E	Cen. 27	Au, Ag, Pb-, Zn-, Cu-	Weathered and oxidized quartz-fissure veins with spotty base metal sulfides, enriched in gold and silver near the surface, cutting Cretaceous sedimentary beds close to a Laramide granitic intrusive.	Shaft and tunnel operations. Worked intermittently from late 1800's to 1936, producing some 2,000 or more tons of ore averaging about 0.5 oz./T in both Au and Ag and minor lead and copper.	ABM file data
22. San Luis Wash gold placers	21S	9E	27 34 & 35	Au, Ag-	Generally coarse and angular gold particles in spotty placer deposits of gravels and alluvium on benches between washes on a dissected pediment cut on Cretaceous sedimentary and volcanic beds. Few boulders but considerable clay.	Worked sporadically by wet and dry methods, mainly in the 1930's. Some 50 ozs. Au recovered.	Wilson, 1961, p. 79 ABM file data
23. San Luis Wash tungsten placers (Bornstrom, Jarnigan)	22S	9E	Cen. 14	W	Spotty and irregular pockets of wolframite and scheelite in wash alluvial.	Worked by dry washer. A few tens of pounds of WO_3 concentrates produced in mid-1950's.	Dale et alia, 1960, p. 105 ABM file data

[illegible] (Rutledge, Torrey & Roper, Atwood, Byfield Mng. & Mllg. Co.)	[illegible]	[illegible]	[illegible] 5	[illegible] Cu	[illegible] base metal sulfides, oxidized and weathered near the surface with enrichment, cutting metamorphosed Cretaceous sedimentary formations.	[illegible] ably worked originally in early 1900's and sporadically from 1930 thru 1940, producing some 100 tons of ore averaging about 0.5 oz. Au and 15 oz. Ag/T, 5% Pb and 1% Cu.	ABM file data
25. Vindicator mine group (Stewart-Fernstrom, Carboloy group; Cleveland Tungsten Co., Fernstrom, F. H. & R. Mng. Co., Carlson, Whitney)	20S	9E	SW¼ 25	W, Cu-, Au-, Ag-, Pb-	Zones of small, irregular, stringers, veins and lenses of quartz with spotty wolframite, scheelite, pyrite, chalcopyrite, and galena along fracture zones in Laramide granitic intrusive at contact with Cretaceous volcanic breccia and biotite minette dike.	Shallow shaft and open cut workings. Prospected originally for Au and Ag and from WW I thru 1972 for tungsten. Over 31,000 lbs. of WO_3 concentrates produced.	Wilson, 1941, p. 39 Dale et alia, 1960, p. 100-101 Sheikh, 1966, 1970 ABM file data
V. Baboquivari District (Baboquivari and Quinlan Mtns.)	17-21S	7-8E In part protracted	---- ----	Au, Ag, Cu, Pb, Zn, Mn, W, Mo (F, Be)	1. Gold-bearing quartz-fissure veins and stringers, locally with calcite, pyrite, manganese and iron oxides, and spotty molybdenum, cutting metamorphosed or unmetamorphosed Mesozoic and early Tertiary sedimentary formations and usually associated with rhyolite, andesite or pegmatite dikes as well as Laramide granitic to dioritic intrusive bodies. 2. Spotty tungsten mineralization, often with local base metal sulfides, calcium silicates, and quartz along fracture zones in Mesozoic to early Tertiary quartzitic or limy beds adjacent to igneous dikes or intrusives of probable Laramide age. 3. Spotty and irregular manganese oxides in seams and veinlets along narrow fissure zones in shattered and brecciated Laramide intrusive or sedimentary beds. 4. Local, spotty gold placers in benches and bars along dry washes.	Numerous small, shallow mines and prospects but few major producers. Total production through 1972 estimated and recorded as some 56,600 tons of ore containing about 173,500 oz. Ag, 13,900 oz. Au, 122 tons Cu, and 12 tons Pb. About 2,500 units of tungsten were also produced from some 1,000 tons of ore. A small amount of low grade Mn produced. Small amount of placer gold recovered.	Wilson et alia, 1934 (Rev. 1967), p. 179-181 Wilson, 1941, p. 39-40 Wilson, 1961, p. 81 Donald, 1959 Fair, 1965 Heindl & Fair, 1965 ABM file data
1. Allison mine (Fresnel, Chance; Allison Bros. & Wicks, Allison Gold Mng. Co., Tom Reed Gold Mines, El Oro Mng. & Mllg. Co., Tombstone Mng. Co. of Ariz., Gold Bar Mng. Co., Old Gold Mng. Co.)	18S	7E Protracted	Cen. 33	Ag, Au, Cu-, Pb-, Mn	Argentite, silver and gold chlorides, native gold and minor copper and lead minerals in quartz lenses with gouge and abundant manganese and iron oxides along fault zones cutting tilted, metamorphosed Tertiary conglomerate and sedimentary breccia beds with associated rhyolite and andesite porphyry dikes.	Tunnel, shaft and extensive underground workings. Produced intermittently from 1890's thru 1961. Total estimated and recorded production was over 47,000 tons of ore averaging about 0.22 oz. Au/T, 2.7 oz. Ag/T, and minor lead and copper.	Mines Handbook, 1926 Worcester, 1931 Wilson, 1934 (Rev. 1967), p. 179-180 Fair, 1965 ABM file data
2. Arizona Molybdenum mine (Arizona Molybdenum Co.)	20S	7E	No. Cen. 2	Cu, Mo, Au, Ag, Pb	Lensing, quartz-feldspar, pegmatitic veins and dikes, containing spotty base metal sulfides and molybdenite, cutting coarse-grained Laramide granitic intrusive.	Shallow shafts and pits. No recorded production but reportedly operating flotation plant for molybdenum concentrates in 1917.	Mines Handbook, 1922

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
3. Baboquivari mine (Black Diamond group, Red and Black Chief group)	20S	7E	NW¼ 11	Mn, FeO, Cu-, Ag-, Au-	Pyrolusite, psilomelane, and minor rhodonite with abundant iron oxides along narrow fracture zones, in seams and veinlets, in a shattered and brecciated andesite dike cutting Cretaceous sediments.	Trenches, cuts and shaft. About 2 car loads of hand sorted manganese ore shipped in 1917.	Farnham et alia, 1961, p. 121-122
4. Berkley mine (Hickey, Siebert, Chavez)	20S	7E	NE¼ 21	Cu, Ag, Au, Pb-, Zn-	Scattered bunches of oxidized pyrite and base metal sulfides in weathered coarse-grained quartz and calcite along fault fissure in partly metamorphosed Cretaceous sediments cut by intrusive dikes.	Shallow workings. In 1936-1937 some 200 tons of ore averaging about 2.5% Cu, .04 oz. Au/T and 6.5 oz. Ag/T shipped.	ABM file data
5. Big Banana mine (Coplen, C. G. Glasscock, Tideland Oil Co.)	17S	7E	No. Cen. 32 Protracted	W, Cu-, Mo-, F-	Spotty scheelite with epidote, garnet, pyrite and minor chalcopyrite, molybdenite and fluorite in narrow en echalon shoots in strongly fractured zone cutting Laramide metamorphic quartzite adjacent to altered intrusive rhyolite.	Tunnels and open cuts. In 1955 and 1956 about 20,000 lbs. of tungsten concentrates produced.	Dale et alia, 1960, p. 67-69
6. Big Juanita mine group (Brown)	17S	7E	Cen. border 29-30 Protracted	W	Spotty scheelite with epidote, zoisite, garnet and stringers of secondary calcite along fracture zone in Laramide quartzite cut by numerous narrow aplite dikes.	Open cuts and pits. Reportedly produced about 50 lbs. of 62% tungsten concentrates.	Dale et alia, 1960, p. 70
7. Black Dragon mine group (Coplen, Talcott, Black Dragon Mng. Co., Arizona Materials & Service Co.)	18S	7E	SE¼ 15 NE¼ 22	Mn	Discontinuous small lenses, coatings, and narrow fracture-fillings of soft manganese oxides and spotty pyrolusite in a sheared and brecciated zone in Tertiary (?) rhyolite.	Open cuts and pits. Some 165 long tons of sorted manganese ore and 19 tons of manganese concentrates produced in the early 1950's.	Farnham et alia, 1961, p. 117 Fair, 1965
8. Edna J. Placer (Baboquivari Gold Placer Co., Conard)	19S 20S	8E 8E	31, 32 5, 6	Au	Finely divided gold in a 6 to 11 foot thick gravel bar containing abundant boulders but little clay, resting on a granite pediment.	Small intermittent placer operations. A few tens of ounces of gold recovered.	Wilson, 1961, p. 31 ABM file data
9. Emmett & Elgin mine (Robinson)	20S	7E	SE¼ 3	Au, Ag, Cu-	Pockets of oxidized auriferous pyrite and minor base metal sulfides along irregular quartz-fissure zones in metamorphosed Cretaceous sedimentary beds.	Shallow workings. In 1950 produced some 150 tons of ore averaging about 1 oz. Au/T and minor Ag and Cu.	ABM file data
10. Giant mine (Grand Mountain; Coplen, Shannon Mines, Inc., Cinderra Mng. & Eng. Co.,	20S	7E	No. Cen. 30 Protracted	W, Cu-, Ag-, Mo-	Irregular, disconnected quartz lenses with spotty scheelite and minor copper oxides in badly faulted Laramide quartzitic beds. Local epidote, zoisite, and narrow aplite dikes.	Open cuts and pits. Some 20 tons of low grade copper-silver ore and about 50 tons of tungsten ore produced in 1957.	Dale et alia, 1960, p. 78-81

11. Gold Bullion mine (Banes claims, Last Chance and Tellurium claim groups; Gold Bullion Mines Co., Gold Bullion Consolidated Mng. Co., Moore)	19S 20S	7E 7E	So. Cen. 35 No. Cen. 2	Au, Ag, Cu-, Pb-, Zn-, Mo-	Sporadic pockets of auriferous pyrite with minor chalcopyrite, galena, sphalerite, and molybdenite, partly oxidized, along fault-fissures, bedding plane faults, and in strong quartz veins or pegmatites in metamorphosed Cretaceous sedimentary bed, strongly altered and cut by intrusive dikes.	Shafts and underground workings. Intermittent production in 1880's, from about 1910 to 1918, and in 1939. Some 3,100 or more tons produced, averaging about 1.0 oz. Au/T, 12 oz. Ag/T and minor Cu and Pb. Several 100 tons of high grade molybdenum ore shipped.	Joseph, 1915-1916 Wilson, 1934 (Rev. 1967), p. 181 Donald, 1959 Kirkemo, Anderson, & Creasen, 1965, p. 10-11 ABM file data
12. Gold King mine (Beals, Gold King Mng. & Dev. Co., Wright Mines & Dev. Co., Riddle)	20S	7E	NE¼ 10	Au, Ag, Pb-, Cu, Zn-, Mn-, (Be)	Spotty gold and silver values with minor base metal oxides and sulfides in a quartz-manganese oxide vein along a fault structure cutting metamorphosed Cretaceous sedimentary beds invaded by Laramide granite porphyry dikes. Some beryllium minerals along dike contacts.	Shafts, adits, and drifts. Probably originally worked prior to 1900 and later in 1933-1937 and in 1963. Produced some 500 or more tons of ore averaging about 1.0 oz. Au/T, 12 oz. Ag/T and minor copper and lead.	Wilson, 1934 (Rev. 1967), p. 181 Meeves, 1966, p. 59 ABM file data
13. Iowana mine (Iowana Mines, Inc., Bent & Shields)	19S	7E	NW¼ 36	Au, Ag, Pb-, Cu-, Zn-, W-	Series of small, lensing, quartz-calcite fissure veins with spotty gold and silver values and sparse, partly oxidized base metal sulfides, cutting partly metamorphosed Cretaceous sedimentary beds invaded by numerous granite and diorite porphyry dikes. Some sparse wolframite in cross-cutting quartz dikes.	Shallow shafts and tunnels. Probably prospected prior to 1900 and worked subsequently in 1933-1936 and 1940-1941. Produced some 100 tons of ore averaging about 1 oz. Au/T, 16 oz. Ag/T and minor lead and copper.	Wilson, 1934 (Rev. 1967), p. 181 ABM file data
14. Jezebel mine (Francis, Thornton)	17S	7E	So. Cen. 19	W	Spotty scheelite in an altered, vuggy, and siliceous fault-fissure zone in metamorphosed Cretaceous quartzitic and schistose formation.	Shallow shaft, adit, and open cut. About 600 tons of tungsten ore produced in the mid-1950's.	Dale et alia, 1960, p. 72-73
	Protracted						
15. Jupiter mine (Arizona Jupiter Mines, Inc., Flynn, Lamp, Larrys, Dinnerly)	19S	7E	NW¼ 36	Au, Ag, Pb-, Cu-, Zn-	Strong, coarse-grained, quartz-calcite fissure veins containing partly oxidized, spotty, auriferous and argentiferous pyrite and minor base metal sulfides, cutting metamorphosed Cretaceous sedimentary beds intruded by granite and diorite dikes.	Shafts, tunnels and underground workings. Prospected prior to 1900 with intermittent production from 1930 to 1941. Some 400 tons of ore produced averaging about 0.7 oz. Au/T, 12 oz. Ag/T and minor lead and copper.	Wilson, 1934 (Rev. 1967), p. 181 ABM file data
16. Lesjimfre claims (Greenfield State lease; Carlson, Fernstrom, and Cummins)	21S	7E	NE¼ 4	W, F-, Be-	Sporadic scheelite associated with minor fluorite and beryllium-bearing vesuvianite in sheer zones in quartzite cut by narrow pegmatite dikes.	Shallow shaft, open cuts, and pits. About 2 tons of tungsten concentrates produced in 1953.	Dale et alia, 1960, p. 105-106 Balla, 1962, p. 59 Meeves, 1966, p. 59
17. Papago Chief mine (Napoleon; Grijalba, Amado, Verduzco, Bustamonte, Papago Chief Mines, Griscom Mng. Co., O'dell & Mears)	20S	7E	NE¼ 21	Cu, Ag, Au, Pb-, Zn-, U-	Coarsely crystalline quartz-calcite veins with partly oxidized base metal sulfides along fault-fissures cutting partly metamorphosed Cretaceous sedimentary beds cut by numerous granite and diorite dikes. Wall rocks silicified and sericitized. Gold and silver enriched in shallow oxidized and weathered zone. Minor metatorbernite associated with copper minerals.	Tunnel and shaft workings. Probably originally prospected and worked superficially in 1800's. Intermittent production from early 1900's to 1956 of some 4,500 tons of ore averaging about 2% Cu, 5.6 oz. Ag/T, 0.04 oz. Au/T and minor Pb.	Wright, 1950 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
18. San Juan mine (Coplen, Taylor & Gorman, Mountain States Uranium Co.)	17S	7E	NE¼ 30 Protracted	W	Discontinuous bands of spotty scheelite along a fault zone in Cretaceous sediments metamorphosed to quartzite and hornfels.	Open cuts and adit. Some 8,000 pounds of tungsten concentrates produced in 1954 and 1957.	Dale et alia, 1960, p. 71-72
19. Sparks mine (Juanita #9)	17S	7E	SE¼ 30 Protracted	W	Spotty scheelite along fracture zone in Cretaceous sediments metamorphosed to quartzite and hornfels.	Open cuts, adit, and shaft. Some 100 tons of 0.5% WO_3 mined in the mid-1950's.	Dale et alia, 1960, p. 70
20. Ventana mine group (Ventana Mng. Co., Arizona Mng. Co.)	19S	7E	18 Protracted	Cu, Ag, Au, Pb-, Zn- (Mn)	Partly oxidized base metal sulfides in a series of narrow quartz-calcite fissure veins along a strong fault zone cutting Cretaceous volcanics and metamorphosed sediments and Laramide intrusive.	Open cuts, trenches and shallow shafts. Located in early 1900's but only worked sporadically to 1954 with a production of some 185 tons of ore averaging about 1.3% Cu, 2 oz. Ag/T and 0.7 oz. Au/T.	ABM file data
21. Yellow Star mine (New Dragoon; Francis, Coplen, Griffith, Standard Tungsten Corp.)	17S	7E	W. Cen. 19 Protracted	W	Spotty scheelite along stringers and in cavities along a shear zone in Cretaceous sediments metamorphosed to friable and granular felspathic quartzite.	Adit, shafts, and open cuts. Produced some 700 tons of tungsten ore from which 5,100 lbs. of WO_3 extracted.	Dale et alia, 1960, p. 73-74
VI. Cababi (Comobabi) District (North and South Comobabi Mtns. and Ko Vaya Hills)	14- 17S	4- 6E	---- Partly Protracted	Au, Ag, Pb, Cu, Zn, W (Ba, V)	1. Auriferous and argentiferous quartz, quartz-calcite or dolomite, and quartz-barite veins with partly oxidized, spotty base metal sulfides and local tungsten minerals along faults and fracture zones in a thick series of Cretaceous (?) andesite flows invaded by Laramide granitic to dioritic intrusions, and in the intrusive.	Numerous scattered small mines and prospects, mostly relatively shallow, worked sporadically from at least early 1700's to recent times. Total production estimated and recorded as some 6,500 tons of ore containing about 3,500 ozs. Au, 102,000 ozs. Ag, 92 tons Cu, 182 tons Pb, 2 tons Zn and a small amount of tungsten concentrates.	MacKallor, 1957 Bryner, 1959 Heindl, 1965 ABM file data
1. Badger mine (Jaeger, Akron Gold Mng. Co.)	16S	5E	SE¼ 34 Protracted	Au, Ag	Irregular, sugary, quartz-calcite vein with spotty oxidized pyrite, showing enriched gold and silver values in iron oxides near the surface, along fracture zone in Laramide granitic intrusive. Sericitized and silicified wall rock.	Relatively shallow inclined shaft. Only a relatively few tons of ore, averaging about 8 oz. Au/T and 5 oz. Ag/T produced in 1938.	Wilson, 1934 (Rev. 1967), p. 177-178 Bryner, 1959 ABM file data
2. Columbia mine group (Weideman, Papago Copper Co.)	16S	5E	So. Cen. 1 Protracted	Cu, Ag, Au-	Spotty copper carbonates and chalcocite in an irregular quartz vein along a fissure zone in Laramide granitic rock.	Tunnel workings. Relatively small tonnage of ore averaging about 0.1 oz. Au/T, 29 oz. Ag/T and 19% Cu. produced in 1907.	ABM file data

3. Comobabi and Crusader mines (Comobabi Copper Co., Taylor, Pidgett, May)	16S 4E Protracted	No. Cen. 25	Cu, Ag, Au, Pb-	Quartz veins on fractures along a contact of Cretaceous (?) andesite porphyry volcanics with Laramide granitic intrusive. Spotty, largely oxidized, argentiferous copper and lead mineralization.	Shallow workings. Produced up to 100 tons of ore averaging about 0.2 oz. Au/T, 24 oz. Ag/T, 6% Cu and minor Pb.	ABM file data
4. Coyote Hole prospect (Coplen & O'Brien)	15S 4E Protracted	NW 34	W, Cu-	Coarsely crystalline, quartz veins with irregular seams and particles of wolframite and sparse disseminated scheelite and chalcopyrite along fractures in Cretaceous (?) andesite volcanics near an altered Laramide granitic granitic intrusive cut by diorite and granitic porphyry dikes.	Incline shaft. Reportedly several hundred dollars worth of hand picked tungsten ore produced.	Wilson, 1941, p. 40
5. Cunquian mine (Cooncan; Hedderman, Picacho Mines, Inc.)	16S 4E Protracted	NE 18	Au, Ag, Cu, Pb, Zn	Partly oxidized, lensing, quartz vein with spotty copper, lead, and zinc mineralization and with gold enrichment near the surface, along a fracture zone in Cretaceous (?) andesite volcanics.	Prospected and worked in late 1800's with sporadic production up to 1950 of some 600 tons of ore averaging about 0.5 oz. Ag/T, 1.5 oz. Ag/T, 1.5% Cu and 1.3% Pb. Zn not recovered.	MacKallor, 1957 ABM file data
6. Desert Lode mine (Hedderman)	16S 4E Protracted	Cen. 17	Au, Ag	Oxidized, lensing, quartz vein with weak sulfides along fractures cutting Cretaceous (?) andesite volcanics.	Shallow workings. Small tonnage of ore averaging 0.7 oz. Au/T, 3 oz. Ag/T produced in 1937.	MacKallor, 1957 Bryner, 1959 ABM file data
7. Emperor & Dutchess mines (Emperor & Dutchess Mines Co.)	16S 5E Protracted	E. Cen. 29	Cu, Ag, Au, Pb-, Zn-	Partly oxidized, lensing quartz-calcite vein with chalcocite and minor lead and zinc mineralization along a fissure zone cutting altered Laramide granitic intrusive.	Shallow workings. Some 140 tons of ore averaging 0.01 oz. Au/T, 9 oz. Ag/T, and 5% Cu produced in 1951.	Brymer, 1959 ABM file data
8. High Card mine (Faro Bank group; Holmes & Padres, Maxwell)	17S 5E Protracted	SW 4	Au, Ag, Cu-, Pb-, Zn-	Oxidized and weathered quartz veins with minor, spotty, base metal sulfides along a fissure zone cutting Laramide granitic rock. Gold enriched in surface zone.	Shallow shafts and tunnels. Worked intermittently from 1931 to 1940, producing a few tons of ore averaging about 0.9 oz. Au/T, 1.5 oz. Ag/T and minor Cu, Pb, and Zn.	Bryner, 1959 ABM file data
9. Jaeger mine (Akron; Jaeger, Williams, Akron Gold Mng. Co., Desert Gold Mng. Co.)	17S 5E Protracted	NE¼ 3	Au, Ag, Cu-	Series of parallel, irregular quartz-fissure veins; vuggy, composite, oxidized, and enriched near the surface in gold with minor silver and copper. In Laramide dioritic intrusive containing brecciated blocks of older rocks.	300 foot shaft workings. From 1930-1943 produced some 2,800 tons of ore averaging about 0.5 oz. Au/T and 0.3 oz. Ag/T with minor Cu.	Wilson, 1934 (Rev. 1967), p. 177-178 Bryner, 1959 ABM file data
10. Little Mary mine (Steppe; Stepp Bros., Como-Pima Mng. Corp., Withers, Beids Mng., Hardy, Rogers, Medd)	16S 4E Protracted	SW¼ 23 NW¼ 26	Au, Ag, Cu-	Lensing, quartz-fissure veins, partly brecciated, containing shoots of barite and stringers of dolomite. Iron and copper oxides in upper part change to galena, pyrite, chalcocite, chalcopyrite and ruby silver in depth. Minor tetrahedrite and molybdenite are found. Wall rock is Cretaceous (?) amygdaloidal andesite flows.	Shaft and tunnel workings. From 1917 to 1970, some 800 tons of picked ore produced averaging about 0.2 oz. Au/T, 15 oz. Ag/T, 54% Pb, 4% Cu and a little Zn.	MacKallor, 1957 Bryner, 1959 Williams, 1962, 1963

Table 4 Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
11. Lucido claim group (Jaeger, Desert Gold Mng. Co.)	17S	5E	NE¼ 3 Protracted	Au, Ag, Cu-	Irregular, lensing, quartz-fissure vein with minor oxidized copper mineralization cutting Laramide dioritic intrusive. Gold and silver enriched in oxidized zone.	Incline shaft and trenches. Up to 100 tons of ore averaging about 0.4 oz. Au/T and 0.4 oz. Ag/T with minor copper produced in 1938 and 1948.	ABM file data
12. Mildren mine group (Mildren Mng. Co., Wayne Developing Co., Dunn, McCaughy, Sowles)	16S	4E	E Cen. 16 Protracted	Pb, Ag, Au, Cu, Zn (V)	Lensing, crystalline quartz-fissure veins, partly brecciated, with some dolomite in Cretaceous (?) amygdaloidal andesite flows. Galena with minor bornite, chalcocite and ruby silver occur in pods and lenses with minor pyrite, tetrahedrite, sphalerite, molybdenite and vanadenite. Deposit oxidized near surface with enriched gold values.	Shafts and pits. Worked mainly in 1932-1934 and 1940-1941, producing some 460 tons of ore averaging about 7% Pb, 12 oz. Ag/T, 0.2 oz. Au/T and 1.6% Cu.	McKallor, 1957 Bryner, 1959 Williams, 1962, 1963 ABM file data
13. Old Timer mine (Rudolph, Picacho Mines Inc.)	16S	4E	SW¼ 3 Protracted	Ag, Cu-, Au-	Series of overlapping quartz-dolomite vein-like lenses containing native silver and spotty chalcocite and pyrite, oxidized near the surface, in fracture zone in Cretaceous (?) andesite flows.	Incline shaft and pit. Worked 1946-1949 producing a few tons of about 28 oz. Ag/T and minor Cu and Au.	MacKallor, 1957 ABM file data
14. Picacho mine (Cahuabi, Cababi; Bustamante, Ehrenberg, Jaeger & Halsteád, Francisco Padres, Choate, Cababi Mng. Co., Picacho Mng. Co., Bartlett, Redhead)	16S	4E	NW¼ 9 Protracted	Ag, Au, Cu-, Pb-, Zn-	Faulted, crystalline quartz veins with minor milky quartz, calcite, and siderite, with gouge along vein walls, in a major fault zone cutting Cretaceous (?) andesite flows and invaded by andesite and felsic dikes. Irregular base metal and iron oxides and sulfides. Spotty rich silver values, particularly in oxidized zone.	Shaft and pit operations. Worked prior to 1850's and sporadically up to 1960's. Produced at least 500 tons of ore averaging about 250 oz. Ag/T, 0.3 oz. Au/T and minor Cu and Pb.	Copper Handbook, 1910-1911 Mines Handbook, 1922 MacKallor, 1957 Bryner, 1959 ABM file data
15. Sherwood mine (Reilly Lode, Green; Anderson, Sherwood Copper Co., Leonard, Duffy)	16S	5E	NE¼ 31 Protracted	Cu, Ag, Au-	Partly oxidized, quartz-calcite veins with spotty pyrite, chalcopyrite, bornite, and chalcocite along a fault zone cutting Laramide dioritic to quartz monzonitic intrusive. High silver values in oxidized zone.	Shaft workings. Sporadic production 1917-1927 and 1952-1953 of a few tens of tons of ore averaging about 10% Cu, 37 oz. Ag/T and minor Au.	Bryner, 1959 ABM file data
16. Silver Dollar mine (Tungsten King; Kyriak & Bartlett)	15S	4E	Cen. 34 Protracted	W	Irregular crystalline quartz and barite vein with scattered and spotty wulframite and scheelite cutting Cretaceous (?) andesite flows.	Shallow workings. A small amount of hand picked tungsten ore produced 1939-1940.	Wilson, 1941, p. 40-41 MacKallor, 1957 ABM file data
17. Silver Giant mine (Rhrads & Holmes)	16S	5E	NE¼ 10 Protracted	Ag, Cu-	Oxidized, quartz vein with spotty copper and silver values cutting Laramide quartz monzonite intrusive along fracture zone.	Shallow workings. A few tons of ore averaging about 19 oz. Ag/T and minor copper produced in 1947.	ABM file data

	(Silver Queen Consolidated Mng. Co., Bartlett, Luofboro & Nelson)	---	---	4 Protracted	Pb-	dolomite stringers and spotty pyrite, chalcopyrite, and galena. Ruby silver occurred in oxidized zone.	radically since early 1910's to 1950's, producing some 125 tons of ore averaging about 28 oz. Ag/T, 1.6% Cu, 0.1 oz. Au/T and minor Pb.	ABM file data
	19. Sun-Gold mine (Sun Gold Mng. Co.)	16S	4E	So. Cen. 15 Protracted	Au, Pb, Ag, Zn, Cu	Irregular, partly oxidized, quartz vein with dolomite stringers and spotty pyrite, galena, chalcopyrite, sphalerite and ruby silver along strong fracture zone cutting Cretaceous (?) andesite flows. Pockets of high grade gold values.	Shallow shaft operations. Worked sporadically 1949-1952, producing a small tonnage of ore averaging about 3.7 oz. Au/T, 11% Pb, 8 oz. Ag/T, 3% Zn and 1% Cu.	MacKallor, 1957 Bryner, 1959 ABM file data
VII.	Canada del Oro District (West side of Santa Catalina Mountains)	11S	14E	----	Au	Minor amounts of placer gravel along Canada del Oro and tributary washes draining off a Precambrian granite which contains spotty gold-bearing quartz veins.	Minor placer operations from 1700's and probably not more than some 100 ounces produced in Pima County. Main placer area of district farther northeast in Pinal County.	U.S.G.S. Min. Res., 1912, pt. 1, p. 259-260 Wilson, E. D., 1961, p. 61-62 ABM file data
VIII.	Catalina (Santa Catalina) District (South base of the Santa Catalina Mountains)	12S	14E	----	Cu, Ag, Au-, Mo-	Relatively weak, spotty, and local copper mineralization with minor molybdenite in a wide altered breccia zone along the Catalina foothill fault dividing Catalina Gneiss, a Laramide metamorphic, from Tertiary to Quaternary Pantano conglomerate beds.	Shaft, pit, and tunnel operations. Only one productive mine, Pontotoc (T 12S, R 14E, NE¼ Sec. 3), located in 1906 and worked in 1907 and 1916-1917 by Pontotoc Copper Co., Ramsdall, and Texas-Arizona Copper Co., producing a total of some 5,000 tons of hand picked ore averaging about 4% Cu, 0.5 oz. Ag/T and a trace of Au.	Moore et alia, 1941 DuBois, 1959 Fair & Jinks, 1961 Medhi, 1964 ABM file data
IX.	Cerro Colorado District	20S	10E	----	Ag, Au, Cu-, Pb-, Zn- (Hg)	Epithermal quartz-fissure veins with minor base metal sulfides and mercury-bearing tetrahedrite. Silver and gold enrichment in the oxidized zone. Host rocks are a complex of Cretaceous quartz latite and andesite porphyry flows and tuff with some interbedded sedimentary beds, invaded by Laramide (?) andesite porphyry, rhyolite and dioritic plugs and dikes.	One of the oldest producing areas in Arizona with scattered small and relatively shallow mines and prospects active intermittently from at least the 1770's to about 1950. Total estimated and recorded production has been some 4,500 tons of ore containing about 376,000 oz. Ag, 460 oz. Au and minor Cu, Pb,	Davis, 1955 Jones, 1957 Chaffee, 1964 ABM file data
	1. Black Princess mine (Udall)	20S	10E	SE¼ 14	Ag, Au, Pb, Cu-	Spotty anglesite, cerussite, argentiferous galena and minor copper carbonates in an oxidized and supergene enriched quartz-fissure zone in Cretaceous andesite porphyry.	Shallow shaft and surface operations. Worked sporadically from early 1800's to 1939. Some 100 tons of ore produced, averaging about 20 oz. Ag/T, 0.2 oz. Au/T with minor lead and copper.	Jones, 1957 ABM file data

Table 4, cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
2. Cerro Colorado mine (Heintzelman, Silver Queen; Sonora Exploration & Mng. Co., Consolidated Arizona Mine & Mllg. Co., Cerro Colorado Mng. & Mllg. Co., Udall, Cerro Cristo Mines Co., Steinfeld, Baker, Snyder.	20S	10E	Cen. 25	Ag, Au, Pb, Zn, Cu (Hg)	Irregular, lensing, drusy, quartz-fissure vein with spotty cerargyrite, cerussite, anglesite, chrysocolla, copper carbonates, freibergite, galena, sphalerite and traces of cinnabar. Minor barite, calcite and much iron oxide. Wall rock is an andesite porphyry complex.	Shaft workings. Operated from 1770's to about 1937, producing some 3,000 tons of ore averaging about 100 oz. Ag/T, 0.1 oz. Au/T, and minor amounts of lead and copper.	Copper Handbook, 1903, 1909 Jones, 1957 ABM file data
3. Liberty mine (Liberty Mng. & Smltng Co.)	20S	10E	NE¼ 16	Ag, Au, Pb, Cu	Irregular quartz-fissure vein with spotty, oxidized, argentiferous galena and minor gold and copper mineralization.	Shaft and pit workings. Operated sporadically from mid-1800's to early 1900's producing some 100 tons of ore averaging about 80 oz. Ag/T, 0.5 oz. Au/T and minor Pb and Cu.	Copper Handbook, 1903, 1908 Chaffee, 1964 ABM file data
4. Mary G mine (Mary E, Princess group; Mary Leasing Co., Ayers, Goodsill & Carry Bros., Workman, Worsley, Bledsoe, Turner, Mary G. Mng. Co., Roberts)	20S	10E	E. Cen. 21	Ag, Pb, Cu, Au, Zn (Hg)	Irregular, lensing, drusy, and milky, partly oxidized, quartz vein containing stringers and veinlets of galena, sphalerite, copper carbonates, and mercury-bearing tetrahedrite with minor barite and calcite along a fault zone in Laramide (?) propylitized andesite porphyry. Specs of cinnabar. Ore shoot controlled by fault intersection.	Shaft workings. Operated intermittently from late 1880's to 1950, producing some 800 tons of ore averaging about 60 oz. Ag/T, 1.5% Pb, 0.7% Cu and minor Au and Zn.	Davis, 1955 Jones, 1957 Chaffee, 1964 ABM file data
5. New Colorado mine (Silver Colorado Mng. Corp. of Am.	20S	10E	E. Cen. 17	Ag, Au, Pb, Cu, Zn (Hg)	Irregular, partly oxidized, quartz-fissure veins with argentiferous galena, freibergite, copper carbonates and oxides, sphalerite and rich silver mineralization. Minor barite, calcite, and cinnabar. Strong iron and manganese oxides. Wall rock is Cretaceous andesite porphyry.	Shallow shaft and pit workings. Prospected and worked from 1800's to about 1900 with estimated production of some 50 tons of ore averaging about 120 oz. Ag/T, 2.7 oz. Au/T, 19% Pb and 2% Cu.	Chaffee, 1964 ABM file data
6. Silver Hill mine (Gold Coin; Cotton & Flynn, Lowell, MacFarlane)	20S	10E	E. Cen. 17	Ag, Au, Pb, Cu, Zn (Hg)	Irregular, lensing, oxidized, quartz-fissure veins with spotty argentiferous base metal sulfides in stock of Laramide dioritic intrusive and bordering andesite porphyry. Minor tetrahedrite and cinnabar.	Shallow shaft operation. Worked sporadically from 1800's to 1930's, producing an estimated 50 tons of ore averaging about 80 oz. Ag/T, 5% Pb, 4% Cu and 0.1 oz. Au/T.	Chaffee, 1964 ABM file data
7. Silver Shield mine (Colorado Clark; Falk, Mitchell)	20S	10E	NE¼ 35	Ag, Pb, Au, Cu, Zn (Hg)	Irregular, spotty, and weak, oxidized, argentiferous, base metal sulfides in a lensing quartz-fissure vein in Cretaceous andesite porphyry.	Shallow shaft operation. Worked intermittently from 1880's to early 1900's, producing about 20 tons of high grade silver ore	Jones, 1957 Chaffee, 1964 ABM file data

X. Cimarron Mts. (Salt Well) District (Cimarron and Sheridan Mtns.)	11- 2- ---- 12S 3E	Mn, Au, Cu, Ag, Pb, Zn	1. Manganese oxides along fault zones in Paleozoic limestone, Laramide quartz diorite and andesite porphyry. 2. Spotty, oxidized, auriferous, and argentiferous, base metal sulfides in irregular quartz-fissure veins in Precambrian schist, Laramide granodiorite intrusive, and Tertiary volcanics.	Mostly shallow, surface workings. Base and precious metal deposits produced some 120 tons of ore averaging about 0.7 oz. Au/T, 8% Cu, 1.5 oz. Ag/T and minor Pb from 1910 to 1939. Manganese production in early 1940's and mid-1950's amounted to about 9,500 long tons of 35%+ Mn.	Farnham et alia, 1961, p. 108-115 ABM file data
1. Black Diamond group (Pettijohn & Kennedy)	11S 3E NW¼ 7 11S 2E NE¼ 12 Protracted	Mn	Soft manganese oxides with segregations of psilomelane and stringers and blebs of calcite along a brecciated fault zone in Laramide quartz diorite. Also a vein-like occurrence along an intrusive-andesite porphyry contact.	Open cut and adit workings. About 40 long tons of low grade sorted manganese ore shipped in 1955.	Farnham et alia, 1961, p. 114-115
2. Black Jack mine	11S 2E N. Cen. 36 Protracted	Mn	Psilomelane, wad, and other soft manganese oxides, with local abundance of iron oxides, in and around Paleozoic limestone fragments in a bedding plane fault zone between limestone and quartzite beds.	Shaft and drift workings. Some 1,240 long tons of 35% Mn ore produced in the mid-1950's.	Farnham et alia, 1961, p. 113-114
3. Isabella mine (Isabella Mines Co.)	11S 2E NW¼ 21 Protracted	Au, Ag, Cu-, Pb-, Zn-	Irregular and lensing, quartz vein with spotty and weak, base metal sulfides along a fault zone between Precambrian schist and Tertiary silicic volcanics. Slight oxidation and enrichment near the surface.	Shaft and pit workings. Prospected and developed in early 1910's but only produced some 20 tons of ore averaging about 0.5 oz. Au/T and 0.1 oz. Ag/T.	ABM file data
4. Manganese King group (Struckmeyer, Young, Price and Dorsey, Manganese King Mng. Co.)	11S 2E NW¼ 36	Mn	Irregular and erratic psilomelane, wad, and soft manganese oxides with some calcite and hematite in a Paleozoic limestone bed.	Shallow shafts and open cuts. Some 580 long tons of sorted 30% Mn ore produced in 1955.	Farnham et alia, 1961, p. 112-113
5. Monte Cristo mine (McNatt, Andrade)	12S 3E NW¼ 7 Protracted	Au, Ag, Cu	Oxidized, quartz-fissure vein with surface enrichment of gold, silver and copper in Laramide metamorphic schist and phyllite.	Shaft and tunnel workings. In the 1930's produced some 65 tons of ore averaging about 0.9 oz. Au/T, 0.5 oz. Ag/T and 1% Cu.	ABM file data
6. Montizona mine (Montizona Copper Co.)	11S 3E SW¼ 19 Protracted	Cu, Pb, Ag, Au	Spotty, argentiferous, and auriferous, copper carbonates, chalcocite, cuprite, tenorite, chrysocolla, and minor chalcopyrite and galena in brecciated quartz-fissure veins along a fault zone in Laramide granodiorite. Numerous aplite, trachyte, and andesite dikes.	Shafts, tunnels and diamond drilling. Developed in late 1920's and mid-1930's but only shipped some 15 tons of high grade oxidized copper ore averaging about 67% Cu, 8 oz. Ag/T, 7% Pb and 0.1 oz. Au/T.	ABM file data
7. Oro Grande mine (Sterling; Westbrook & DeRhodes)	12S 3E W. Cen. 7 Protracted	Cu, Ag, Au	Oxidized, quartz-fissure veins with surface enrichment of gold, silver, and copper in Laramide metamorphic schist and phyllite.	Shallow shafts and pits. A few tons of about 4% Cu, 3.5 oz. Au/T and 8 oz. Ag/T shipped in 1924.	ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
8. Stella Maris No. 1 mine (De Silva & Allinio)	11S	2E	N. Cen. 36 Protracted	Mn	Psilomelane and wad, with pyrolusite, minor manganite, and calcite stringers in depth, in irregular replacements in folded and partly marbleized Paleozoic limestone along a bedding plane fault above a rhyolitic porphyry intrusion.	Surface stope, shaft and incline workings. Some 2,700 long tons of manganese ore averaging about 30-40% Mn shipped in 1939-1946 and 1954-1956.	Farnham et alia, 1961, p. 109-111
9. Stella Maris No. 2 mine (De Silva & Allinio)	11S	2E	N. Cen. 36 Protracted	Mn	Mixed hard and soft manganese oxides with some admixed hematite and calcite in replacements in Paleozoic limestone overlying quartzite.	Open cut and incline shaft workings. Some 540 long tons of sorted ore averaging about 27% Mn shipped in 1954-1955.	Farnham et alia, 1961, p. 111-112
XI. Coyote District (Coyote Mtns. and area N. of Quinlan and Coyote Mtns.)	16S	7-8E	----	Cu, Ag, Au, Mn, Zn, Ag	1. Partly oxidized copper, zinc and molybdenum mineralization in a faulted, contact metamorphosed Paleozoic limestone pendant in Laramide quartz monzonite intrusive. 2. Spotty and relatively weak oxidized copper mineralization along a fault zone cutting volcanics and sediments of Laramide age. 3. Narrow stringers and discontinuous lenses of manganese oxides along strong fracture or fault zones cutting Laramide age rhyolite.	Shallow cuts, pits, adits and shaft workings except for Roadside mine. About 710 tons of ore averaging 10% Cu, 0.03 oz. Au/T and 1.7 oz. Ag/T produced. Some 145 long tons of low grade Mn ore also shipped.	Wargo, 1954 Kurtz, 1955 Heindl, 1965 ABM file data
1. Black Hawk group (Drake Mng. Co.)	16S	7E	SE¼ 14	Mn	Discontinuous, narrow stringers of hard manganese oxides on fractures, and soft wad between fractures, along a fault zone cutting Tertiary rhyolitic volcanics.	Cuts and pits. Some 46 long tons of sorted 20% Mn ore shipped in 1955.	Farnham et alia, 1961, p. 116
2. Bonanza mine (SRK; Manzo, Death & Mitchell, Calvillo, Kerr)	16S	8E	W. Cen. 26	Cu, Mo, Zn, Ag	Partly oxidized pyrite, chalcopyrite, bornite, covellite, and chalcocite with some molybdenite, sphalerite, garnet, and epidote in small high grade pyrometasomatic bodies in a roof pendant of faulted metasomatized Paleozoic limestone along a contact with Laramide aplitic to pegmatitic quartz monzonite.	Shaft and adit operations. Worked sporadically from 1909 to 1951, producing some 700 tons of ore averaging about 10% Cu, 0.03 oz. Au/T and 1.7 oz. Ag/T.	Carrigan, 1971 ABM file data
3. Jean E group (Black Bear; Drake Mng. Co.)	16S	7E	SW¼ 13	Mn, Cu-, Zn-	Numerous fractures contain narrow, discontinuous, high grade veinlets of hard manganese oxides, with some soft wad between, along a wide fault zone cutting Tertiary rhyolitic volcanics. Copper-zinc mineralization in fracture zone to north of manganese outcrops.	Open cut, shaft, and pits. Some 100 tons of ore concentrated to 17.5 long tons of 43.5% Mn produced in 1954-1955.	Farnham et alia, 1961, p. 115-116

4. Roadside mine (St. Francis; Randolph and Huntington)	16S	8E	W. Cen. 11	Cu, Ag, Au, Hg	Disseminations, streaks, and fracture fillings of native copper, copper carbonates, oxides, and sparse sulfides, tetrahedrite, schwatzite, cinnabar and native mercury with quartz, calcite, and epidote in strongly altered and kaolinized Laramide andesitic volcanics and Cretaceous (?) arenitic sediments along a strong fault zone cut by cross-fracture zones. Deep oxidation (800 feet) and reported aplitic or pegmatitic quartz monzonite cut at depth.	Shaft workings. Originally developed prior to 1900 and further developed in 1920-1921. Recent diamond drilling. No production reported but ore said to average about 3% Cu in place with good silver and minor gold. Reportedly some spots of 0.8% Hg.	ABM file data
XII. Empire District (Empire Mtns.)	17-18S	17E	----	Pb, Zn, Cu, Ag, Au, Mo, W-, V-	1. Replacement deposits of partly oxidized lead, zinc, copper mineralization in Permian limestone and shale and in Cretaceous sedimentary formations, localized largely in badly faulted and overthrusted blocks and associated with strong faults and fissures. Some rhyolitic and dioritic dikes. 2. Contact metamorphic deposits of copper, tungsten, and minor lead and molybdenum along the contact of Paleozoic limestone and Laramide intrusive. 3. Weak base metal sulfides along fissure veins in Laramide intrusive and Paleozoic quartzite.	Numerous mines and prospects, mostly relatively shallow. Worked sporadically from about 1880 and through 1964, producing some 34,500 tons of ore containing about 172 tons of copper, 8,335 tons of lead, 258 tons of zinc, 740 ounces of gold, 206,400 ounces of silver and 76 tons of molybdenum.	Schrader, 1915, p. 141-152; 1917, p. 237-269 Feiss, 1929 Wilson, R. A., 1934 Alberding, 1938 Alexis, 1939 Mayuga, 1940 Wilson, E. D., 1941, 1951 Galbraith, 1940, 1949 Marvin, 1942 Butler, 1969 Finnell, 1971
1. California mine (Mann, Andrade; Bradford Development Co., Andrade, Schley & Dement, Tucson Transfer Co.)	17S	17E	Cen. 19	Cu, Pb, Ag, Au	Copper and lead carbonates and minor sulfides in a pyrometasomatic deposit in brecciated Paleozoic limestone along a much faulted contact with Laramide granitic intrusive.	Shaft, tunnel, and open pit operations. Worked intermittently since about 1880 to 1915, producing some 150 or more tons of ore averaging over 10% Cu, 5 oz. Ag/T, 2% Pb and 0.5 oz. Au/T.	Copper Handbook, 1904 Schrader, 1915, p. 150-151 Gillingham, 1936 Wilson, E. D., 1951, p. 51 ABM file data
2. Chief mine (Hiltano group, State of Maine group; Dick & Sullivan, Hilton, U. S. Magnetite Co.	18S	17E	NE ¼ 18	Pb, Zn, Ag, Cu-, Au-	Irregular replacement orebodies and chimneys containing cerussite, anglesite, smithsonite, malachite, aurichalcite, galena, plumbojarosite, and azurite in a gangue of calcite, aragonite, siderite, and quartz in badly faulted Permian limestone beds, overlying a Laramide dioritic dike and associated with a rhyolite porphyry dike. Orebodies controlled by intersecting fissures and faults.	Incline shaft operations. Worked intermittently from early 1900's to 1963, producing over 500 tons of ore averaging about 25% Pb, 8 oz. Ag/T, 0.5% Cu, and minor gold and zinc.	Schrader, 1915, p. 149 Feiss, 1929 Alexis, 1939 ABM file data
3. Copper Mtn. mine (Sullivan)	18S	17E	NW ¼ 8	Au, Ag, Cu-, Pb-	Oxidized, base metal sulfides in weathered, contact metamorphosed, Paleozoic limestone and quartzite along a contact with Laramide quartz monzonite.	Surface workings. Some 100 tons of 0.5 oz. Au/T and 19 oz. Ag/T ore shipped in 1903.	ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
4. Forty-nine (49) mine (Arizona Lead & Copper Co., Schley, Middleton Mines Inc., Hoff, Hilton, St. Louis Smltg. & Refng Co.)	18S	17E	NE¼ 18	Pb, Cu, Zn, Ag, Au	Oxidized, irregular, replacement orebodies containing base metal carbonates and minor sulfides with calcite, aragonite, quartz, and siderite in strongly faulted and fissured Permian limestone and quartzite beds parallel to a rhyolite dike. Ore controlled by fissure intersections.	Incline shaft and tunnel operations. Worked from early 1900's to 1937, producing some 2,000 tons of ore averaging about 18% Pb, 5% Cu, some Zn, and 7 oz. Ag and minor Au/T.	Schrader, 1915, p. 149 Feiss, 1929 Alexis, 1939 ABM file data
5. Gopher mine (Hiltano and State of Maine groups; Sullivan & Pantano, Hilton, McMahon)	18S	17E	NE¼ 18	Pb, Zn, Cu-, Ag, Au, Mo-	Anglesite, cerussite, wulfenite, copper carbonates and minor residual galena, chalcopyrite, and pyrite in irregular replacement orebodies and chimneys along fissure intersections in folded and faulted Permian limestone intruded by Laramide dikes.	Incline shaft operations. Worked irregularly since late 1800's to 1930, producing some 1,200 tons of ore averaging about 20% Pb, 3% Zn, 0.8% Cu, 1.5 oz. Ag/T and minor Au.	Schrader, 1915, p. 148 Feiss, 1929 Alexis, 1939 ABM file data
6. Graveyard mine (Hilton)	18S	17E	E. Cen. 9	Pb, Cu, Zn, Ag, Au	Small replacement bodies of lead, copper, and zinc carbonates and minor sulfides in faulted and folded Paleozoic limestone close to large Laramide intrusive.	Shallow workings. In 1941 and 1943 produced some 120 tons of ore averaging about 6% Pb, 2% Zn, 3% Cu, 19 oz. Ag/T and 0.1 oz. Au/T.	ABM file data
7. Hilton mine (Hilton, Jacobs, Tucson Ore Mllg. Co.)	18S	17E	SE¼ 8	Pb, Ag, Cu-, Au-	Irregular replacement orebodies of lead carbonate ore with minor galena in faulted Paleozoic limestone close to the contact with Laramide quartz monzonite intrusive.	Relatively shallow workings. Produced some 350 tons of ore averaging about 8% Pb, 2 oz. Ag/T, and minor Cu and Au in 1935, 1946-1947.	ABM file data
8. Hilton Tungsten claims	18S	17E	4, 8, & 9	W, Cu-, Pb-, Ag-, Mo-	Disseminated scheelite and powellite with sparse copper and lead carbonates in marmolized, garnetized, silicated, and epidotized Paleozoic limestone beds close to Laramide quartz monzonite intrusive.	Shallow workings. A small amount of 0.5-0.75% WO_3 ore produced in 1941. Small base metal production.	Wilson, 1941, p. 36 Dale et alia, 1960, p. 107-109 ABM file data
9. Jerome #2 mine (State of Maine group; Hilton, Tong)	18S	17E	NE¼ 18	Pb, Zn, Ag, Cu, Au	Lead, zinc, and minor copper carbonates with calcite, quartz, and jarosite in irregular replacement orebodies along the faulted contact of Permian limestone and quartzite close to Laramide intrusive dikes.	Shaft operations. Worked intermittedly from early 1900's to 1930's, producing some 250 tons of ore averaging about 30% Pb, 11% Zn, 0.6% Cu, 6 oz. Ag/T and minor gold.	Schrader, 1915, p. 149 ABM file data
10. Justice, Red Top and La Plata mines (Hilton, Driggs)	18S	17E	NE¼ 18	Pb, Ag, Cu-, Au-	Small irregular replacement orebodies of base metal carbonates in faulted Permian limestone with associated Laramide intrusive dikes.	Shallow operations. Worked sporadically from early 1900's to 1940, producing some 50 tons of ore averaging about 23% Pb, 6 oz. Ag/T and minor Zn, Cu and Au.	ABM file data

11. Lead Carbonate mine (Grindell, Hilton)	18S	17E	NE¼ 18	Pb, Ag, Zn-, Cu-, Au-	Lead carbonate with minor zinc and copper carbonates in irregular replacement orebodies in faulted Permian limestone close to contact with Laramide intrusive.	Shaft and tunnels. Worked since early 1900's and in 1924-1930, producing some 700 tons of ore averaging about 20% Pb, 3 oz. Ag/T and minor Cu, Zn and Au.	ABM file data
12. Lavery mine	17S	17E	SE¼ 31	Cu, Ag	Enriched copper carbonate in surficial deposit along contact of Laramide quartz monzonite intrusive and faulted Paleozoic and Cretaceous sedimentary formations.	Surface workings. Reportedly some 1,000 tons of copper-silver ore shipped in late 1800's or early 1900's.	Schrader, 1915, p. 152
13. Lone Mtn. mine (Hilton, Dubernac Mng. Co.)	18S	17E	SE¼ 8	Pb, Ag, Cu-, Zn-, Au-	Irregular replacement orebodies of base metal carbonates and minor sulfides in faulted Permian limestone invaded by Laramide intrusive dikes.	Shaft operation. Worked from early 1900's and in 1920's and 1930's, producing some 4,800 tons of ore averaging about 35% Pb, 6 oz. Ag/T, and minor Cu, Zn, and Au.	Mayuga, 1940 ABM file data
14. Montana mine (Black Diamond; Dement & Schley)	17S	17E	NW¼ 31	Cu, Ag	Oxidized copper mineralization along a fault zone in brecciated Paleozoic limestone.	Tunnel and incline operations. Worked in the 1890's, producing about 10 tons of 9% copper ore.	Schrader, 1915, p. 151-152
15. Prince mine (Hiltano group; Hilton)	18S	17E	Cen. 18	Pb, Ag, Zn-, Cu-, Au, Mo	Small pockets of cerussite, anglesite, smithsonite and minor malachite, azurite and galena along fissures in Permian limestone in close association with a dioritic intrusive sill or dike.	Shaft operations. Worked since early 1900's to 1930's, producing some 150 tons of ore averaging about 50% Pb, 10 oz. Ag/T, some Zn and minor Cu and Au.	Feiss, 1929 Alexis, 1939 Wilson, 1951, p. 54-55 ABM file data
16. Red Cloud mine (Driggs, Hilton)	18S	17E	NE¼ 18	Pb, Zn, Ag, Cu, Au	Lead and zinc carbonates and silver chlorides in a ferruginous, oxidized Paleozoic limestone bed.	Shallow workings. In late 1800's and early 1900's produced considerable high grade lead-silver ore.	Schrader, 1915, p. 150 ABM file data
17. State of Maine mine (Hilton; Eastern Pacific Mng. & Mlng. Co., Tong)	18S	17E	NE¼ 18	Pb, Zn, Ag, Cu-, Au-	Zinc and lead carbonate replacement orebodies in Permian limestone.	Shallow operations. Worked in early 1900's and 1939-1943, producing some 100 tons of ore averaging 10% Pb, 6 oz. Ag/T, some Zn and minor Cu and Au.	ABM file data
18. Total Wreck mine (Empire Mng. & Development Co., Vail, Schley, Adams & Saxby, Gardner & Young, Torres)	18S	17E	E. Cen. 3	Pb, Ag, Cu, Mo, Au-, Mn-, V	Cerussite, wulfenite, vanadinite, cerargyrite, malachite, azurite, chrysocolla and minor copper and lead sulfides in irregular replacement orebodies in badly faulted Permian limestone beds intruded by Laramide diorite stringers and dikes.	Shafts and tunnels. Worked from 1880's to 1940, producing some 14,000 tons of ore averaging about 8% Pb, 7 oz. Ag/T and minor Cu and Au. Some 8 tons of molybdenum concentrates shipped in 1918.	Schrader, 1915, p. 142-147 Aberding, 1938 Wilson, 1951, p. 52-53 ABM file data
19. Verde Queen mine (Verde Queen Mng. Co., Hilton)	18S	17E	W. Cen. 17	Pb, Ag, Zn, Cu-, Au-, Mo-	Base metal carbonates with silver chlorides, wulfenite, and iron oxides in irregular replacement orebodies in Permian limestone.	Shaft and tunnel workings. Produced sporadically, from late 1800's to 1928, some 3,000 tons of ore averaging about 23% Pb, 5 oz. Ag/T and minor Cu & Au.	Schrader, 1915, p. 148-149 Alexis, 1939 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
XIII. Greaterville District	19S	15-16E	----	Au, Pb, Ag, Cu, Zn	1. Relatively coarse and angular flakes and nuggets of gold occurred in irregularly distributed gravels, both in present and past stream channels and terraces. Source was scattered mineralized veins in the mountains. 2. Scattered quartz and calcite veins with free gold or oxidized base metal sulfides in block faulted Cretaceous sediments and Precambrian granite that was intruded by Laramide quartz latite and associated dikes.	Numerous placer operations and relatively small mines. Placer production since 1870's by various estimates and records is some 28,500 oz. placer gold with about 6,000 oz. of silver. Mine production would be some 2,000 tons of ore containing about 20 tons of copper, 170 tons of lead, 16 tons of zinc, 390 ounces gold and 12,660 ounces silver.	Hill, 1910 Schrader, 1915 Heatwole, 1966 Drewes & Finnell, 1968 Gross, 1969 Drewes, 1969a, 1969b, 1970, 1971a, 1971b, 1971c, 1972a, 1972b Stewart, 1971 ABM file data
1. Arrastra mine (Holliday)	19S	15E	NW¼ 12	Au, Pb, Ag, Cu	Partially oxidized galena, pyrite, and minor chalcopyrite with free gold in a honeycombed, limonite-stained, quartz vein bordering a Laramide quartz latite dike cutting Precambrian granodiorite.	Shallow shaft and open cut. Worked prior to 1900 and in 1932, producing a small tonage of high grade Au ore with minor Pb, Ag and Cu.	Schrader, 1916, p. 156 ABM file data
2. Buckhorn mine (Wisconsin; Hill, Pallanes)	19S	15E	E. Cen. 14	Ag, Cu-, Pb-	Partially oxidized pyrite, galena, and chalcopyrite with free gold in an oxidized zone in an iron-stained quartz vein cutting Precambrian granodiorite.	Shallow shaft, incline and tunnel. Worked in late 1880's and in 1936-1937, producing a small tonnage of Au, Ag, Pb, and Cu ore.	Schrader, 1915, p. 157 ABM file data
3. Comstock mine group (Arizona Comstock lode; L. & R., Comstock Mines Co., Hurlbut, Jones & Clyne, Arizona Comstock Mng. Co.)	19S	15E	NW¼ 25	Pb, Cu, Ag, Au	Irregular quartz veins with spotty, partially oxidized, lead and copper mineralization associated with Laramide quartz latite plugs and dikes cutting Cretaceous sediments and volcanics.	Tunnel and open cuts. Prospected and worked intermittently from late 1800's to 1940. Produced some 100 or more tons of ore averaging about 30% Pb, 5% Cu, 15 oz. Ag/T and 0.3 oz. Au.	ABM file data
4. Conglomerate mine (Anderson; Midland Copper Co., Phelps Dodge Corp., Snyder Mng. & Mllg. Co.)	19S	15E	So. Cen. 36	Pb, Ag, Au, Cu-	Irregular and lensing quartz vein with partially oxidized lead and copper mineralization in a strongly brecciated and silicified fault zone along a contact of Precambrian granite and Paleozoic limestone.	Shaft and tunnel operations. Worked sporadically from early 1900's to 1955, producing some 1,000 tons of ore averaging about 10% Pb, 8 oz. Ag/T and minor Cu and Au.	Schrader, 1915, p. 154 ABM file data
5. Enzenberg mine (Mountain King)	19S	15E	NE¼ 23	Pb, Zn, Ag, Au, Cu-	Partially oxidized quartz vein associated with a Laramide rhyolite dike cutting Precambrian granite. Contained spotty pyrite with minor chalcopyrite on footwall and irregular banded galena, sphalerite and minor pyrite on hanging wall.	Tunnel workings. A small tonnage of high grade Pb-Ag ore shipped in late 1800's.	Schrader, 1915, p. 154

(Kentucky, Boston, Empire, Graham, Louisiana, Harshaw, Hughes, Nigger, St. Louis, Ophir, Los Pozos, Colorado, Chispa, and Sucker Gulches; Stetson Co., El Oro Mng. Co., Greaterville Dredge Gold Mng. Co.)		16E	26 So.½ 17-19 So.½ 29, 30 NE¼ 31		nor combined silver and some attached galena in medium size gravel along recent and older buried channels and terraces close to the mountain front.	early 1900's and small and sporadic since then. Estimated production of some 30,000 oz. Au or more with about 6,000 oz. Ag.	Schrader, 1915, p. 158-166 ABM file data
7. Hancock mine	19S	15E	E. Cen. 14	Pb, Zn, Ag, Cu-, Au-	Irregular quartz vein containing spotty, partially oxidized, base metal sulfides and rich, near surface, cerussite and cerargyrite. Vein cuts Precambrian granodiorite.	Shaft workings. In late 1800's produced a small tonnage of high grade Pb-Ag ore.	Schrader, 1915, p. 154-155
8. Quebec mine (Quebec Consolidated Mng. Co., Hurlbut & Christman)	19S	15E	NE¼ 26	Pb, Ag, Zn, Au, Cu-, Ba-	Banded, iron-stained, quartz-calcite-barite vein containing irregular pockets of partially oxidized galena, sphalerite, pyrite, and chalcopyrite along a Tertiary quartz-latite stock intruding Cretaceous sedimentary formations.	Shaft and tunnel operations. Worked in 1880's and sporadically up to 1940, producing a small tonnage of Pb-Ag ore with minor Au and Cu.	Schrader, 1915, p. 155 ABM file data
9. St. Louis mine (Morningstar; Liberty Silver Mines Co., Otey & Forney, Martinez, St. Louis Mines, Inc.)	19S	15E	NE¼ 25	Pb, Zn, Ag, Au, Cu	Spotty, partially oxidized, argentiferous galena with sphalerite, minor pyrite, and minor chalcopyrite in a complex stockwork of quartz veins and stringers, and Tertiary quartz latite dikes, in a shear zone cutting altered Cretaceous sediments. High grade pockets of gold in the iron oxide capping.	Tunnel and shaft workings. A sporadic production from 1875 to 1946 of some 300 or more tons of ore averaging about 6% Pb, 7% Zn, 11 oz. Ag/T, 0.5 oz. Au/T and 1% Cu.	Schrader, 1915, p. 155-156 Stewart, 1971 ABM file data
10. Yuba mine	19S	15E	SW¼ 23	Pb, Zn, Ag, Cu, Au	Quartz-calcite-barite veins, banded and with comb texture, containing partially oxidized galena, sphalerite, and chalcopyrite and small pockets of argentite in sheared Precambrian granodiorite along a strong fault zone.	Incline shaft. Worked in the 1880's, producing some 50 or more tons of high grade Pb-Ag-Au ore.	Hill, 1910 Schrader, 1915, p. 156-157
XIV. Growler District	14S	7W	----	Cu, Pb, Ag, Au-	1. Oxidized copper and lead mineralization with minor sulfides in small outcrops of fractured and metamorphosed Paleozoic sedimentary formations on or near contacts with Mesozoic intrusive granitic rocks. 2. Small spotty superficial gold occurrences in fracture and fault zones in volcanics.	One moderate size and several prospects with tunnels, shafts and pits. Some 50 tons of ore containing about 6 tons of copper, 200 ounces silver and a few ounces gold were produced sporadically from prior to 1900 to 1949.	Bryan, 1925, p. 195-196 Darton, 1925, p. 288 ABM file data
1. Growler mine (Copper Hill group; Boston Gold-Copper Co., Colonial Copper Co., Growler Copper Co., Bell, Long, Ferrell & Gow)	14S	7W	NE¼ 34	Cu, Pb, Ag, Au-	Copper carbonates, silicates and minor chalcocite in a strong iron gossan near the contact of Paleozoic limestone and quartzite with diabase. Sulfides reported in depth.	Tunnel and shaft workings. Possibly some 45 tons of ore averaging about 3% Cu, 5 oz. Ag/T and minor Au produced sporadically since early 1900's.	Copper Handbook, 1909 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
XV. Gunsight (Meyer) District (Gunsight Hills)	14-15S	4W	----	Ag, Au, Pb, Zn, Cu, W, Mo, Ba	Spotty base metal mineralization and local tungsten, oxidized and enriched locally with silver and gold, in quartz, calcite and barite veins and lenses in fault and fissure zones cutting Laramide granitic intrusive.	Numerous, generally small and shallow, tunnels, shafts, and pits. Prospected and worked sporadically since the early 1870's. Estimated and reported production would be over 15,000 tons of ore containing about 776 tons of lead, 100,600 ounces of silver, 400 ounces of gold and minor copper. Only a few tons of scheelite ore produced.	ABM file data
1. Ajo Gunsight mine (Ajo Gunsight Mng. Co.)	15S	4W	W Cen. 11	Au, Ag-, Cu-, Mo-, W-	Spotty oxidized copper mineralization with near surface enrichment in gold and silver in quartz-calcite stringers along a fissure zone in decomposed Laramide granitic intrusive, close to the contact with Tertiary basaltic andesite.	Shaft workings. Originally prospected in late 1880's. Produced a few tons of gold ore in early 1920's.	Mine Handbook, 1920 ABM file data
2. Black Bess mine group (Submarine group; Black Bess Consolidated Gold Mng. Co., Black Bess Mng. Co., Ajo-Papago Gold Mng. Co.	15S	4W	SW ¼ 1 SE ¼ 2	Au, Ag-, Cu-, W-, Mo-	Spotty oxidized copper mineralization with minor scheelite and powellite, enriched in gold near the surface, in quartz-calcite stringers along a fissure zone in decomposed Laramide granitic rock near the contact with Tertiary basaltic andesite.	Shaft workings. Originally prospected in late 1880's but worked and produced sporadically some 80 tons of gold ore between 1918 and 1934.	Mines Handbook, 1920 ABM file data
3. Bullion Bar mine group (Mountain Lion group; Bullion Bar Mng. & Development Co., Gunsight Detroit Mng. & Mlng. Co.)	15S	4W	NE ¼ 11	Au, Ag-, Cu-, W	Spotty oxidized copper mineralization, enriched in gold near the surface, in quartz stringers along a fissure zone in decomposed Laramide granitic rock at the edge of a Tertiary basaltic andesite cover. Some spotty scheelite.	Shaft and pit workings. Prospected in late 1880's but worked and produced a few tens of tons of gold ore in 1917-1918.	Mines Handbook, 1920 ABM file data
4. Gunsight mine (Carthage Silver Mng. Co., Fernald & Scott, Gunsight Mng. Co., Butler, Graham & Dickey, Fisher Mng. Co.)	14S	4W	Cen. 16	Pb, Ag, Zn-, Cu-, Ba	Network of lensing quartz-calcite-barite veins with spotty, partly oxidized lead, zinc, and copper mineralization along intersecting fissure zones in Laramide granitic rock.	Shaft and tunnel workings. Prospected as early as 1870's and reportedly produced some 15,000 tons of $40/T Pb-Ag ore in 1881-1884. Sporadic production of some 120 tons of ore averaging 22% Pb, 5 oz. Ag/T and oz. Au/T since 1918.	Mines Handbook, 1920 ABM file data
5. Lilly, Saguaro, and Empire mines (Bradley, Sullivan	15S	4W	No. Cen. 3	Au, Ag	Spotty, small, enriched pockets of gold and silver values in oxidized quartz stringers along a fissure zone in decomposed Lara-	Shaft and surface workings. Produced some 15 tons of ore averaging about 1 oz. Au/T and	ABM file data

6. Little Chief mine (Denning Mng. Co.)	14S	2W	SE¼ 19	Quartz	Strong, irregular quartz veins cutting Laramide granitic intrusive.	Open cut workings. Supply silica flux for Ajo smelter.	[illegible]
7. Lucky Strike mine (Sands)	14S	4W	NW¼ 35	Au, Ag, Cu-	Spotty pockets of enriched gold with minor silver and oxidized copper mineralization in quartz stringers on fissures in decomposed Laramide intrusive.	Shallow shafts and pits. Some 15 tons of ore averaging about 0.5 oz. Au with minor Ag and Cu produced in 1935.	ABM file data
8. Sunset Limited mine group (Yellow Astor, Wonder; Bramwell & Sullivan, Gunsight Gold & Tungsten Mng. Co., Jones, Greer, Myers, Turners)	14S	4W	SW¼ 25	Au, Ag, W	Shear zones with lenticular, oxidized iron-stained, quartz veins containing pockets of enriched gold, minor silver, and spotty scheelite cutting a weathered Laramide granitic pediment.	Shaft and open cut workings. Prospected and worked sporadically since late 1800's. Probably some 50 tons of 1 oz. Au ore and a few tons of scheelite ore produced.	Wilson, 1941, p. 41 ABM file data
9. Surprise mine (New Gunsite; Gunsight Mng. Co., Sparks)	14S	4W	SE¼ 16	Au, Pb-, Ag-	Oxidized quartz stringers and lenses with weak and spotty lead mineralization and small enriched pockets of gold in Laramide granitic intrusive.	Shaft and tunnel workings. A few tons of high grade gold ore shipped in 1932.	ABM file data
XVI. Helvetia-Rosemont Districts (Northern and central Santa Rita Mtns.)	17-18S	15-16E	----	Cu, Pb, Zn, Ag, Au, W-, Mo-, Limestone, Marble	1. Irregular, partly oxidized, pyrometasomatic replacement copper deposits with subordinate and spotty lead, zinc, tungsten, and molybdenum mineralization in thrust-faulted, sheared, and altered Paleozoic limestone and quartzite, and in Cretaceous limy beds. Controlled by structures or bedding planes in contact with or close to Laramide quartz latite porphyry stocks and dikes. Locally the intrusive contains disseminated copper mineralization. 2. Spotty and irregular, partly oxidized, base metal sulfides with some scheelite along quartz-shear zones or breccia zones in Precambrian and Laramide granitic intrusives. 3. Paleozoic limestones, locally metamorphosed to marble.	Fifty or more small to medium size mines and prospects have been opened or worked since the early 1880's. Total estimated and reported production through 1972 would be some 430,000 tons of ore containing about 17,500 tons of copper, 350,000 ounces of silver, 680 tons of zinc, 260 tons of lead and a minor amount of gold, molybdenum and tungsten. An indefinite amount of limestone and marble have been produced.	Schrader, 1915, p. 91-141 Schrader, 1917 Thomas, 1931 Lee & Borland, 1935 Dunham, 1937 Popoff, 1940 Jones, 1941 Johnson, 1941, 1949 Creasey & Quick, 1943, 1955 Browne, 1958 Schafroth, 1965 Drewes, 1969a, 1969b, 1971a, 1971c, 1972a, 1972b, 1972c Drewes & Finnell, 1968 Finnell, 1971
1. Andrada Marble quarry	17S	16E	NW¼ 21	Crushed marble	Faulted and metamorphosed Paleozoic limestone.	Open quarry. Indefinite amount of stone taken for roofing granules and decorative purposes.	ABM file data
2. Blow Out mine (Cardiello & Serasio, Aricu Mng. Co.)	17S	16E	NW¼ 21	Cu, Ag	Spotty chrysocolla, malachite, and minor pyrite and chalcopyrite with sooty magnetite along fault and fracture intersections in a silicified, garnetized, and epidotized Paleozoic limestone block engulfed in Laramide intrusives.	Tunnels, shafts, and open cuts. Some 150 tons of ore averaging about 3.5% Cu and 2 oz. Ag/T produced in mid-1950's.	Browne, 1958 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
3. Blue Jay-Good Friday mines (Iowa Mng. & Development Co., Good Friday Mng. Co.; Corzelius, Taggert & Drunzer)	18S	15E	W. Cen. 12	Ag, Au, Pb-, Cu-, W-	Tabular replacement deposits of argentite, argentiferous galena, and pyrite, oxidized near the surface, with rich cerargyrite and free gold, along steep bedding planes and lamprophyric dikes in Permian limestone bordering Laramide intrusive quartz monzonite. Some copper staining and scheelite in area.	Tunnel, shafts and open cuts. Worked sporadically from 1881 to 1939, producing some 2,300 tons of ore averaging about 21 oz. Ag/T, 1 oz. Au/T, and minor Pb. High grade Ag-Au ore in surface cuts.	USGS Min. Res., 1907, p. 175 Schrader, 1915, p. 132-134 Dunham, 1937 Johnson, 1941 ABM file data
4. Broad Top mine (Lewisohn Copper Corp.)	18S	15E	E. Cen. 24	Cu, Ag, Au-, W-, Mo-	Irregular copper mineralization, largely oxidized, in strongly brecciated Permian quartzite, silicated Permian limestone and bordering Laramide quartz latite porphyry along a fault zone. Some disseminated scheelite and spots of molybdenite.	Tunnels from adjoining Exile claim. In late 1950's produced some 3,600 tons of ore averaging better than 5% Cu and 10 oz. Ag/T. Minor Au.	Heyman, 1958 ABM file data
5. Bulldozer mine (Tip Top Copper Co., Chamrod, Bulldozer Mines Co., Owens, Rainey)	18S	15E	No. Cen. 15	Cu, Ag, Au-	Copper mineralization, mainly malachite and azurite, with minor chrysocolla, tenorite, and native copper, in small, thin, isolated, thrust faulted, crushed blocks of silicated Pennsylvanian (?) limestone in contact with Laramide granitic intrusive.	Shafts, tunnels, and open cuts. Productive intermittently from 1879 to early 1950's. Probably yielded some 38,000 tons of ore averaging about 5% Cu, 1 oz. Ag/T, and minor Au.	Schrader, 1915, p. 124 ABM file data
6. C. & H. mine group (Copper Alex, Black Horse, Nevada, Green Monument, Coyote)	17S	16E	21	Cu, Ag, Au-	Sporadic and relatively weak copper carbonates and minor sulfides, pyrite, scheelite, and powellite in small, irregular pyrometasomatic deposits in Cretaceous brecciated conglomerates and faulted Paleozoic limestones in contact with dikes and stocks of Laramide quartz monzonite.	Shallow shafts and adits. Possibly some 100 tons of hand-picked copper ore averaging 3-5% Cu produced prior to 1900 and 3 tons of 1% + WO_3 ore in 1955.	Schrader, 1915, p. 136-137 Lee & Borland, 1935 Dale et alia, 1961, p. 111-112
7. Copper World mine (Black Horse shaft; Helvetia Copper Co., Michigan-Development Co., Helvetia Copper Co. of Arizona, Blankenship, Santa Rita Mng. Co.)	18S	15E	SW ¼ 13 NW ¼ 24	Cu, Ag, Au, W-	Chalcopyrite with minor chalcocite; copper carbonates, oxides and sulfate; and some spotty disseminated scheelite and molybdenite along fractures, in irregular pyrometasomatic replacements, and disseminated, in silicated and locally pyritized Pennsylvanian limestone and underlying Cambrian quartzites along a strong fracture zone accompanying a thrust fault plane.	Shaft workings. A major producer, mainly from 1899 to 1916, with some 42,000 tons of ore averaging better than 5% Cu, about 1 oz. Ag/T, and minor Au.	Schrader, 1915, p. 99-106 Johnson, 1941 Jones, 1941 Creasey & Quick, 1955, p. 314-315 Heyman, 1958 ABM file data
8. Crown claims Nos. 1 & 2 (Cardiello)	17S	16E	No. Cen. 30	Pb, Zn, Ag, Cu-	Spotty, mostly oxidized, lead, zinc, and minor copper mineralization along a shear zone in Laramide quartz monzonite.	Shallow workings. Produced some 90 tons of ore averaging about 10% Pb, 6% Zn, and 8 oz. Ag/T in 1947-1948.	ABM file data

9. Cuprite mine group (Cuprite Mng. & Smltg. Co.)	17S	16E	NW¼ 28	Cu, Ag, Mo-, Zn-, Pb-	Copper sulfides with minor carbonates, silicates, and oxides and spotty minor molybdenum, sphalerite, and galena in irregular pyrometasomatic replacement deposits in silicated Paleozoic marble and along fault and fracture zones in overlying Cretaceous sediments in a thrust-faulted and strongly fractured block in contact with Laramide intrusive.	Shaft and minor workings. Produced sporadically from 1899 to 1915 some 2,000 tons of ore averaging about 6% Cu and 0.6 oz. Ag/T.	Schrader, 1915, p. 134-136 Lee & Borland, 1935 Browne, 1958 ABM file data
10. Daylight-Narragansett mines (York, Hilo, Narragansett Bay; Lewisohn Copper Co., Brown, Ramsdell, Narragansett Mines Co., Holderness, Steinfeld & Co., Bennett, Wilson Mng. Inc.)	18S	15E	SE¼ 24 NE¼ 25	Cu, Ag, Pb, Zn, Ag, Au-	Copper carbonates with minor chalcopyrite, chalcocite, pyrite, and local areas of lead and zinc mineralization in irregular pyrometasomatic replacement orebodies in intensely silicated and crushed Paleozoic limestone along folded series of thrust-faulted block segments.	Tunnels and shafts. The Narragansett mine worked intermittently from late 1870's to 1961 and has produced over 90,000 tons of ore averaging over 4% Cu and 0.5 oz. Ag/T. The Daylight mine produced, mainly from 1943-1951, some 4,000 tons of ore averaging about 5% Cu, 5% Zn, 3% Pb and 1 oz. Ag/T.	Schrader, 1915, p. 128-129 Mines Handbook, 1918 Creasey & Quick, 1955, p. 318, 319 ABM file data
11. Dimple mine group (Noscut mine; Noscut Mng. Co.)	17S	16E	E. Cen. 28	Pb, Zn, Ag, Cu-, Au- (Sb)	Irregular, lensing replacement deposits of partly oxidized galena, sphalerite, pyrite, and minor chalcopyrite, tetrahedrite, bournonite, and pyrrhotite along fractures and faults in chloritized and sericitized Cretaceous sediments and volcanics.	Shallow tunnel workings. Originally opened in 1915 with sporadic production through 1949 of some 180 tons of ore averaging about 13% Pb, 11 oz. Ag/T and minor Cu and Zn.	Lee & Borland, 1935 Browne, 1958 ABM file data
12. Eclipse mine group (Olcott or Triangle, Eldon or Backbone; Steinfeld & Co.)	18S	15E	So. Cen. 24 No. Cen. 25	Cu, Pb, Ag, Au-	Irregular ferruginous gossan zone with copper and lead carbonates underlain locally by disseminated and massive chalcocite and argentiferous galena in pyrometasomatic replacement deposits along faulted contact of Paleozoic quartzite and silicated limestone in thrust-faulted block segments.	Shaft workings. Probably produced a few 100 tons of ore, mainly prior to 1900, averaging about 10% or more Cu and some high grade Pb-Ag ore.	Schrader, 1915, p. 118 ABM file data
13. Elgin mine group (General, Dan; Helvetia Copper Co., Michigan-Arizona Development Co., Helvetia Copper Co. of Ariz., Chilson, Elgin Mng. Co., Helvetia Mng. Trust, McFarland & Hullinger)	18S	15E	NW¼ 23	Cu, Ag, Au	Irregular pyrometasomatic replacement lenses of copper carbonates and sulfides, controlled largely by faults, fractures, and favorable silicated Paleozoic limestone, in thrust faulted and deformed blocks.	Shaft and tunnel workings. Produced some 40,000 tons of ore averaging about 2% Cu and 0.3 oz. Ag/T in 1899-1902 and sporadically in 1947-1960.	Heyman, 1958 ABM file data
14. Falls claim (Lewisohn Copper Co.)	18S	15E	Cen. 25	Cu, Ag	Copper carbonates and sulfide in irregular pyrometamorphic lenses in thrust-faulted segments of silicated Paleozoic limestone, cut by cross faulting.	Shallow shaft and tunnel. Some 170 tons of ore averaging about 5% Cu and 0.3 oz. Ag/T produced in 1958-1959.	ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
15. Franklin, Cushing & Marion mine group (Rosemont group; Lewisohn Estate)	18S	15E	So. Cen. 25	Cu, Ag, Au-	Relatively small, spotty, irregular, and shallow pyrometasomatic deposits of copper carbonates and minor sulfides in thrust-faulted, silicated, Paleozoic limestone blocks.	Tunnel workings. Produced some 150 tons of ore averaging about 4% Cu and 2 oz. Ag/T in 1944.	ABM file data
16. Golden Gate mine group (U. S. Grant; Holliday, Ramsey, Hunnell, Halbert, Nail, Arizona Mng. & Refng. Co.)	19S	15E	SE¼ 1 NE¼ 12	Au, Ag, Pb, Zn-, Cu-	Irregular quartz stringers, lenses, and bunches containing partly oxidized base metal sulfides in fissure veins and replacements along thrust fault contacts of Paleozoic limestone and Cretaceous sedimentary formations.	Numerous small shafts, tunnels, adits, and open cuts. Worked sporadically from 1880's to 1969, producing some 200 tons of ore averaging about 1 oz. Au/T, 3 oz. Ag/T, 4% Pb and minor Zn and Cu.	Schrader, 1915, p. 132 Heatwole, 1966 ABM file data
17. Heavy Weight mine (Light Weight; Helvetia Copper Co., Michigan-Arizona Development Co., Helvetia Copper Co. of Arizona)	18S	15E	SE¼ 14	Cu, Ag, Au- (Be)	Irregular, pyrometasomatic, replacement orebodies containing copper carbonates and sulfides in silicified, garnetized, sheared, and thrust-faulted Paleozoic limestone along a contact with Laramide quartz latite porphyry intrusive.	Tunnel workings. Produced some 3,000 tons of ore averaging about 5% Cu and 1.5 oz. Ag/T from late 1880's to 1902.	Schrader, 1915, p. 110-113 Johnson, 1941 Creasey & Quick, 1955, p. 320 Heyman, 1958 Warner et alia, 1959, p. 103 ABM file data
18. Isle Royal mine group (Helvetia Copper Co., Michigan-Arizona Development Co., Helvetia Copper Co. of Arizona)	18S	15E	NW¼ 24	Cu, Ag, Au-	Copper carbonates and sulfides with cupriferous pyrite in deeply oxidized, irregular, pipe-like replacement orebodies in an altered Paleozoic limestone block along a thrust fault. Some high grade pulverulant mixture of copper carbonate and chalcocite occurred along strong fracture zones in crushed and silicified limestone.	Shaft workings and surface cuts. From early 1880's to 1912 sporadic production of some 30,000 tons of ore averaging about 3% Cu and 1 oz. Ag/T.	Schrader, 1915, p. 108-110 Johnson, 1941 Creasey & Quick, 1955, p. 320 ABM file data
19. King-Exile mine group (Rosemont Copper Co., Rosemont Development Co., Lewisohn Estate, Daylight Mng. Co., Maffeo, Allison Steel Co., Chilson)	18S	15E	E. Cen. 24	Cu, Ag, Zn-, Pb-, Au, Mo-, W-, U- (Be)	Copper carbonates, oxides, and sulfides with some minor zinc and lead mineralization in bedded, pyrometasomatic orebodies and in massive fracture fillings in silicated Permian limestone along the contact with Laramide quartz latite porphyry stock. Sparsely disseminated scheelite, pods of molybdenite in late quartz stringers and small pockets of pitchblende.	Adit and open cut workings. Over 55,000 tons of ore averaging about 6% Cu, 1 oz. Ag/T and minor Zn and Pb produced between early 1900's and 1959.	Schrader, 1915, p. 119 Johnson, 1941 Creasey & Quick, 1955 Miller, 1955, AEC, PRR A-37 Heyman, 1958 Michel, 1959 Warner, et alia, 1959, p. 103 ABM file data
20. Leader mine (Helvetia Copper Co., Michigan-Arizona Development Co., Helvetia Copper Co. of Arizona, Molybdenum Inc., Burney, Helvetia Mng. & Mlg. Co.)	18S	15E	NW¼ 24	Cu, Ag, Mo, W-, Zn-, Au-	Banded seams and irregular lenses of pyrometasomatic replacement ore containing copper carbonates and sulfides, with considerable cupriferous pyrite, in shattered, silicated, thrust-faulted Paleozoic limestone along the thrust fault. Local spotty molybdenite and disseminated scheelite and powellite. Some minor sphalerite.	Shaft and adit workings. Produced sporadically some 30,000 tons of ore averaging about 6% Cu, 1 oz. Ag/T and minor Au. In 1934, about 13 tons of 50% MoS_2 concentrate shipped.	Schrader & Hill, 1910, p. 156-157 Schrader, 1915, p. 106-108 Johnson, 1941 Wilson, 1941, p. 36 Creasey & Quick, 1955, p. 315-318 Heyman, 1958 Warner et alia, 1959, p. 103 ABM file data

21. Mohawk mine (Rosemont Copper Co., Rosemont Development Co., Scott, Lewisohn Estate)	18S	15E	NW¼ 23	Cu, Ag, Zn-, Au- (Be)	Chalcopyrite with minor pyrite and sphalerite, and copper and zinc carbonates, in small, irregular, pyrometasomatic orebodies in xenolith of silicated Paleozoic limestone in Laramide quartz latite porphyry stock within a thrust fault klippe.	[illegible] from surface in late 1880's. Total production from 1880's and 1940's would be some 50,000 tons of ore averaging about 3% Cu and minor Ag and Zn.	Johnson, 1941 Creasey & Quick, 1955, p. 320 Heyman, 1958 Warner et alia, 1959, p. 103 ABM file data
22. Muheim-Grafen mine (Muheim)	18S	16E	NW¼ 31	Cu, Ag, Au-	Oxidized copper mineralization associated with a quartz latite porphyry intrusive dike in Cretaceous sediments.	Shaft and adit workings. In 1960 produced some 130 tons of ore averaging about 3.5% Cu and 2 oz. Ag/T.	ABM file data
23. Newman mine (Lewisohn Estate, MacFarlane, Chilson)	18S	15E	SW¼ 14	Cu, Ag, Au-	Copper carbonates and sulfides in irregular, pyrometasomatic, replacement deposits in silicated Paleozoic limestone intruded by quartz latite porphyry within a thrust fault klippe.	Tunnel and open cuts. From 1943 to 1948 produced some 6,000 tons of ore averaging about 2% Cu and 0.5 oz. Ag/T.	ABM file data
24. New York mine (Beuhman; McMahon, New York Copper Co.)	17S	16E	NE¼ 29	Pb, Cu, Ag, Zn, Mo (Sb, F)	Partly oxidized lead, copper, and zinc sulfides with quartz, calcite, fluorite, pyrite, and manganese and iron oxides in shear zones in pyrometamorphosed Paleozoic limestone along the contact with Laramide quartz monzonite intrusive.	Tunnels and shaft. Worked from 1890's and produced sporadically in early 1900's some 50-100 tons of ore averaging about 6% Pb, 4% Cu and 20 oz. Ag/T.	Schrader, 1915, p. 137-138 Lee & Borland, 1935 Browne, 1958 ABM file data
25. Old Dick mine (American; Helvetia Copper Co., Michigan-Arizona Development Co., Helvetia Copper Co. of Arizona, Helvetia Oil Co., Chilson)	18S	15E	No. Cen. 23	Cu, Ag, Pb-, Zn-, Au-	Irregular pyrometasomatic replacement orebodies and pipes with copper carbonates, oxides, and sulfides, minor lead and zinc mineralization, and iron oxides in a broken and silicated Paleozoic limestone block intruded by quartz latite porphyry, in a thrust fault klippe.	Shafts and cuts. One of oldest mines, producing sporadically from late 1870's to 1907 and 1938 to 1952, a probable total of at least 20,000 tons of ore averaging about 5% Cu, 1 oz. Ag/T and minor Pb and Au.	Schrader, 1915, p. 113-114 Johnson, 1941 Creasey & Quick, 1955, p. 320 Heyman, 1958 ABM file data
26. Old Pap-Old Put mines (Rosemont Copper Co.)	18S	15E	Cen. 25	Cu, Ag	Copper carbonates, oxides, and silicates in silicified, shattered, crushed and locally iron stained Paleozoic quartzite along cross-faults cutting thrust-faulted Paleozoic formations.	Tunnel workings. Probably some 2,000 tons of ore averaging about 5% Cu produced in late 1800's and early 1900's.	Schrader, 1915, p. 131-132
27. Omega and Omega Extension mines (Zeckendorf, Omega Copper Co., McKay)	18S	15E	W. Cen. 24	Cu, Ag, Pb-, Zn-, Au-, Mn	Partly oxidized copper and minor lead-zinc mineralization, largely soft and earthy with manganese and iron oxides, and local massive chalcopyrite and pyrite, in replacement bodies with garnet-magnetite gangue along a fault zone between Paleozoic limestone and Precambrian granodiorite.	Tunnel, shaft, and open cuts. One of earliest mines, producing sporadically some 7,000 tons of ore averaging about 6% Cu, 1 oz. Ag/T and minor Pb from 1880's to 1920.	Schrader, 1915, p. 115-117 Johnson, 1941 Creasey & Quick, 1955, p. 320 ABM file data
28. Oregon copper, Chicago, and Coconino mines (Rosemont Copper Co., Rosemont Development Co., Chilson)	18S	15E	No. Cen. 36	Cu, Ag, Pb-, Zn-, Au-	Copper carbonates, oxides, silicates, and sulphides with minor lead and zinc mineralization in fault, fracture, and bedding-controlled pyrometasomatic replacement orebodies in crushed and silicated Paleozoic limestone intruded by quartz latite porphyry in thrust-faulted Paleozoic formations.	Shafts, tunnels, and open cuts. Rich surface ores mined in 1890's and sporadic production of some 3,000 tons of ore averaging about 10% Cu and 1 oz. Ag/T.	Schrader, 1915, p. 129, 130 Thomas, 1931 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
29. Pauline mine (Hayward's Sulphide mine; Andrade)	17S	16E	Cen. 27	Pb, Ag, Cu, Zn, Au-, Mo- (Sb)	Banded, partly oxidized, lead-zinc-copper mineralization, with spotty molybdenum, in irregular pyrometasomatic replacement deposits in a dark, garnetized, Cretaceous limestone bed along faulting and in contact with quartz latite porphyry intrusive.	Shaft and surface workings. From 1882 to 1952, some 150 tons of ore averaging about 2% Pb, 2% Cu, 1 oz. Ag/T and 0.3 oz. Au/T produced sporadically.	Schrader, 1915, p. 138 Lee & Borland, 1935 ABM file data
30. Peach mine (Rosemont Copper Co., Rosemont Development Co., Scott & Hyde, Chilson and Green, Louden Mng. Co.)	18S	15E	SE¼ 15	Cu, Zn, Ag, Pb-, Au-	Copper carbonates, oxides, silicates, and sulfides with some spotty lead and zinc mineralization in selective, pyrometasomatic replacement deposits guided by faults and favorable beds in thrust faulted Paleozoic limestone in a thrust fault klippe. Some disseminated copper mineralization in shattered early Paleozoic quartzite.	Shaft and open cut workings. From 1882 to 1952, intermittent production of some 13,000 tons of ore averaging about 5% Cu, 2% Zn, 0.8 oz. Ag/T and minor Pb and Au.	Schrader, 1915, p. 125 Heyman, 1958 ABM file data
31. Pickwick mine (Sweet group; McCleary, Southern Arizona Mng. Co.)	18S	15E	NE¼ 36	Cu, Ag	Copper carbonates, oxides, and chalcocite in crushed and altered Paleozoic limestone and Laramide quartz latite porphyry along fault contacts and in fault zones.	Shaft and tunnel workings. Some 140 tons of ore averaging about 8% Cu and 6 oz. Ag/T produced in the late 1910's.	Schrader, 1915, p. 129-130 Mines Handbook, 1918 ABM file data
32. Ridley mine (Minerals & Metals Corp.)	18S	15E	SE¼ 21	Cu, Pb, Zn, Ag, Au, Mo-	Tabular, banded, quartz, pyrite, chalcopyrite, argentiferous galena, sphalerite, and minor molybdenite, partly oxidized, in a vein cutting Precambrian granodiorite.	Shaft workings. Sporadic production of some 50 or more tons of ore averaging about 5% Pb, 2% Cu, and 40 oz. Ag/T from early 1900's to 1929.	Schrader, 1915, p. 126-127 ABM file data
33. Santa Rita limestone quarry (Santa Rita Mining Co., Limestone Division)	18S	15E	SE¼ 11 NE¼ 14	Limestone	Partly marmolized Paleozoic limestone.	Quarry. Producing limestone for lime plant.	ABM file data
34. Silver Spur mine (Old Frijole; Hart & Weigel, Lauterback, Barbre)	18S	15E	SW¼ 24	Ag, Cu, Pb, Au-	Quartz fissure vein associated with an aplite dike, with partly oxidized chalcocite and argentiferous galena, minor chalcopyrite, and pyrite, cutting Precambrian granodiorite.	Shaft workings. Oldest property in district, worked sporadically from late 1870's to 1963, producing some 200 tons of ore averaging about 22 oz. Ag/T and 1% Cu and 1% Pb.	Schrader, 1915, p. 119 ABM file data
35. Sweet Bye & Bye mine (Saratoga; McFarland, Jones)	18S	15E	NE¼ 36	Cu, Ag, Au-	Small lenses and pockets of banded quartz and oxidized copper mineralization along fault zone in crushed and silicified, thrust-faulted, Paleozoic limestone, intruded by Laramide quartz latite porphyry.	Tunnels and open cuts. High grade copper ore shipped in early 1880's and sporadic production of some 1,500 tons of ore through 1918; averaged about 7% Cu, 3 oz. Ag/T and minor Au.	Schrader, 1915, p. 130-131 Popoff, 1940 ABM file data

36.	Tip Top mine group (Little Helvetia, Copper Duke; Tip Top Copper Co., Am. Smltg. & Refng. Co., Chamrod, Forbes, Mattingly, Sierrita Mng. & Ranching Co., Tip Top Mng. Co., D. & P. Mng. Co.)	18S	15E	NE¼ 15	Cu, Ag, Au-	Irregular pockets, stringers, [illegible] pyr[illegible] metasomatic replacement orebodies, mostly oxidized, with copper mineralization often associated with quartz stringers and seams in shattered, faulted, silicified, and silicated Paleozoic limestone close to a contact with underlying Paleozoic quartzite in a thrust-faulted klippe.	[illegible] cuts. Produced, intermittently from late 1890's to 1936, a total of over 27,000 tons of ore averaging about 5% Cu and 0.4 oz. Ag/T.	1907 Schrader, 1915, p. 120-124 Creasey & Quick, 1955, p. 320 ABM file data
XVII.	Horsehoe Basin District (See Quijotoa District)							
XVIII.	Las Guias District (See Arivaca District)							
XIX.	Montezuma (Puerto Blanco Mtns.) District (Puerto Blanco Mtns., Sonoyta Mtns., Organ Pipe Cactus Nat'l Monument)	16-17S	6W	----	Cu, Pb, Zn, Au, Ag	Scattered, small deposits of oxidized base metal sulfides in narrow and irregular quartz-calcite veins along fracture zones in granitic porphyry and metamorphic schists and phyllites of Mesozoic age.	Mostly shallow operations worked sporadically since from prior to 1900 to the 1930's. Total production estimated and reported as some 1,300 tons containing about 8% Cu, 5% Pb, 52 oz. Ag/T and minor Au.	Bryan, 1925, p. 342, 425 ABM file data
1.	Cimarron mine group (Bernice, Milton-Sturges, Verde groups; Milton-Sturges, Montana-Arizona Mng. Co.)	17S	6W	So. Cen. 4 Protracted	Cu, Ag, Au-	Strong fracture zone in Mesozoic schist with granitic porphyry intrusions. Spotty and irregular, high grade copper carbonates and strong chloritic alteration in and along quartz stringers.	Shallow shaft and surface cuts. Worked in 1916-1917 and 1951-1954, producing some 1,100 tons of ore averaging about 9% Cu and 4 oz. Ag/T.	ABM file data
2.	Victoria mine (La Americana; Ortega; Levy, Knight)	17S	6W	Cen. 24 Protracted	Pb, Ag, Cu, Au, Zn	Base metal carbonates with silver chlorides and argentite in irregular and spotty occurrences associated with quartz-calcite fissure veins in Mesozoic schist cut by Mesozoic granitic porphyry intrusives.	Shafts and glory hole. Prior to 1900, some $80,000 of high grade Pb-Ag ore shipped. In 1915-1918 and in 1935 some 50 tons of ore averaging nearly 600 oz. Ag/T, 58% Pb, 4% Cu and 0.2 oz. Au/T was produced.	ABM file data
XX.	Old Baldy District (Central to southern Santa Rita Mtns.)	19S	14-15E	----	Cu, Ag, Au, Mo-	1. Scattered, small, and relatively weak, partly oxidized, copper and local molybdenite mineralization in quartz fissure zones in Mesozoic volcanics and Laramide intrusives. 2. Gold placer deposits in alluvial cone in Madera Canyon.	Scattered, small, and generally shallow prospects and mines worked intermittently since the 1880's. Total estimated and reported production not more than a few hundred tons of sorted high grade copper ore. Considerable placer gold recovered in late 1880's.	Schrader, 1915, p. 166-180 Drewes, 1968, 1971a, 1972b, 1973 ABM file data
1.	Jackson mine group (Iron Mask; Old Hickory Copper Co., Parber)	19S	14E	SE¼ 24	Cu, Ag, Au	Compound quartz-fissure vein and stockwork with copper carbonates and sulfides, cutting a Laramide granodiorite intrusive. Some disseminated chalcocite in the wall rock.	Shafts and tunnels. Produced intermittently some 200 tons of picked 9% Cu and 3 oz. Ag/T ore, mainly in 1915-1919.	Schrader, 1915, p. 171-172 Mines Handbook, 1920 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
XXI. Oracle (Control, Old Hat, Santa Catalina) District (North slope of Santa Catalina Mtns.)	11S	15-16E	----	Cu, Ag, Pb, Zn, Au, W	1. Irregular copper sulfides with local disseminated scheelite in pyrometasomatic replacement deposits in folded and faulted Paleozoic limestone intruded by Laramide quartz diorite to quartz monzonite intrusive. 2. Irregular lead, zinc, and copper sulfides, with minor oxidation products, in pyrometasomatic replacements along a fault in Cambrian Abrigo Formation near Laramide quartz diorite intrusive. 3. Quartz veins with spotty gold or scheelite mineralization in Precambrian or Laramide metamorphics or intrusives.	Numerous relatively shallow adits, tunnels, and shafts worked sporadically since the early 1900's. Total production up thru 1972 has been some 136,000 tons of ore containing about 3,000 tons of copper, 94 tons of lead, 25 tons of zinc, 118,000 ounces of silver and 387 ounces of gold.	Peterson & Creasey, 1943 Braun, 1969 ABM file data
1. Bluff mine group (Combs, Hill)	11S	16E	So. Cen. 13	Pb, Zn, Ag, Cu-, Au-	Spotty and irregular, partly oxidized, lead, zinc, and minor copper sulfides in replacement deposits in Paleozic limestone.	Tunnel workings. Sporadic production 1951-1957 of some 80 tons of ore averaging about 13% Pb, 3% Zn, 3 oz. Ag/T and minor Cu and Au.	ABM file data
2. Corregedor mine (Wells, Arizona Copper Mines, Inc.)	11S	16E	Cen. 15	W	Shallow, spotty scheelite in a metamorphosed Precambrian quartzite lens near the contact with Laramide quartz diorite intrusive.	Shallow shafts. Some 100 tons of 4% WO_3 produced in 1940's.	Peterson & Creasey, 1943 Dale et alia, 1961, p. 116-117
3. Daily mine (Daily Arizona Copper Co., Daily Mines Co., Catalina Consol. Copper Co., Control Mines, Inc., Control Mines Co., Arizona Copper Mines, Inc., Continental Materials, Inc.	11S	16E	SW¼ 16 SE¼ 17	Cu, Ag, Au-, W-	Chalcopyrite, pyrite, and minor disseminated scheelite associated with irregular skarn zones of pyrometamorphic replacements in structurally deformed and marblelized Paleozoic limestone along the contact with intrusive Laramide quartz diorite. Cross-cutting lamprophyre, alaskite, and quartz dikes.	Adit and incline shaft workings. Some 25,000 tons of ore averaging about 3% Cu, 0.8 oz. Ag/T, and minor Au mined, mainly from 1937-1947.	Peterson & Creasey, 1943 Dale et alia, 1961, p. 116-118 Braun, 1969 ABM file data
4. Geesman mine group (Phelps Dodge Corp., Catalina Consol. Copper Co., Control Mines, Inc., Control Mines Co., Arizona Copper Mines, Inc., Continental Materials, Inc.)	11S	16E	E. Cen. 17	Cu, Ag, Au-, W-	Chalcopyrite, bornite, chalcocite, covellite, and spotty, disseminated scheelite associated with irregular skarn zones of pyrometamorphic replacements in structurally deformed and marbleized Paleozoic limestone along the contact with intrusive Laramide quartz diorite. Cross-cutting lamprophyre and alaskite dikes.	Adit and shaft workings. Some 115,000 tons of ore averaging about 2% Cu, 0.6 oz. Ag/T and minor gold produced, mainly from 1937-1948. One ton of 11% WO_3 ore produced in 1940's.	Peterson & Creasey, 1943 Dale et alia, 1961, p. 116-118 Braun, 1969 ABM file data
5. Hartman-Homestake mines (Adams, Shanklin)	11S	16E	NW¼ 18	Pb, Zn, Cu, Ag	Partly oxidized, base metal sulfides and pyrite in skarn, gouge, and breccia along strong fault zone and in adjacent metamorphosed Cambrian Abrigo Formation close to the contact with Laramide quartz diorite	Adit and winze workings. Some 600 tons of ore averaging about 5% Pb, 3% Zn, 3% Cu, and 30 oz. Ag/T produced in 1947-1948	Peterson & Creasey, 1943 Braun, 1969 ABM file data

6. Leatherwood mine group (Apache group; Phelps Dodge Corp., Catalina Consol. Copper Co., Control Mines, Inc., Control Mines Co., Sanford, Arizona Copper Mines, Inc.)	11S	16E	Cen. 20	Cu, Ag, Au, Pb-	Partly oxidized copper sulfides in calcite veinlets and disseminated in skarn in pyrometamorphosed Paleozoic limestone close to the contact with Laramide quartz diorite. Lamprophyre dikes.	Adits and open pit. Some 5,000 tons of ore, averaging about 5% Cu, 1.5 oz. Ag/T and minor Au and Pb, produced intermittently from 1939 to 1968.	Peterson & Creasey, 1943 Braun, 1969 ABM file data
7. Stratton mine (Old Hat; Stratton Copper Co., Stratton Consol. Copper Co.)	11S	16E	NW¼ 20	Cu, Ag, Au-, Mo-	Thin fracture fillings and disseminations of chalcopyrite and pyrite with skarn in pyrometamorphosed Paleozoic limestone along a bedding plane fault. Bornite and molybdenite associated with quartz in depth.	Incline shaft and prospect adits. A few hand sorted tons of high grade ore shipped in the past.	Peterson & Creasey, 1943 Braun, 1969 ABM file data
8. Taylor X claims Taylor, Standard Tungsten Corp.)	11S	16E	E. Cen. 18	W, Cu, Ag, Au-	Scattered large and small clusters of scheelite in an irregular, metamorphosed, and sheared quartzitic zone, possibly Precambrian or Cambrian, near the contact of Precambrian granite and Laramide quartz diorite.	Adits and shaft. Developed originally in early 1900's for copper, silver, and gold. A few tons of ore hand-sorted to produce 36% WO_3 concentrates in 1948 and 45 tons of 1-5% WO_3 produced in 1953.	Dale et alia, 1961, p. 112-113
XXII. Papago (Sierrita) District (West side of Sierrita Mtns.)	17-18S	10-11E	----	Ag, Pb, Cu, Zn, Mn, Mo-, F, U-	1. Bands of folded and faulted Paleozoic and Mesozoic sedimentary and volcanic formations intruded by Mesozoic and Laramide granitic intrusives. Spotty base and precious metal deposits, largely oxidized, with minor local molybdenum and traces of uranium, in irregular replacement orebodies or along faults and fractures. 2. Gold placers 3. Fluorspar along fault veins.	Mainly small mines and prospects worked sporadically since 1870's. Total estimated and reported mine production would be some 5,000 tons of ore containing about 30,000 ounces of silver, 400 tons of lead, 26 tons of copper, 1 ton of zinc, and 100 ounces of gold. About a thousand ounces of gold may have been recovered from placers and a small amount of fluorspar has been shipped.	Ransome, 1922 Drewes & Cooper, 1973
1. Ash Creek and Pascola Canyon gold placers	18S	10E	12	Au	Relatively small placer deposits resulting from weathering and erosion of mineralized veins and replacement bodies.	Worked mainly prior to 1900 by Mexicans and to a small extent in 1930's and 1940's. Total estimated production not more than a few 1,000 ounces.	Allen, M. A., 1922, p. 12 Wilson, E. D., 1961, p. 80 ABM file data
2. Aguinaldo mine group (Hump, Purcell; Aguinaldo Mining Co.)	17S	10E	SE¼ 26	Pb, Ag, Mn, Cu, Au-, Mo-	Veins and replacement lenses of oxidized manganese, pyrite, galena, and minor chalcopyrite, molybdenite, and wulfenite in fractured and metamorphosed Paleozoic limestone.	Adits, shafts, and open cuts. Originally worked for silver prior to 1900 with minor sporadic, subsequent production. Probably not more than 100 tons of high grade lead-silver ore produced plus some copper and hand-picked wulfenite.	Ransome, 1922, p. 416-417 Farnham et alia, 1961, p. 119-121 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
3. Banner mine group (Olympia, Hughes; Francis Hagerman Mng. Co., Banner-Sierrita Mng. Co.)	18S	10E	SE¼ 2	Pb, Ag, Zn, Au-, Cu-	Oxidized, narrow, stranded, and lenticular quartz-calcite veins with disseminated argentiferous galena and spotty pyrite, chalcopyrite, tetrahedrite, and sphalerite in sheared and metamorphosed Paleozoic limestone.	Tunnel and shaft workings. Chloriders produced high-grade silver ore in late 1800's and early 1900's. Total sporadic production would be some 700 tons averaging about 60 oz. Ag/T, 40-50% Pb, 2% Cu, and minor Au.	Ransome, 1922, p. 415-416 Thoms, 1966 ABM file data
4. Big Johnny-Little Johnny mines	17S	10E	So. Cen. 23	Pb, Ag, Mn, Cu-, Au-, Mo-	Manganiferous veins and replacement lenses containing spotty oxidized argentiferous galena and minor chalcopyrite, pyrite, and wulfenite in fractured and metamorphosed Paleozoic limestone.	Shafts and pits. Worked by chloriders for silver in late 1800's and by prospectors in 1937-1938. Total production only some 100 tons averaging over 20 oz. Ag/T with good lead values and minor copper.	Ransome, 1922, p. 417 ABM file data
5. Black Dike group	17S	10E	SE¼ 23	Cu-, F-, U-	Spotty and weak copper staining, pyrite, chalcopyrite, and disseminated fluorite with local admixture of manganese and sooty pitchdende along fracture vein in contact zone of Mesozoic granite and a basaltic dike.	Shaft. No production known.	Granger & Raup, 1962
6. Fluorine mine (Neptune, Fluxore)	17S	11E	Cen. 34	F	Shear zone along a Mesozoic quartz-mica schist-granitic contact zone with associated aplite dikes. Lenses of fluorite with minor calcite and silica.	Shaft, adits, and pits. A few tons of 80% F may have been shipped in 1918-1920 and in 1940's.	Allen & Butler, 1921, p. 7 Wilson, 1950, p. 11 Elevatorski, 1971 ABM file data
7. Lincoln mine group (Yellow Bird, Providence; Lincoln Consol. Mng. Co., Silverta Mng. & Mllg. Co., Yellow Bird Silver Mines)	17S	10E	SW¼ 26 SE¼ 27	Pb, Ag, Zn, Cu, Au	Oxidized, argentiferous galena and sphalerite with minor copper in spotty replacement bodies in metamorphosed Paleozoic limestone; and argentiferous chalcocite, copper carbonates and oxides in shattered Paleozoic quartzite. Paleozoic beds infolded in Mesozoic sediments and volcanics.	Shaft, tunnels, and open cuts. Prospected and worked in late 1800's for high grade lead-silver ore and sporadically from 1905 to 1919, producing some 65 tons of 14% Cu, 12 oz. Ag/T, and minor Au.	Copper Handbook, 1905 Ransome, 1922, p. 418 ABM file data
8. Sunshine & Sunrise mines	18S	10E	SE¼ 12	Pb, Ag, Zn, Cu, Au- (Ba)	Pods and disseminations of galena, cerussite, anglesite, cerargyrite, sphalerite, argentite, and tetrahedrite with pyrite, barite, and covellite in irregular quartz-calcite fissure veins and along fractures and faults cutting sinuous thrust-faulted bands of metamorphosed Paleozoic limestone.	Shaft, tunnels, and open cuts. Worked by chloriders for high grade lead-silver ore in late 1800's. Since 1900 some 4,000 tons of ore, averaging about 8% Pb, 3 oz. Ag/T, and minor Cu, Zn, and Au produced mainly and intermittently between 1923 and 1959	Ransome, 1922, p. 415 Mines Handbook, 1926 Higdon, 1933 Thoms, 1966 ABM file data

XXIII. Pima (Olive, Mineral Hill, Twin Buttes) District (East side of Sierrita Mtns.)	16-18S	11-13E	----	Cu, Pb, Zn, Ag, Au, Mo, W	1. Small, shallow-seated, low temperature fissure veins with spotty, partly oxidized, base metal sulfides and relatively rich gold and silver values, in faults and fractures in Cretaceous sedimentary formations and andesite intrusives within the San Xavier thrust sheet. 2. Pyrometasomatic deposits with copper and/or lead-zinc mineralization in silicified Paleozoic limestone, often associated with fault contacts and bordering Laramide intrusions. 3. Large irregular disseminated copper orebodies with minor or considerable molybdenite and locally minor sphalerite and galena in pyrometamorphosed sedimentary and volcanic formations or in complex intrusives.	Numerous small to large underground mines and prospects, and large open pit operations. Total estimated and reported production, up through 1972, would be some 369,707,400 tons of ore containing 2.1 million tons of copper, 42 thousand tons of lead, 116 thousand tons of zinc, 31 million ounces of silver, 53.7 thousand ounces of gold and 33 thousand tons of molybdenum.	Ransome, 1922 Wilson, E. D., 1950, p. 39-51 Lacy, 1959 Cooper, 1960 ABM file data
1. Alpha mine (Pima and Fries groups; Alpha Copper Co., Pima Mng. Co.)	17S	12E	SE¼ 15	Cu, Ag, Au-, Pb, Zn-	Mineralized, partly oxidized, fissure zones with spotty copper-silver, lead-silver, and local pyrite-gold mineralization in brecciated Cretaceous sediments of San Xavier thrust sheet.	Shaft and tunnel workings. Some 70,000 tons of ore, averaging about 6% Cu, 1 oz. Ag/T and minor Pb and Au, produced sporadically from 1876 to 1954.	Mines Handbook, 1922 Mayuga, 1942 ABM file data
2. Arizona No. 3 mine (Dogtown; Hill, Thornel Co. Inc.)	17S	12E	No. Cen. 21	Pb, Ag, Zn, Cu-, Au-	Spotty, partly oxidized, base metal sulfides in narrow, irregular fissure veins in Cretaceous volcanics within the San Xavier thrust sheet.	Shaft workings. Some 125 tons of ore averaging about 12% Pb, 2% Zn, 0.5% Cu, 47 oz. Ag/T, and minor Au produced in 1948-1949, 1952, and 1966.	ABM file data
3. Contention mine (North Star; Twin Buttes Mng. & Smltg. Co., Bush-Baxter Mng. Co., Glance Mng. Co., A. S. & R. Co., Midland Copper Co., Foy, Amuran Mng. Co., Banner Mng. Co.)	18S	12E	SW¼ 1	Zn, Cu, Pb, Ag, Mn, Au	Partly oxidized zinc-copper and minor lead-silver mineralization in lenticular orebodies along closely spaced fissure veins in silicated and garnetized, Paleozoic limestone along a strong fault zone. Considerable pyrite, pyrrhotite, and specularite with the ore.	Shaft workings. Intermittent production 1919-1947 of some 8,000 tons of ore averaging about 11% Zn, 2% Cu, 1% Pb and 2 oz. Ag/T.	Brown, 1926 Whitcomb, 1948 Houser, 1949 Wilson, E. D., 1950, p. 50-51 Cummings & Romslo, 1950 ABM file data
4. Copper Butte mine (Twin Buttes Mng. & Smltg. Co., Bush & Baxter, Foy)	17S	12E	SE¼ 36	Cu, Ag	Small zone of chalcopyrite mineralization in fractured, garnetized, Paleozoic limestone near or at a fault contact with Precambrian granite at the border of Minnie claim. Other slightly mineralized garnetiferous zones eastward along the limestone-granite fault contact.	Shaft workings from Minnie mine and Butte shaft. Possibly some 200 tons of ore, averaging about 3% Cu, produced in 1929.	Cummings & Romslo, 1950 ABM file data
5. Copper Glance mine (Baxter, Twin Buttes Mng. & Smltg. Co., Bush & Baxter Mng. Co., Glance Mng. Co., Midland Copper Co., Foy, Amuran Mng. Co., Banner Mng. Co.)	18S	13E	No. Cen. 6	Cu, Ag, Pb-, Zn-, Au-	Slightly oxidized, near surface enriched, large irregular orebodies of chalcopyrite, bornite, pyrite, and minor galena and sphalerite with garnet, magnetite, chlorite, and actinolite in selective, pyrometasomatized and brecciated, Paleozoic limestone beds along a fault contact with Precambrian granite. Some mineralization controlled by fissures.	Shaft workings. From 1905 thru 1957, intermittent production totalled some 186,000 tons of ore averaging about 7% Cu and 1 oz. Ag/T.	Ransome, 1922, p. 425-426 Mines Handbook, 1916, 1920 Brown, 1926 Cummings & Romslo, 1950 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
6. Copper King mine (Baxter, Twin Buttes Mng. & Smltg. Co., Midland Copper Co., Foy)	18S	13E	NW¼ 6	Zn, Pb, Ag, Cu, Au-	Irregular, lensing copper and zinc carbonate ores along fissure veins in partly garnetized Paleozoic limestone.	Shaft workings. Possibly some 100 tons of 12% Cu ore produced in the early 1900's as well as 2,183 tons of 27-34% Zn in 1912.	Brown, 1926 Whitcomb, 1948 Wilson, E. D., 1950, p. 50 Cummings & Romslo, 1950 ABM file data
7. Copper Queen mine (Baxter, Twin Buttes Mng. & Smltg. Co., Bush & Baxter Mng. Co., Midland Copper Co., Foy, Banner Mng. Co. Amuran Mng. Co.)	18S	13E	NW¼ 6	Cu, Ag, Pb-, Zn-, Au-, Mo-, W-	Series of relatively large copper sulfide orebodies along bedding planes and a sheared fault contact zone in garnetized and silicated, pyrometamorphosed Paleozoic limestone. Some enrichment. Precambrian granite somewhat mineralized also.	Shaft workings. From early 1900's thru 1957, some 122,000 tons of ore, averaging about 4.2% Cu, 1 oz. Ag/T and minor Zn and Pb, produced intermittently.	Ransome, 1922, p. 425-426 Brown, 1926 Mines Handbook, 1926 Whitcomb, 1948 Cummings & Romslo, 1950 ABM file data
8. Cowboy mine (Cowboy Mng. & Smelting Co., Sierrita Mng. & Ranching Co.)	18S	12E	So. Cen. 7	Cu, Ag, Mo-	Relatively weak and spotty copper and molybdenum mineralization, with pyrite, along a fault zone in Laramide intrusive granodiorite and diorite.	Shaft workings. Developed around 1917-1919 and mined in 1947, producing some 1,700 tons of ore averaging about 2% Cu and 0.3 oz. Ag/T.	ABM file data
9. Crown King & Tiger mine groups (Sneider group; Chesterfield Copper Co., Blanche Rose Mng. Co., Magnate Copper Co.)	18S	12E	So. Cen. 16 No. Cen. 21 W. Cen. 15	Pb, Cu, Ag, Zn, Au-	Spotty, base metal sulfides, partly oxidized, in irregular quartz veins along faults and fractures in Cretaceous sedimentary-volcanic formations intruded by Laramide quart monzonite porphyry and andesite dikes and plugs.	Numerous small shafts and pits. Worked intermittently from early 1900's to about 1917, producing some 360 tons of ore averaging about 7% Pb, 4% Cu, 13 oz. Ag/T and minor Au.	Copper Handbook, 1908, 1912-1913, 1920 ABM file data
10. CWT mine (Continental Materials Corp.)	17S	12E	NW¼ 23	Zn, Cu, Pb, Ag	Irregular replacement lenses of zinc and minor copper and lead in fractured Paleozoic limestone near the bottom of the San Xavier thrust sheet.	1,000 foot shaft workings. Produced some 69,000 tons of ore, averaging about 4% Zn, 0.5 oz. Ag/T and minor Cu and Pb, in 1967.	ABM file data
11. Daisy mine (Banner Mng. Co., Pima Mng. Co.)	16S 17S	13E 13E	SW¼ 36 NW¼ 1	Cu, Ag, Zn-, Pb-, Au-, W-, Mo-	Partly oxidized, roughly banded and zoned, pyrometasomatic orebody of magnetite, pyrite, chalcopyrite-bornite, sphalerite, and galena in garnetized Paleozoic limestone along the contact with Laramide quartz monzonite. Minor molybdenite and tungsten present. Mineral Hill fault an important controlling structure.	Shaft and open pit workings. From underground mining, 1954-1962, some 522,000 tons of ore averaging about 3% Cu, 0.5 oz. Ag/T and some Zn and Pb produced. From 1962-1963, Pima Mng. Co. produced from its open pit some 3.2 million tons averaging about 0.8% Cu, 0.1 oz. Ag/T and some Zn and Pb	Storms & Bowman, 1957 MacKenzie, 1959 Bowman, 1963 ABM file data

12. Esperanza mine group (old) (At various times included the Hughes, Snyder, Costillo, Wheeler-Perry, and Magnet Copper groups and the Crown King and Tiger mines; Chesterfield Copper Co., Elston Esperanza Co., Blanche Rose Mng. Co., Pike, Magnet Copper Co.)	18S	12E	So. 8 SW 9 So. 16 No. 17 No. Cen. 21	Pb, Zn, Cu, Ag, Au, Mo-	Partly oxidized, relatively weak and irregular, quartz-calcite fissure veins containing spotty galena, sphalerite and chalcopyrite in Cretaceous sedimentary-volcanic rocks. Locally low grade, disseminated copper and molybdenum mineralization in siliceous, brecciated Laramide quartz monzonite porphyry, Cretaceous rocks, and quartz masses.	Numerous relatively shallow shafts, adits, pits and small open cuts. Originally prospected in Spanish colonial times but main intermittent production, from early 1900's through 1943, on a small scale, was about 2,000 tons of ore averaging some 12% Pb, 4% Cu, 12 oz. Ag/T and minor Zn and gold. For later production under Duval, see Esperanza open pit mines.	Copper Handbook, 1908, 1909, 1912-1913 Ransome, 1922, p. 427 Tainter, 1947 Anderson & Kupfer, 1945 ABM file data
13. Esperanza Open Pit mines (Esperanza, West Esperanza; Duval Sulphur & Potash Co., Duval Corp.)	18S	12E	SE¼ 8 NW¼ 16 NE¼ 17	Cu, Mo, Ag, Au, Pb-, Zn-, (U-)	Disseminated copper sulfides, oxides, and carbonates with molybdenite and minor lead and zinc mineralization, and traces of torbernite, in brecciated, fissured, and jointed, strongly altered, Laramide intrusive complex of quartz latite to andesite invading Triassic to Cretaceous volcanics.	Open pit operations. From 1959 through 1972, some 59 million tons of ore averaging about 0.5% Cu, 0.017% Mo, 0.04 oz. Ag/T and minor Au, Zn and Pb has been produced.	Anderson & Kupfer, 1945 Tainter, 1947 Schmitt et alia, 1959 Lynch, 1966, 1967 ABM file data
14. High Hill mine (Costello, Paly & Anderson, Amargosa Molybdenum & Copper Co., Wilson)	18S	12E	E. Cen. 19 W. Cen. 20	Pb, Zn, Cu, Ag, Au	Spotty and irregular, partly oxidized, lead, zinc, and copper mineralization in quartz shear veins cutting Laramide volcanics and diorite intrusive.	Shaft operations. Worked intermittently 1931-1954, producing some 1,200 tons of ore averaging about 4% Pb, 3% Zn, 2% Cu, 3 oz. Ag/T and 0.07 oz. Au/T.	ABM file data
15. Keystone mine (Golden Fleece; McGee, Sierrita Mng. & Ranching Co.)	18S	11E	E. Cen. 9 W. Cen. 10	Au, Ag, Pb-, Cu-, Zn-	Spotty, partly oxidized, base metal sulfides in quartz fissure zone in Triassic and Cretaceous volcanics, cut by Laramide andesite dikes. Near surface enrichment of gold and silver.	Shallow shafts and adits. Small intermittent production, 1921-1956, of some 170 tons of ore averaging about 1 oz. Au/T, 3 oz. Ag/T, 1% Pb and minor Cu.	ABM file data
16. Lone Valley mine group (Serasio group; Pemberton, Serasio)	17S	12E 13E	SE¼ 25 SW¼ 30	Cu, Ag, W	Irregular and small, largely oxidized, pyrometasomatic deposits containing copper and sporadic scheelite, mainly along small veins and shear zones in Paleozoic limestone and quartzite, near the contact with Laramide quartz monzonite intrusive.	Shaft operations. Sporadic production, 1911 to mid 1940's, yielding a few hundred tons of ore averaging 3 to 7% Cu and a few ounces Ag. About 20 tons of 4% WO_3 also reported shipped.	Dale et alia, 1960, p. 93, 94 ABM file data
17. Marconi mine group (Hilzinger)	18S	12E	No. Cen. 12	Zn, Pb, Cu, Ag, Au-	Spotty, largely oxidized, zinc, lead, and minor copper mineralization along strong fracture zones in Cretaceous arkose and conglomerate.	Incline shafts. In 1948, some 350 tons of ore, averaging about 6% Zn, 3% Pb, 2 oz. Ag/T and minor Cu and Au, produced.	ABM file data
18. Mineral Hill mine (Emperor Copper Co., Mineral Hill Mng. Co., Copper King Co., Azurita Copper & Gold Co., Mineral Hill Consol. Copper Co., Barnsdall Corp., Banner Mng. Co.)	16S 17S	12E 12E	So.½ 35 No.½ 2	Cu, Ag, Au, Pb-, Zn-, Mo-, W-	Sporadic and irregular, pyrometasomatic, and manto replacement orebodies, partly oxidized, of copper sulfides with minor lead and zinc in garnetized or brecciated Paleozoic limestone, often at fault and fracture intersections and near or on a Laramide intrusive contact. Spotty scheelite and molybdenite with pyrite in garnetized zones.	Shaft operations. Worked sporadically 1880's to 1959, producing an estimated and reported tonnage of over 605,000 tons of ore averaging about 2% Cu, 0.5 oz. Ag/T and minor Au.	Ransome, 1922, p. 419-421 Mines Handbook, 1918, 1920, 1925, 1926, 1931 Manuga, 1942 Storms & Bowman, 1957 MacKensie, 1959 Dale et alia, 1960, p. 93-98 Bowman, 1963 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
19. Minnie mine (Venus group, Arizona Buttes group; Bush & Baxter Mng. Co., A. S. & R. Co., Buttes Copper Co.)	17S	12E	So. Cen. 36	Cu, Ag, Au-	Copper carbonate above and sulfides below in irregular, pyrometasomatic orebodies in Paleozoic limestone and bordering quartzite along a fault contact with Precambrian granite.	Shaft operations. Worked sporadically from early 1900's to 1929, producing some 63,000 tons of ore averaging about 6.5% Cu, 1.5 oz. Ag/T and minor Au.	Ransome, 1922, p. 425-426 Brown, 1926 Houser, 1949 Cummings & Romslo, 1950 ABM file data
20. Mission mine (East Pima; A. S. & R. Co.)	16S 16S	12E 13E	E. Cen. 36 W. Cen. 31	Cu, Ag, Zn, Mo-, Pb-, Au-, Sn-, W-, F-	Seams and disseminations of copper carbonates and sulfides with minor zinc, lead, and molybdenum mineralization in a pyrometasomatic deposit in altered, complexly folded, and faulted Paleozoic limestone and Triassic sedimentary and volcanic formations intruded by Laramide and Tertiary intrusives. Thin secondary enrichment zone.	Open pit operation. From 1961 through 1972, produced over 77.6 million tons of ore averaging about 0.7% Cu, 0.13 oz. Ag/T and considerable by-product Zn, Mo and Pb. Very little gold.	Richard & Courtwright, 1959 Skillings Mining Review, 1961, 1962 Eng. Min. Jour., 1962 Gale, 1965 Kinneson, 1966 ABM file data
21. New Years Eve mine (Snyder group, Red Carbonate, Amargosa; Snyder, Gastellum, Amargosa Molybdenum Co., General Mines, Ltd.)	18S	12E	So. Cen. 9	Cu, Ag, Mo	Erratic seams, bunches, and disseminations of copper carbonates and copper and molybdenum sulfides in brecciated, quartzitic rocks intruded by Laramide quartz monzonite porphyry.	Shaft and adit operations. From early 1900's to 1955, produced sporadically some 2,600 tons of ore averaging about 4% Cu, 0.3 oz. Ag/T and minor Au and Mo. Now part of Esperanza Open Pit.	Anderson & Kupfer, 1943 ABM file data
22. Olivette and Annette mines (Olive, New Olivette, Corda Bros. group; Olive Camp Mng. Co., Anderson)	17S	12E	W. Cen. 11	Ag, Pb, Zn, Cu-, Au-	Argentiferous bornite, chalcopyrite, chalcocite, tetrahedrite, galena, sphalerite, and pyrite, oxidized near the surface with rich silver chlorides, in narrow, lensing, brecciated, quartz-gouge filled, intersecting fissure veins cutting Cretaceous sedimentary beds in the San Xavier thrust block.	Shaft operations. Total estimated and reported production, mainly in late 1800's and early 1900's by chloriders, has been some 10,000 tons of ore averaging about 10 oz. Ag/T, 5% Pb, 1% Zn and minor Cu and Au.	Ransome, 1922, p. 423-424 Manuga, 1942 Wilson, E. D., 1950, p. 48 Waller, 1960 ABM file data
23. Palo Verde mine (Eisenhauer group; Banner Mng. Co.)	16S	12E	No. Cen. 36	Cu, Ag, Zn, Pb-, Au-, Mo-	Copper, zinc, and minor lead sulfides in irregular and spotty high grade lenses, fracture veinlets, and disseminated in step-faulted and brecciated garnetiferous tactite in Paleozoic limestone and marble, close to Laramide quartz monzonite intrusive and above the thrust fault contact with Precambrian granite. Some mineralization, oxide and sulfide, disseminated in overlying Cretaceous sediments.	Shaft operations. Some 480,000 tons of ore averaging about 5% Cu, 1 oz. Ag/T, and 1% Zn produced 1960-1963.	Bowman, 1963 Venable, 1963 Gale, 1965 ABM file data
24. Paymaster mine group (Victoria group; Paymaster Mng. Co., Arizona Paymaster Mng. Co., Paymaster Consol. Mng. Co., Paymaster Silver & Lead Co.)	17S	12E	E. Cen. 16	Pb, Ag, Cu, Zn-, Au-	Partly oxidized argentiferous galena, tetrahedrite, chalcopyrite, and sphalerite, with pyrite and quartz, in spotty and irregular, complex, ore lenses along fissure zones, associated with strong clay and sericite alteration in Cretaceous andesite and andesite breccia and tuff at the eastern edge of the San Xavier thrust fault block above Precam-	Shaft operations. Worked sporadically from late 1880's to 1941, producing some 13,000 tons of ore averaging about 3% Pb, 20 oz. Ag/T, 2% Cu and minor Au and Zn.	USGS Min. Res., 1905 Ransome, 1922, p. 413, 424-425 Manuga, 1942 Wilson, E. D., 1950, p. 49-50 Waller, 1960 Nye, 1961 ABM file data

(Pima Mng. Co.)	17S	12E	36 No.½ 1	Zn-, Pb-, Au-	minor molybdenum, zinc, and lead mineralization with some local high grade lenses, slightly oxidized in upper part, in a pyrometasomatic ore deposit in a structurally complex mix of Paleozoic limestone, Cretaceous clastic and volcanic rocks and Laramide quartz monzonite intrusive.	through 1972, about 104 million tons of ore, averaging about 0.56% Cu and 0.06 oz. Ag/T with by-product molybdenum, zinc, gold and lead have been produced.	Spaulding, 1954 Thurmond, 1955 Thurmond et alia, 1958 Thurmond & Storms, 1958 Journey, 1959 Himes, 1971 ABM file data
26. Plumed Knight mine group (Mineral Hill Consol. Copper Co., Chilson, Pioneer Smltg. Co., Copper Star Mng. Co., Plumed Knight Leasing Co.)	17S	12E	NE¼ 2	Cu, Ag, Zn-, Pb-, Au-	Largely copper carbonates and oxides in irregular replacement lenses along fissured bedding planes in Paleozoic limestone. Weaker sulfide deposits in depth.	Shaft operations. Worked sporadically from 1907 through 1919 and in 1947 and 1956, producing some 20,000 tons of ore averaging about 3.5% Cu, 1 oz. Ag/T, 0.4% Zn, 0.2% Pb and minor Au.	Ransome, 1922, p. 419, 421 ABM file data
27. Prosperity mine group (Helmet Peak group, Camden, Elsie, Tit-for-Tat; Prosperity Smltg. & Mng. Co., Helmet Peak Mng. & Mllg. Co., Great Northern Exploration Co., Inc.)	17S	12E	SE¼ 10 SW¼ 11 No. Cen. 15	Pb, Ag, Zn, Cu, Au-	Complex, partly oxidized, silver-lead-zinc-copper mineralization, including tetrahedrite, tennantite, and pyrrhotite, in irregular pockets, lenses, and pods along fractures zones in brecciated, altered, Cretaceous andesite volcanics and clastic sediment within the San Xavier thrust fault block.	Shaft operations. Worked sporadically from late 1880's to 1955, producing an estimated and reported total of some 1,000 tons averaging about 7% Pb, 7 oz. Ag/T, 1% Zn, 0.5% Cu and minor Au. Most high grade ore mined prior to 1900.	Ransome, 1922, p. 424 Manuga, 1942 Houser, 1949 Wilson, E. D., 1950, p. 49 Waller, 1960 ABM file data
28. Rich Hill mine group (Swastika Mines Co., Swastika Copper & Silver Mng. Co., Rich Hill Mng. Co.)	17S	12E	Cen. 10	Cu, Ag, Pb, Zn, Au-	Argentiferous tetrahedrite, galena, sphalerite, and pyrite, partly oxidized, in irregular, lensing, vein-like, quartz orebodies along fissure zones and at fissure intersections in altered and locally brecciated Cretaceous sediments and volcanics within the San Xavier thrust-faulted block.	Shallow shaft operations. Some 4,000 tons of ore, averaging about 4% Cu, 6 oz. Ag/T, 2.5% Pb and minor Au, produced intermittently from early 1900's to 1925.	Ransome, 1922, p. 423 Mines Handbook, 1926 Manuga, 1949 Wilson, E. D., 1950, p. 48-49 ABM file data
29. San Xavier mine (San Xavier Mng. & Smltg. Co., Myers, Clark, & Rowe Co., Empire Zinc Co., Eagle Picher Mng. & Smltg. Co., McFarland & Hullinger)	17S	12E	SW¼ 2	Zn, Pb, Ag, Cu-, Au-	Irregular, pyrometasomatic replacement, ore deposits as pipes, lenses, and mantos with smithsonite, cerussite, copper carbonates, plumbojarosite and limonite, and rich silver chlorides at the surface. Pyrite, sphalerite, chalcopyrite and galena in depth. Ores largely controlled by fractures and fracture intersections forming breccia pipes as well as favorable beds in Paleozoic limestone below a fault contact with mixed Triassic and Cretaceous sediments and volcanics.	Shaft operations. Worked as early as 1700's for silver and total estimated and reported intermittent production, mainly in 1913-1918 and 1943-1959, would be some 800,000 tons of ore averaging about 10% Zn, 6% Pb, 3 oz. Ag/T, 0.7% Cu, and minor gold.	Ransom, 1922, p. 422-423 Park, 1929 Manuga, 1942 Wilson, E. D., 1950, p. 46-47 Irvin, 1959 Wilson, C. A., 1960 Arnold, 1964 ABM file data
30. San Xavier Extension mine (Red Oxide group, Wakefield group; San Xavier Extension Copper Co., Chilson)	17S	12E	SW¼ 2 SE¼ 3	Zn, Pb, Ag, Cu-, Au-	Irregular, pyrometasomatic, replacement ore deposits as shoots and lenses of partly oxidized zinc, lead, and copper mineralization along fractures and bedding in folded and faulted Paleozoic limestone.	Deep shaft operations. Intermittent production, mainly in 1917-1918 and 1943-1944, of some 5,000 tons of ore averaging about 10% Zn, 2% Pb, 7 oz. Ag/T, 1% Cu and minor gold.	Ransome, 1922, p. 422 Park, 1929 Manuga, 1942 Wilson, E. O., 1950, p. 47-48 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION R.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
31. San Xavier unit open pit (A. S. & R. Co.)	16S	12E	NE¼ 23 NW¼ 24	Cu, Ag-	Siliceous oxidized copper mineralization in Cretaceous sedimentary rocks under alluvium cover.	Open pit operation. From 1967 through 1972, produced over 521,000 tons of leaching ore averaging about 0.76% Cu and 0.02 oz. Ag/T.	ABM file data
32. Senator Morgan mine group (Baxter, Twin Buttes Mng. & Smltg. Co., A. S. & R., Taylor)	18S	12E	SW¼ 1 SE¼ 2	Cu, Ag, Zn-, Pb-, W-, Au-	Fine grained, pyritic, chalcopyrite mineralization, very little oxidized, in garnetized, pyrometasomatic zones, with spotty and local scheelite and powellite in quartz veins, localized by faulting, fracturing and favorable beds in Paleozoic limestone along a fault contact with Cretaceous sediments. Closely associated Laramide granodiorite porphyry dike.	Shaft operations. Worked from 1890's to 1918 for copper with estimated and reported production of some 100,000 tons of 4% Cu, 9 oz. Ag/T and minor Zn and Au. About 120 tons of 1.25% WO_3 shipped in 1942-1943.	Ransome, 1922, p. 425-427 Brown, 1926 Wilson, E. D., 1941, p. 44-46 Manuga, 1942 Whitcomb, 1948 Dale et alia, 1960, p. 85-92 ABM file data
33. Sierrita open pit mine (Duval Sierrita Corp.)	18S	12E	SE¼ 7 SW¼ 8 NW¼ 17 NE¼ 18	Cu, Mo, Ag, Zn-, Pb-, Au-	Superficially oxidized, disseminated chalcopyrite and pyrite with copper and molybdenum sulfides in seams and fractures in a large V-shaped orebody containing Triassic to late Laramide andesite porphyry, quartz monzonite, quartz latite, quartz diorite, and quartz monzonite porphyry as well as a breccia pipe.	Open pit operation. Starting in 1970, production thru 1972 has been some 68 million tons of Cu-Mo ore. Average grade was about 0.24% Cu, 0.03 oz. Ag/T, 0.016 MoS_2 and trace amounts of Au, Pb, and Zn.	ABM file data World Mining, June 1972
34. Silver Helmet mine (Pemberton)	17S	12E	W. Cen. 12	Pb, Ag, Cu-, Au-	Relatively weak and spotty replacement ore of partly oxidized lead and minor copper mineralization along a fault contact of Paleozoic limestone and Cretaceous sedimentary beds.	Tunnel operation. Worked intermittently, 1912-1918, producing some 100 tons of 6% Pb, 22 oz. Ag/T and minor Cu and Au.	ABM file data
35. South San Xavier mine group (Gray Copper, Franklin group; South San Xavier Copper Co., Empire Zinc Co., Selim Franklin, Eagle Picher Mng. & Smltg. Co.)	17S	12E	NE¼ 10	Cu, Pb, Ag, Zn, Au-	Irregular, pyrometasomatic, replacement orebodies with siliceous capping and strong garnetization, containing partly oxidized base metal sulfides in Paleozoic limestone along a strong fault zone and in contact with Laramide intrusive.	Shaft operations. Sporadic production, early 1900's to 1947, of some 2,000 tons of ore averaging about 4% Cu, 4% Pb, 2% Zn, 2.5 oz. Ag/T and minor Au.	Ransome, 1922, p. 422-423 USGS Min. Res., 1906 Manuga, 1942 ABM file data
36. Twin Buttes open pit mine (The Anaconda Co.)	18S	13E	SW¼ 5	Cu, Ag, Mo, Zn-, Pb-, Au-	Dissemination, fracture filling, and bunchy replacements of copper and molybdenum mineralization, with minor lead and zinc, oxidized with erratic enrichment in the upper part, in a folded and faulted complex of Paleozoic limestone, silicated limestone, and impure argillaceous limestone; Cretaceous siltstone, arkose, tuffs, and quartzites, and Laramide intrusive quartz mon-	Open pit operations. Production from 1965 through 1972 amounted to some 29 million tons of ore averaging about 0.8% Cu, 0.1 oz. Ag/T, and minor Mo, Pb, and Au.	Paydirt, May 27, 1970 Skillings Mining Review, vol. 59, no. 36 ABM file data

37. Vulcan mine group (Vulcan Mng. Co., Vulcan Consol. Mng. Co., Vulcan Copper & Zinc Mng. Co.)	[illegible]	[illegible]	W. Cen. 2 E. Cen. 3	Pb-, Zn-	zinc mineralization in irregular, strongly garnetized, pyrometasomatic deposits in folded and faulted Paleozoic limestone close to the contact with Laramide granodiorite intrusive.	mittently from early 1900's to 1952, producing some 12,000 tons of 6-7% Cu and 1.3 oz. Ag/T.	Manuga, 1942 ABM file data
38. Whitcomb mine (Whitcomb Mng. & Mllg. Co., Assoc. Mng. & Mllg. Co.)	17S	12E	W. Cen. 11	Pb, Ag, Cu, Zn, Au-	Partly oxidized, lead-silver and minor copper and zinc mineralization in replacement lenses, nodules, and pockets along a quartz fissure zone in altered and brecciated Cretaceous sedimentary and volcanic rocks within San Xavier thrust fault sheet.	Incline shaft operation. Worked sporadically from early 1900's to 1948, producing some 900 tons of ore averaging about 8% Pb, 9 oz. Ag/T, 0.75% Cu, 0.5% Zn and minor Au.	ABM file data
XXIV. Quijotoa District (Quijotoa Mtns., Ben Nevis Mtn., Sierra Blanca, Brownell Mtns.)	13-16S	2-3E	----	Ag, Au, Cu, Pb, Zn-, U-, Ba-, limestone, quartzite	1. Spotty, irregular, and local, silver and gold values with minor, largely oxidized, base metal sulfides in irregular quartz, calcite, hematite, manganese oxides, and gouge along fissure and breccia zones accompanying strong faults cutting Cretaceous and Tertiary volcanic and sedimentary formations. 2. Spotty and bunchy, oxidized, base metal sulfides with enriched precious metals along faults and fractures cutting Laramide granitic intrusives, along Laramide intrusive — Cretaceous or early Tertiary volcanic and sedimentary formation contacts. Traces of uranium mineralization. 3. Gold placer deposits in valley alluvium. 4. Paleozoic limestone and quartzite in a thrust-fault silver in Laramide metamorphics.	Numerous, small, relatively shallow, mines and prospects; some with spectacular high grade silver-gold pockets. Worked sporadically since 1880's and up through 1972 have produced some 15,600 tons of ore containing about 233,000 ounces of silver, 10,000 ounces of gold, 66 tons of copper, and 29 tons of lead. Some 1,400 ounces of gold have been produced from dry placer operations since 1700's.	Gebhardt, 1931 Wilson, E. D., 1934 (rev. 1967), p. 178-179 Wilson, E. D., 1961, p. 77-78 ABM file data
1. Ballas mine area (Silver Screen, Ballas Silver-Lead; Julian Merger Mines, Inc.)	15S	2E	NE¼ 14 Protracted	Ag, Pb, Zn, Cu, Au	Largely oxidized, irregular, quartz lenses containing spotty argentite, galena, sphalerite, chalcopyrite, pyrite,. and free gold along shear zones and fractures in Laramide granitic intrusive.	Numerous prospects and a few mines worked sporadically since 1880's. Probably produced up to 100 tons of ore averaging about 200 oz. Ag/T, 8-9% Pb, 1% Cu, and minor Au.	Mines Handbook, 1926 Gebhardt, 1931 ABM file data
2. Ben Lomand mines (McKay; Ben Lomand Mines)	16S	2E	E. Cen. 11 Protracted	Au, Ag, Pb-, Cu-, Zn-	Small spotty, pockety, oxidized, gold-silver-lead-copper-zinc mineralization in irregular and narrow, lensing, quartz-calcite fissure veins in Tertiary silicic volcanics.	Tunnel and shaft workings. In 1880's produced some 100 tons of ore averaging about 10 oz. Au/T and 20 oz. Ag/T. In 1932 some 200 tons of ore averaging about 10 oz. Au/T, 3 oz. Ag/T, and minor Pb and Cu.	Stephens, 1884 Mines Handbook, 1926 ABM file data

Table 4, Cont.

MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
3. Black Prince mine (Black Prince Metal Production Co., Ajo Mines Corp.)	14S	1E	Cen. 13	Ag, Pb, Cu-, Zn-, Au-	Spotty and generally weak, oxidized, argentiferous galena with minor chalcopyrite, pyrite, and sphalerite in quartz-calcite gangue along a strong fault zone between Laramide metamorphic gneiss and schist and faulted Paleozoic (?) limestone and Cretaceous beds. Numerous intrusive dikes.	Shaft and open cut workings. Sporadic production of some 50 or more tons of ore, from 1880's to 1924, averaging about 9 oz. Ag/T, 11% Pb, and 1% Cu.	Mines Handbook, 1922 ABM file data
4. Brownell mine (Century-Chief, Index groups; Childs, Brownell Arizona Mng. & Smltg. Co., Producer Mng. & Smltg. Co.)	13S	2E	Cen. 35 Protracted	Ag, Cu, Au-	Irregular and spotty copper oxides and minor sulfides, with hematite and pyrite, in fractured and altered Laramide sediments and volcanics, intruded by igneous dikes and plugs.	Shaft workings with sporadic production in early 1900's and 1920's of some 500 or more tons of ore averaging about 3% Cu and 8 oz. Ag/T.	Copper Handbook, 1906, 1910-1911 ABM file data
5. By Chance mine (V. O.; Childs, Calloway, H. M. Mng. Co.)	14S	2E	NE¼ 12 Protracted	Ag, Cu, Au-	Disseminations and fracture fillings of copper carbonates with hematite and limonite in shattered siliceous Laramide rhyolite.	Shaft and open cut operations. Produced some 1900 tons of ore averaging about 1% Cu and 5 oz. Ag/T in 1950's. Sold as smelter flux.	Ariz. Dept. of Min. Res. file data ABM file data
6. Cara Vaca mine (Knight)	14S	2E	W. Cen. 29 Protracted	Au, Ag	Oxidized quartz-pyrite stringers with enriched gold and silver along a fracture zone in Laramide granitic intrusive.	Shallow shaft operation. Prospected and worked sporadically since 1880's, producing some 60-100 tons of ore carrying about 0.5 ozs. each of Au and Ag per ton.	ABM file data
7. Copper Squaw mine (Andrade, Cooley, Luper)	14S	3E	Cen. 31 Protracted	Cu, Ag, U-	Spotty and weak copper carbonates, minor chalcocite, and traces of urophane and uraninite with quartz, calcite, hematite, and limonite in a fault zone breccia and gouge cutting altered Tertiary volcanics.	Shaft, adit, and pit operations with some 60-100 tons of 5% Cu and 1 oz. Ag/T produced intermittently in late 1940's and early 1950's.	Ariz. Dept. of Min. Res. file data Granger & Raup, 1962, p. 29 ABM file data
8. Horseshoe gold placers (Quijotoa, Golconda; Imperial Gold Mng. Co., Manhattan Co.)	15S	2E	13 and extending 4-5 miles south along mountain front. Protracted	Au, Ag-	Erratically distributed placer gold with some silver in gravelly alluvium resting on caliche-cemented gravel along a mile wide pediment zone at eastern base of mountains.	Placer operations, mainly by dry methods, worked sporadically since 1700's and may have produced some 6,000 ozs. Au and 1,000 ozs. Ag.	Wilson, E. D., 1961, p. 77-78 ABM file data
9. Man's Dream mine (Calloway)	14S	2E	SW¼ 9	Cu, Ag-	Spotty copper oxides and carbonates in lenticular deposits along fractures in a shear zone cutting Laramide rhyolite porphyry.	Open cut operations. Produced some 250 tons of 1.4% Cu ore for smelter flux in late 1950's.	Ariz. Dept. of Min. Res. file data ABM file data
10. Mocking Bird mine group (Pack Rat group; Hadsell, Helldorado Gold & Silver Mng. Corp.)	15S	2E	W. Cen. 13 E. Cen. 14 Protracted	Au, Ag, Pb-, Cu-, V-	Spotty, free gold and silver chlorides, enriched from deeply weathered and oxidized, minor, copper and lead mineralization in quartz-calcite-hematite stringers in a fault breccia zone between Laramide intrusive quartz monzonite and Cretaceous volcanics.	Shaft, tunnel, and open cut operations. Worked sporadically since 1880's with production of some 450 tons of ore averaging about 0.3 oz. Au/T, 1 oz. Ag/T and minor Pb and Cu.	Wilson, E. D., 1934 (Rev. 1967), p. 178 ABM file data

11. Morgan mine group (Cube Iron; Stephens-Harford Mines, Inc., Larrymade Mines Co., Knight, Hedrick)	15S	2E	No. Cen. 23 Protracted	Au, Ag, Pb-, Cu-	Spotty, free gold and silver chlorides with minor oxidized base metal sulfides in quartz, gouge, calcite and iron and manganese oxides in lenticular lenses along a shear zone in altered Laramide quartz diorite intrusive.	Shaft and pit operations. Worked intermittently since 1880's and mainly in 1931-1935, producing some 600 tons of ore averaging about 0.5 oz./T each of Au and Ag and minor Pb and Cu.	Wilson, 1954 (Rev. 1967), p. 179 ABM file data
12. Peer and Peerless group	15S	2E	SW¼ 35 Protracted	Au, Ag, (Ba)	Free gold with silver chlorides in oxidized quartz-calcite-barite-hematite pockets in Laramide rhyolite volcanics along a fault zone.	Numerous small shafts, pits, and adits. Worked out in a short period in 1880's. Production estimated at some 50 or more tons of high grade gold-silver ore.	Stephens, 1884 Stewart & Pfister, 1960, p. 50-51 ABM file data
13. St. Patrick mine (Covered Wells Copper Co.)	14S	2E	E. Cen. 33 Protracted	Cu, Ag, Au-	Oxidized copper sulfides and pyrite in irregular fractures in a strongly chloritized and pyritized fault zone between Laramide rhyolitic volcanics and quartz diorite intrusive.	Tunnel and pit operations. Prospected in late 1800's but main production of some 730 tons of about 2% Cu, 1 oz. Ag/T, and minor gold in 1956.	Ariz. Dept. of Min. Res. file data ABM file data
14. Weldon mine (Weldon Gold & Copper Co.)	16S	2E	E. Cen. 3 Protracted	Au, Ag, Pb-, Cu-, Zn-	Spotty free gold and silver chlorides with minor, largely oxidized, base metal sulfides in pockety lenses of quartz, hematite, manganese oxides, breccia, and gouge along a fault contact zone between Laramide andesitic volcanics and a granitic intrusive.	Shaft and tunnel operations. Prospected and worked intermittently since 1880's to early 1900's. Estimated production could be some 2,500 tons of ore containing about 1 oz./T each Au and Ag and minor Cu and Pb.	Copper Handbook, 1907, 1908 USGS Min. Res. 1907 Engr. Min. Jour., 1909, vol. 87, p. 103 ABM file data
XXV. Quitobaquito District (See Montezuma District)							
XXVI. Redington District (East flank of Santa Catalina Mtns.)	11-13S	17-18E	----	Cu, Ag, W-, U-	Weak and spotty copper mineralization, mostly oxidized; in fracture zones along faults in Precambrian quartzite and Cretaceous sediments. Some minor tungsten occurrences in contact metamorphosed sediments. Traces of uranium minerals, usually with iron oxides, on fractures. Pyrometasomatic copper mineralization at Korn Kob prospect in south central section 14 and north central section 15, T123, R17E.	Numerous pits, shafts, and tunnels. Some 90 tons of ore containing about 6 tons of copper and 140 ounces silver produced up through 1972.	Raabe, 1959 McKenna, 1966 Broderick, 1967 ABM file data
XXVII. Rincon District (Southern Rincon Mtns.)	15-16S	16-18E	----	Cu, Pb, Ag, Clay, Ba	Spotty pockets and generally weak occurrences of lead and copper mineralization, mostly oxidized, as contact metamorphic deposits and along fissure and fault zones in thrust and block faulted Precambrian quartzite and diabase, Paleozoic limestone, and Cretaceous sediments, intruded by Laramide granitic rock. Clay for brick quarried from Tertiary lake beds along Pantano Wash in south central T16S, R17E. Some barite occurs along fault zones.	Mostly small prospect pits and tunnels except for open pit clay quarries. Some 200 tons of ore containing about 18 tons lead, 7 tons copper, 470 ounces silver and 112 ounces gold produced in the district up through 1972.	Layton, 1957 Weidner, 1957 Acker, 1958 Kerns, 1958 Metz, 1963 ABM file data

Table 4, Cont.

	MINING DISTRICT AND MINES	LOCATION T.	R.	Sec.	MINERAL PRODUCTS	GEOLOGY	TYPE OF OPERATION AND PRODUCTION	REFERENCES
XXVIII.	Rosemont District (See Helvetia-Rosemont Districts)							
XXIX.	Roskruge District (Roskruge Mtns.)	14-15S	9-10E	----	Ag, Cu, Pb, Au-	Spotty, scattered, and generally weak, oxidized silver, copper, lead, and minor gold mineralization along fracture zones in Cretaceous and Tertiary volcanics and sediments.	Mostly prospects. Some 380 tons of ore containing about 10,500 ounces silver, 25 tons copper, 25 tons lead, and 20 ounces gold produced through 1972.	Bikerman, 1965, 1968 Heindl, 1965 ABM file data
1.	St. Jude mine (Brickta, Carpenter)	15S	9E	W. Cen. 17	Ag, Cu, Pb-, Au-, (Ba, Mn)	Argentite and native silver with minor copper and lead mineralization, manganese, and barite in a fault zone cutting Cretaceous volcanics and sediments.	Shaft workings. Produced some 300 tons of ore, averaging about 33 oz. Ag/T, 1% Cu and minor lead and gold in 1933 and 1939.	ABM file data
XXX.	Santa Rosa District (Santa Rosa Mtns.)	11-12S	5E Protracted	----	Cu, Ag, Au, Pb, Zn	Oxidized copper, silver, lead, zinc, and gold mineralization along shear and fault zones in metamorphic schist intruded by Laramide granitic intrusive and in the intrusive. Mainly quartz gangue. Andesite dikes.	Numerous small prospects and mines, mainly in southwest quarter of T11S, R5E and T12S, R5E, protracted, at north and south ends of Santa Rosa Mountains. Total sporadic production from 1916 to 1940 was some 200 tons of ore containing about 9 tons of copper, 2,000 ounces of silver, 3.5 tons of lead, and 60 ounces of gold.	ABM file data
XXXI.	Silver Bell District (Silver Bell and West Silver Bell Mtns.)	11-12S	7-8E	----	Cu, Ag, Pb, Zn, Mo, Au, Mn-	1. Supergene enriched deposits of chalcocite with minor copper carbonates and silicates in sheeted, closely spaced veinlets and seams of quartz, with pyrite and chalcopyrite, in hydrothermally altered Laramide alaskite, monzonite, and some dacite porphyry. 2. Disseminated, partly oxidized, chalcopyrite, and minor galena and sphalerite, in pyrometasomitized Paleozoic limestone and quartzite pendants in Laramide intrusives. 3. Pyrometasomatic mantos, pods, and lenses of zinc, copper, and lead carbonates and sulfides in a garnetized Paleozoic limestone block. Ore controlled by faults, bedding, and andesite dikes. 4. Spotty copper oxides, minor wulfenite, and manganese and iron oxides in limy Cretaceous and interbedded Permian limestone and quartzites along a fault zone. Often associated with andesite porphyry intrusives.	Shaft, adit, and open pit operations. Worked since 1873 but major production from open pits after 1953. Total estimated and reported output through 1972 would be some 61.2 million tons of ore containing about 504.4 thousand tons of copper, 24 thousand tons of zinc, 900 tons of lead, 5.3 million ounces of silver and 1,490 ounces of gold.	Barney, 1904 Tolman, 1909 Stewart, 1912 Shoemaker & Somers, 1924 Richard & Courtright, 1954, 1966 Kerr, 1961 Agenbroad, 1962 Clarke, 1966

1. Atlas mine (Atlas Mng. Co., Atlas Mines Inc., B. S. & K. Mng. Co.)	11S	8E	E. Cen. 32	Zn, Cu, Ag, Au, Pb-	Pyrometasomatic mantos, pods, and lenses of zinc, copper, and minor lead carbonates and sulfides, controlled by faults, bedding planes, and intrusive dikes in garnetized Paleozoic limestone bordering Laramide alaskite and dacite porphyry intrusive.	Shaft and tunnel workings. Worked since early 1900's but mainly from 1947, producing some 147.5 thousand tons of ore averaging about 16% Zn, 1.3% Cu, 0.6 oz. Ag/T and minor Pb and Au.	Mines Handbook, 1920 Agenbroad, 1962 ABM file data
2. El Tiro mine (Red Boot group; Cleveland-Arizona Mng. Co., El Tiro Copper Co., El Tiro Leasing Co., Williams, Western American Mines Co., Chemical Process Copper Co., Am. Smltg. & Rfng. Co.)	11S 12S	8E 8E	SW¼ 33 NW¼ 4	Cu, Ag, Pb-, Au-	Irregular pyrometasomatic, partly oxidized, copper orebodies in a garnetized and sheared Paleozoic limestone block in contact with Laramide alaskite, dacite porphyry, and monzonite.	Prospected and worked since late 1800's and developed from Daisy and Kurtz shafts. Underground mine operated until 1931, producing some 203.5 thousand tons of ore averaging about 5% Cu, 0.2 oz. Ag/T and minor Au and Pb. Open pit El Tiro operation included under Silver Bell mine.	USGS Min. Res., 1905, p. 153 USGS Min. Res., 1907, p. 176 Stewart, 1912 Mines Handbook, 1918 Shoemaker & Sommers, 1924 ABM file data
3. Magonigal mine (Gordon)	11S	7E	E. Cen. 34	Cu, Ag, Pb-, Mo-, Mn-	Spotty copper oxides, minor copper sulfides, and wulfenite, with manganese and iron oxides, along a fault zone cutting Cretaceous sediments and andesitic volcanics.	Shallow shaft and surface workings. In mid-1950's produced some 300 tons of ore averaging about 2.5% Cu and 0.14 oz. Ag/T.	Clarke, 1966 ABM file data
4. Mammoth mine (Old Boot, Imperial, Union; Huachuca Mng. & Smltg. Co., Pima Co. Mng. & Smltg. Co., Silver Bell Mng. Co., Albert Steinfeld Co., Imperial Copper Co., Am. Smltg. & Rfng. Co.)	12S	8E	NE¼ 4	Cu, Ag, Pb-, Zn-, Mo-, Au-	Copper, and minor lead and zinc carbonates and sulfides in fissure veins and irregular disseminations in pyrometasomatic deposits in garnetized or altered Paleozoic limestone blocks engulfed in Laramide dacite porphyry and monzonite intrusives, along a major fault zone.	Prospected and worked from 1870's to 1931 as an underground mine. Over 1 million tons of ore produced, averaging better than 3% Cu and about 1 oz. Ag/T with minor Pb, Zn and Au.	Copper Handbook, 1902, 1903, 1904, 1905 USGS Min. Res., 1905 Stewart, 1912 Richards & Courtwright, 1954, 1966 ABM file data
5. Oxide mine (Young America; Oxide Copper Co., Am. Smltg. & Rfng. Co.)	12S	8E	NE¼ 10 NW¼ 11	Cu, Ag, Au-	Veins and disseminations of copper carbonates in pyrometasomatic deposits in garnetized Paleozoic limestone blocks engulfed in Laramide dacite porphyry and monzonite along a major fault zone.	Prospected and worked by shaft, tunnel and some open pits since 1880's. Up through 1918, produced some 5,000 tons of ore averaging about 11% Cu and 1 oz. Ag/T. From 1954, production included under Silver Bell mine.	USGS Min. Res., 1905, p. 153 Copper Handbook, 1906, 1908 Stewart, 1912 Mines Handbook, 1918 ABM file data
6. Silver Bell mine (El Tiro and Oxide open pits; Am. Smltg. & Rfng. Co.)	12S	8E	NW¼ 4 Cen. 11	Cu, Ag, Mo, Au	Supergene enriched deposits of chalcocite with minor copper carbonates and silicates derived from sheeted, closely spaced, veinlets and seams of quartz, pyrite, chalcopyrite, and minor molybdenite in hydrothermally altered Laramide dacite porphyry and monzonite.	Two open pit operations since 1954. Up through 1972, production has been some 59.8 million tons of ore averaging about 0.8% Cu, 0.06 oz. Ag/T, 0.004% Mo and minor Au and Pb.	Richards & Courtwright, 1954, 1966 ABM file data
7. Silver Lead mine group (Contreras)	11S	8E	SW¼ 28	Pb, Zn, Cu, Ag	A small, spotty, pyrometasomatic deposit of largely oxidized, base metal sulfides in a Paleozoic limestone block along a fault contact with Laramide intrusive.	Shallow shaft and pit workings. In 1948-1949 produced some 130 tons of ore averaging about 3% Pb, 2% Zn, 1% Cu and 2 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	REFERENCES
8. Sunset mine group (Hartley)	11S	7E	Cen. 34	Mn, Cu-	Spotty and irregular, replacement deposit of psilomelane with minor soft manganese and copper oxides, in Permian limestone interbedded with quartzite along a narrow fault zone and associated with an andesite dike.	Shallow shaft, adit and open pit. Produced some 66 long tons of 28% Mn in 1955.	Farnham et alia, 1961, p. 119 Clarke, 1965
XXXII. Waterman District (Silver Hill; Waterman Mtns.)	12S	8-9E	----	Cu, Pb, Zn, Ag, Au	Vein-like deposits of base metal carbonates and sulfides along fault and fracture zones in steeply folded Paleozoic formations. Some oxidized copper found in the Cretaceous sediments and isolated Paleozoic outcrops.	Shaft and adit operations. Worked intermittently since late 1880's with a total production through 1972 of some 25,000 tons of ore containing about 750 tons of copper, 780 tons of lead, 490 tons of zinc, 110 ounces of gold, and 130,000 ounces of silver.	Ruff, 1951 McClymonds, 1957, 1959 ABM file data
1. Indiana-Arizona mine group (Carbonate group, Burro, Homestake, Abbie Waterman, Paddy Woods; Indiana-Arizona Development Co., Indiana-Arizona Copper Co., International Ore Separation Co., Indiana-Arizona Mng. Co., Golden Crown Mng. Co., Waterman Mtns. Mng. Co., Western Minerals Corp., Knox-Arizona Copper Mng. Co.)	12S	8E	NE¼ 25 Protracted	Pb, Zn, Cu, Ag, Au-, Mn-	Irregular, vein-like, and pipe-like orebodies containing base metal carbonates and sulfides in siliceous, limonitic and manganiferous breccia zones along strong faults and fissures or at fissure intersections in folded Paleozoic quartzites and limestones.	Shaft and adit operations. Found in late 1880's but only worked sporadically from 1907 to 1969, producing some 8,000 tons of ore averaging about 7% each of Pb and Zn, 2% Cu, 8 oz. Ag/T and minor Au.	Mines Handbook, 1926 Ruff, 1951 ABM file data
2. Carlo & Eclipse mines (Carrillo, Bruce, Ace Mng. Co.)	13S	8E	NW¼ 1 NE¼ 2	Cu, Ag	Oxidized copper mineralization associated with a fault zone cutting Cretaceous sediments. Fault blocks of Paleozoic limestone, quartzite, and mudstones.	Shaft and pits. Worked in 1955-1956 and 1962-1963, producing some 600 tons of ore averaging about 2% Cu and 1.1 oz. Ag/T. Shipped as siliceous smelter flux.	Ariz. Dept. Min. Res. file data ABM file data
3. Silver Hill mine group (Silver Hill Consol. Copper Co., Ohio Arizona Copper Co., Silver Hill Mines Co., Snyder, Byrd, Arizona Copper Bell Mng. Co.)	12S	9E	NW¼ 31	Cu, Ag, Pb	Lensing veins and some limestone replacements, containing copper and lead carbonates and sulfides along faults and fractures in Paleozoic limestone and quartzite.	Shaft and adit operations. Originally prospected in late 1800's and worked sporadically from 1916 to 1947, producing at least 16,000 tons of ore averaging about 3.5% Cu, 3.5 oz. Ag/T, 0.6% Pb and minor Au.	ABM file data

XXXIII.	Whetstone (Benson) District (Whetstone Mtns.)	17-19S	18E	----	Cu, Ag	Spotty copper mineralization, mostly oxidized, in Cretaceous sediments intruded by Laramide rhyodacite intrusives. Strong faulting.	Open pit mining for smelter flux at Copper Plate mine, T19S, R18E, central section 24, where some 1,600 tons of ore averaging about 1.2% Cu and 0.6 oz. Ag/T was produced in 1957-1958.	Creasey, 1967 ABM file data

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