

DEPARTMENT OF MINERAL RESOURCES

STATE OF ARIZONA

PHOENIX, ARIZONA

R.I.C. Manning, Director

HISTORY

OF

MINING IN ARIZONA

Compiled by
Frank J. Tuck, Statistical Engineer
1955

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HISTORY OF MINING IN ARIZONA

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The Arizona Department of Mineral Resources has compiled a chronological history of mining in Arizona, from reports of the Arizona Bureau of Mines, the U. S. Bureau of Mines, as well as from the records of this State Department of Mineral Resources. It has been impossible to mention, in this history, all of the mining districts, but it is believed that the important districts are covered. Apology is made if any area that may be considered important is unintentionally overlooked.

GENERAL CHRONOLOGICAL SUMMARY *

- 1530 Nuno de Guzman, president of the Governing Board of New Spain, hears of the Seven Cities of Cibola far to the north, whose streets were "paved with gold and silver." He founds San Miguel de Culiacan in Mexico.
- 1536 Alvar Nunez Cabeza de Vaca and the Negro, Estevan, reach Culiacan with fresh rumors of Cibola.
- 1539 Francisco Vasquez de Coronado sends Friar Marcos de Niza and Estevan to find the Seven Cities of Cibola. Niza was the first white European to enter Arizona. The expedition reaches the Zuni Pueblos. Estevan is slain by the Indians, and Niza returns with imaginative tales of gold and silver utensils.
- 1540 Coronado's expedition enters Arizona and discovers the Seven Cities of Cibola to be seven Indian villages with no metallic riches.
- 1557 Bartolome de Medina, of Pachuca, Mexico, invents the patio process of silver amalgamation.
- 1583 Antonio de Espejo discovers a deposit said to be silver ore, the first in Arizona, possibly the United Verde deposit, near the headwaters of the Verde River. He also discovers the Verde River salt deposits.
- 1604 Juan de Onate explores northern and western Arizona but discovers no mineral.
- 1691 Padre Eusebio Francisco Kino enters Arizona and for twenty-five years explores and develops the Papago country.
- 1705 Kino mentions the mining of rich silver ores. These were probably the Santa Rita Mountain deposits.
- 1736 Famous Bolas de Plata silver deposit at Arizonac in northern Sonora was discovered.
- 1750 Some copper mined at Ajo.
- 1774 Placering for gold in Quijota district.

* Events up to 1950 inclusive are chiefly reported from Arizona Bureau of Mines Bulletins Nos. 145 and 159.

- 1776 Spanish Garrison transferred from Tubac to Tucson, which up to this time was only an Indian village.
- 1777 Arivaca mentioned as a mining community.
- 1790-1820 Period of prosperity for the Spanish Missions but mining was unimportant.
- 1792 Legal ratio between gold and silver in United States made 16 to 1.
- 1800 Copper being mined in a primitive way at Santa Rita, New Mexico.
- 1823 Mexico obtains its independence. The Missions are abandoned.
- 1825 The first American Scouts begin to explore Arizona. Sylvester and John Pattee lease Chino deposit at Santa Rita, New Mexico.
- 1836 The Apaches are made unfriendly to the Americans by the murder of Chief Juan Jose.
- 1848 American troops under Kearney first enter Arizona. Marshall discovers gold in California.
- 1853 Gadsden Purchase from Mexico of that part of Arizona and New Mexico south of the Gila River.
- 1854 Charles D. Poston begins search for gold and silver near Tubac.
- 1855 Mexican troops leave Tucson and Tubac and are replaced by Americans. Rich copper ore hauled from Ajo to San Diego for shipment to Swansea, Wales.
- 1856 Santa Rita silver mine near Tubac opened. Exploration of Santa Rita and Cerro Colorado Mountains.
- 1857 Prospectors begin to enter Arizona in numbers. Gold ore found in Mohave County near Colorado River.
- 1858 Discovery of the Mowry lead-silver mine in the Patagonia Mountains. Discovery of the Gila City or Dome placers near Yuma.
- 1859 Rich silver ore being mined at Heintzelman Mine in Cerro Colorado Mountains.
- 1861 Start of Civil War. Withdrawal of troops followed by Apache depredations.
- 1862 Confederate troops occupy Tucson. They are driven out by California Column under General A. H. Carleton who established posts at Camp Verde, Ft. McDowell, and Ft. Whipple. La Paz gold placers discovered by Pauline Weaver.
- 1863 Castle Dome district near Yuma becomes known. Discovery of many placer and lode deposits in the Prescott region. The Moss Mine, Oatman district, Vulture Mine near Wickenburg, and Planet Mine near the Williams River were discovered. The Moss and Vulture were lode gold mines, the Planet was copper. Many lode deposits discovered in Mohave County. Arizona was made a Territory, chiefly because of gold discoveries, with Prescott as the Capital.

- 1864 Henry Clifton rediscovers copper in eastern Arizona.
- 1865 Small-scale Mexican copper operations at Cananea, Sonora.
- 1866 Apaches on war path.
- 1867 Capital moved from Prescott to Tucson.
- 1871 The Federal Government sends a large number of troops and determines to end the Apache problem which was finally settled with the surrender of Geronimo in 1886.
- 1872 Town of Clifton founded by Metcalf and Stevens.
- 1873 U. S. Mint by act of Congress discontinues the coinage of silver dollars. Great financial and industrial panic.
- 1874 Globe becomes a booming silver camp. Railroad built from Clifton to Metcalf, the first in Arizona. McCracken silver-lead mine discovered in Mohave County. Richmond Basin Silver district northeast of Globe is opened.
- 1875 Silver King Mine in Superior district discovered by Mason and Copeland. Silver Queen (Magma) also discovered. The Lesinsky brothers build a copper furnace of one ton daily capacity at Clifton. Detroit Copper Company founded and mining started at Morenci.
- 1876 Southern Pacific Railway reaches Gila Bend from California. United Verde ore body discovered at Jerome by M. A. Ruffner. Mineral Park district, Mohave County, active.
- 1877 John Dunn, Army Scout, makes first location in Warren district. Ed Schieffelin "goes to hunt for his tombstone"
- 1878 First shipment of matte from Copper Queen claim. First locations made at Tombstone recorded. Act of Congress again makes silver legal tender, Bland-Allison bill.
- 1879 Boom starts at Tombstone.
- 1880 Lesinsky sells out to Arizona Copper Company at Clifton after making \$2,000,000. Phelps Dodge on advice of Dr. James Douglas buys half interest in Detroit Copper and builds small smelter at Morenci. Dr. Douglas pays first visit to Bisbee. Silver-copper ore is mined from Silver Queen at Superior (now the Magma).
- 1881 Railroad reaches Lordsburg. Old Dominion Copper and Smelting Company starts operations at Globe. Phelps Dodge acquires Atlanta claim at Bisbee. Mammoth district opened. A small copper furnace is in operation at the present site of Miami.
- 1882 United Verde Copper Company organized. Atlantic and Pacific Railroad crosses northern Arizona.
- 1883 Some copper mining undertaken at Ray. A small smelter built at Jerome.

- 1885 Copper Queen Consolidated Mining Company formed and builds concentrator and smelter. Territorial Legislature creates University of Arizona.
- 1886 Bonanza ores exhausted at Morenci and concentrator built by William Church to treat oxidized ore that averaged 6.5 per cent copper. Six furnaces in operation at Globe.
- 1887 Congress gold mine discovered by Dennis May.
- 1888 Dr. James Douglas turns down United Verde because of inaccessibility. Old Dominion Company reorganized at Globe. First building to house the School of Mines of the University of Arizona completed at Tucson. Harquahala gold deposit discovered.
- 1889 Senator W. A. Clark obtains control of the United Verde mine, which resumes operations.
- 1890 Sherman silver purchase bill enacted by Congress. Louis D. Ricketts becomes assistant to Dr. Douglas.
- 1891 The cyanide process after years of experimenting becomes a success in South Africa and revolutionizes gold mining.
- 1892 Phelps Dodge Corporation purchases United Globe Mines at Globe and also certain claims in the Miami district.
- 1893 Silver demonitized. Disastrous panic. Prospectors turn from silver to gold. Copper Queen works first sulphides.
- 1894 Rail connection completed to Jerome. An unsuccessful attempt made to work the Ajo deposit.
Raw copper placed on free list.
- 1895 Cyanide process introduced at Congress Mine, one of the first installations of it in this country. Fortuna Mine southeast of Yuma discovered.
- 1896 King of Arizona Mine northeast of Yuma discovered by Chas. E. Eichelberger. McKinley elected President, and gold standard assured. First disseminated copper ore treated at Clifton by James Colquhoun, but this was relatively high-grade ore.
- 1898 War with Spain.
- 1899 McKinley re-elected and free silver issue is dead. Daniel C. Jackling does the pioneer mill testing of a low-grade porphyry ore at Bingham, Utah. United Verde Extension Mining Company formed. An English company, Ray Copper Mines, Ltd., unsuccessfully attempts to work Ray deposit.
- 1900 A smelter is built at Douglas by Phelps Dodge Corporation. Rich gold ore is found in Oatman district. John R. Boddie, Captain Huie, and several others organize the Cornelia Copper Company to work the Ajo deposit.
- 1902 Calumet and Arizona Company is organized.
- 1903 Phelps Dodge obtains control of the Old Dominion at Globe. Gold Road Mine discovered in Oatman district.

- 1904 F. L. Ransome, of the U. S. Geological Survey, prepares report on the Bisbee district.
- 1905 Waldemar Lindgren writes report on Morenci for the U. S. Geological Survey.
- 1906 Philip Wiseman and Seeley Mudd obtain options at Ray. J. Parke Channing examines the copper deposits at Miami, and exploratory shafts are started. The famous McGahan vacuum smelter is built at Ajo, the most fantastic metallurgical scheme ever devised. First low-grade porphyry copper production at Morenci.
- 1907 Daniel C. Jackling undertakes extensive development work at Ray. John Lawler owns eight claims at Bagdad. Panic of 1907.
- 1907-1908 Arizona passes Montana in copper production and becomes the No. 1 copper producer in the U. S.
- 1908 Miami Copper Company and Inspiration Copper Company are organized. Tom Reed Gold Mines Company starts intensive operations on the Tom Reed vein in the Oatman district.
- 1909 Sacramento Hill at Bisbee is drilled. J. Parke Channing and Seeley Mudd drill at Ajo and reject property. Cornelia Copper Company reorganized as New Cornelia Copper Company. Lewis S. Cates is placed in active charge at Ray.
Arizona loses its No. 1 position in copper production.
- 1910 Hayden, Stone and Company finance Chino, and large-scale stripping operations commence at Santa Rita, New Mexico. Magma Copper Company at Superior is formed.
Arizona regains the No. 1 position in copper production and retains it thereafter.
- 1911 Production starts at Miami Copper Company. American Smelting and Refining Company builds smelter at Hayden. Ray production starts on large scale. General John C. Greenway becomes interested in Ajo, and the New Cornelia property is drilled by the Calumet and Arizona Company. Production starts at Magma.
- 1912 Town of Oatman started. Arizona admitted to the Union as forty-eighth state. James S. Douglas becomes interested in United Verde Extension, and development work there is begun.
- 1914 World War 1 starts.
- 1915 Large gold ore body developed in United Eastern Mine at Oatman. Metal prices start to boom. International Smelting Company erects smelter at Miami. Flotation introduced at Inspiration, the first large-scale copper flotation plant in this country. Arizona Bureau of Mines created by State Legislature.
- 1916 United Verde Extension mines bonanza ore body at Jerome.
- 1917 United Eastern purchases Big Jim at Oatman. Production starts at New Cornelia with leaching ore. War prices for metals. Extensive working of small high-cost copper, manganese, and tungsten deposits. New Cornelia buys property of Ajo Consolidated Company.
- 1918 Steam shovel operations start at Sacramento Hill at Bisbee.

- 1919 Experimental flotation plant installed at Ajo.
- 1921 Postwar depression and shut down of copper properties.
- 1922 Entire Morenci district now controlled by Phelps Dodge. End of postwar depression.
- 1923 Copper Queen mill south of Bisbee is placed in operation.
- 1924 Ray and Chino merge. Concentrator at Ajo put into operation, and treatment of sulphide ore commences. Smelter is completed at Magma.
- 1925 End of high-grade ore at Miami in sight. Company plans for working low grade.
- 1926 Ray Consolidated absorbed by Nevada Consolidated. Large-scale leaching operations started at Inspiration.
- 1928 Drilling program started on Clay ore body at Morenci. Extensive addition to concentrator at Ajo.
- 1929 Climax of boom and start of the great depression. Sacramento Hill open pit operations discontinued. Louis S. Cates becomes president of Phelps Dodge. Miami Copper mining low-grade ore body successfully
- 1930 Copper price collapses from 18 to under 10 cents a pound.
- 1931 Phelps Dodge absorbs Calumet and Arizona. Great Britain abandons gold standard.
- 1932 Curtailed copper operations. Extensive reworking of gold placer deposits. Four-cent tariff placed on copper imports. Copper price declines to under 5 cents a pound.
- 1933 Price of gold is raised to \$25.56. Silver legislation.
- 1934 Price of gold is raised to \$34.95 per ounce with subsequent boom in small gold properties.
- 1935 Price for newly mined domestic silver raised to 77.57 cents.
- 1936 Period of general recovery.
- 1937 Business pick up, high copper prices and subsequent collapse in summer and fall. Extensive development of Clay ore body (Morenci Open Pit Mine) is started.
- 1938 Partial or complete shutdown of copper properties and re-opening in late summer. Price for newly mined domestic silver reduced to 64.64 cents. War scares. United Verde Extension finishes ore body, and smelter is dismantled and sold. Arizona Small Mine Operators Association is formed.
- 1939 Arizona Department of Mineral Resources created by Legislature. World War II begins. Mineral industries geared to high production. Copper, Lead, and Zinc prices begin long climb upward.

- 1940 U. S. copper imports exceed exports; government stock piling stimulates entry of Latin American and African copper into United States. Zinc output largest in Arizona's history.
- 1941 Pearl Harbor. United States declares war on Axis nations. Copper price under voluntary control.
- 1942 Morenci begins large-scale, open-pit production. Record zinc output. Government premium prices inaugurated February, 1942. Most gold mines closed by government order L-208, October, 1942.
- 1943 Open pit production at Castle Dome mine commences in April. Arizona's metal output greatest since 1929. Severe labor shortages. Zinc output establishes new record. U. S. Bureau of Mines starts exploratory drilling at San Manuel copper deposit after recommendation by B. S. Butler and N. P. Peterson, of University of Arizona and U. S. Geological Survey.
- 1944 Magma Copper Company becomes interested in San Manuel mine near Mammoth. Seven percent decrease in Arizona metal production owing in part to labor shortage. Increase from 25,000 to 45,000 tons of ore per day at Morenci copper concentrator. Lead and zinc output highest in State's history.
- 1945 Cessation of hostilities with Axis. Zinc production makes new record, 38 percent greater than 1944. Lead also new record, 37 percent greater than 1944.
- 1946 San Manuel exploration continues; 211,500,000 tons of ore proved up. Lead and zinc production continues upward trend, exceeding 1945. Stimulation of interest in non-metallics owing to building boom.
- 1947 San Manuel Copper Company reports a total of 462,784,500 tons of copper ore proved. Government premium prices expire in June.
- 1948 Copper excise tax reduced from 4 cents to 2. (Tax had been suspended during the war, and suspension continued to March 31, 1949.) High metal prices continue to stimulate mining industry. The output of copper ore and zinc-lead ore was the highest of any year in the history of the State. Open-pit development was completed at Inspiration and in progress at Ray. Underground exploration begins at San Manuel.
- 1949 Copper import tax again suspended in March to June 30, 1950. Owing to a drop in base-metal prices in March and April and subsequent reduction of the work-week to 40 hours, copper production was curtailed by 5 percent under the output of 1948. Production of zinc and lead, however, reaches a new high.
- 1950 Production of copper, gold, and silver increased while the output of zinc and lead decreased. Interest in tungsten, manganese, and other critical metals and minerals was stimulated by world conditions. 2-cent copper tax resumed July 1st. Open-pit production commenced at Ray. Phelps Dodge begins development of Lavender Pit. New copper smelter blown in at Ajo.
- 1951 The 2-cent copper tax suspended April 1st, with provision for resumption of the tax if copper drops to 24 cts.

1951-1953 Flood of imports of lead and zinc causes shut-down of many lead and zinc mines.

1952-1954 Banner Mining Company and Pima Copper Mining Company appear among notable producers of copper in the Pima Mining District south of Tucson.

1953- Castle Dome ore reserves exhausted.
Operations cease at United Verde in March.
Development of Miami's low grade ore started.
Manganese ore purchasing depot opened at Wenden, January 26th.
Copper price decontrolled May 1st.
Asbestos purchase depot opened by U. S. Government at Globe.
Copper tax suspension continued to June 30, 1954.

1954 Castle Dome's mill building is moved to Copper Cities, and production is begun at the latter mine in August.
Miami begins production from low-grade ore-body.
Inspiration takes option on Christmas mine.
A. S. & R. Company begins production from Silver Bell mine in Pima County, in March.
Phelps Dodge begins production at Lavender Pit (Bisbee), August 7th.
Copper tax suspension extended to June 30, 1955.

HISTORY OF GOLD MINING IN ARIZONA

Source: J. B. Tenney, Arizona Bureau of Mines Bull. No. 137

Gold mining in Arizona did not start to any appreciable extent until after the acquisition of the territory by the United States from Mexico in 1848 and 1853. What little mining was done by the Spanish and Mexican miners was for silver. A little placer gold was brought in to the churches by Indian converts from the dry working of gravels in the desert, but no systematic mining was done.

After the final occupation of Arizona in 1853, the only accessible part of the Territory was that around the old Mexican settlements of Tucson and Tubac. Considerable prospecting was done in this part of the Territory by American prospectors, and several silver mines and one copper mine was opened, but little or no gold mining was done. On the outbreak of the Civil War, the withdrawal of troops opened the door to Apache raids, and all mining ceased.

During the Civil War, prospectors entered the Territory with the California troops, and several exploring parties were organized to hunt for gold in the central part of the State, hitherto an unknown wilderness dominated by Apaches. Rich placers were found near the Colorado River at Gila City, La Paz, and Quartzsite, and soon after the Rich Hill, Lynx Creek, Hassayampa, and Big Bug placers in the Bradshaw Mountains of central Arizona were discovered. Base metal mines and even silver mines were not sought, as only gold could be mined at a profit from this inaccessible and hazardous corner of the world. After the richer parts of the placers were exhausted, gold ledges were located and worked in the crudest manner. Most of the free-milling ore proved superficial. Only one large deposit, the Vulture, was exploited on a large scale.

At the end of the Civil War, troops were again withdrawn, resulting in ten years of chaos and bloody warfare with the Apaches. Little mining was done except around Prescott and Wickenburg where some protection was given by troops guarding Prescott, then the capital of the Territory.

Finally, in 1872, large reservations were set aside for the Indians and the first truce was declared. The country was then enjoying the post-Civil War period of high commodity prices. Gold was relatively low in price as compared with silver and copper. Prospecting for these two metals, on the establishment of peace with the Indians, took precedence over gold, resulting, in the succeeding ten years, in the discovery and exploitation of rich silver mines in the Bradshaws, Silver King, Signal, Globe, and Tombstone. This silver boom was followed after the completion of the two transcontinental railroads in 1881 by the discovery and early exploitation of nearly every copper deposit in the Territory.

From 1884 to 1893 the country went through a severe deflation of commodity values. The copper and silver markets fell rapidly resulting in a relative rise in the price of gold. On the demonitization of silver in 1893, practically all silver mining ceased, and only the richest and largest copper mines continued to operate.

From 1893 to 1900, miners from all the old silver camps of the west again turned to the search for gold, which resulted in Arizona in the discovery of numerous new gold deposits, more notably the Congress and Octave in the Bradshaw Mountains, the Mammoth north of Tucson, and the rich Harqua Hala, La Fortuna, and King of Arizona mines in the desert of Yuma County. The development of the cyanide process and of better concentration methods encouraged the re-opening of numerous old mines near Prescott and the exploitation of the deeper base ore.

Towards the end of the nineteenth century, the long period of stagnation ended and commodity prices again turned upwards. Gold mining became less attractive, and the miners in Arizona turned their attention to copper. From 1900 until the business collapse of 1929 and 1930, gold mining was subordinate to base-metal mining. The only exceptions were the discovery and exploitation of the rich vein deposits of the Gold Road, Tom Reed, United Eastern, and others, in the Oatman district. Gold mining also continued on a reduced scale in the older mines of the Bradshaw Mountains and in those of Yuma County.

On the collapse of commodity prices in 1930, miners again turned their attention to gold. The first result was the search for new placers and the re-working of old fields, with indifferent results. The higher gold prices that were established by the United States in 1933 have revived activity in most of the old gold camps and stimulated prospecting throughout the State. In 1933, production was about 12 percent greater than in 1932.

Arizona has produced more non-ferrous metallic wealth than any state or territory in the Union. While most of this production has been in copper, nearly every copper mining operation in the State has yielded important quantities of gold.

Before the advent of the big porphyry copper producers in 1912, the gold lode mines and placers were accounting for 75% of gold production in Arizona. From 1912 until 1942, when the gold mine closing order (L-208) was issued by the Government, the gold mines and placers still accounted for almost half of Arizona's gold production. Since the gold mine closing order, production of gold lode mines and placers has dropped to below 3% of the total; sometimes less than 1%.

HISTORY OF COPPER MINING IN ARIZONA, BY DISTRICTS

NEW CORNELIA MINE IN AJO

- 1854 First mining of copper by Americans in Arizona said to have occurred in Ajo.
- 1855 Rich copper ore hauled from Ajo to San Diego.
Intermittent shipments of high-grade copper ore continued off and on until 1900.
- 1900 John R. Boddie, Capt. Huie and others organize the Cornelia Copper Company, to work the Ajo deposit.
- 1906 The famous McGann vacuum smelter is built at Ajo, and comes to an inglorious end in an unsuccessful run.
- 1909 Cornelia Copper Company reorganized as New Cornelia Copper Company.
- 1909-1910 J. Parke Channing and Seeley W. Mudd drill at Ajo and reject the property.
- 1911 Gen. John C. Greenway becomes interested in Ajo, and New Cornelia property is drilled by the Calumet and Arizona Company.
- 1912 Leaching tests begin at Ajo by the New Cornelia Company.
- 1917 A five thousand ton leaching plant is built at Ajo and becomes completely successful.
The New Cornelia Company acquires the property of its neighbor, the Ajo Consolidated Company.
- 1918 New Cornelia pays its first dividend - November.
- 1924 A 5,000 ton flotation plant, designed by H. Kenyon Burch, is started at Ajo. Expanded to 29,000 tons in subsequent years.
- 1929 New Cornelia merged with Calumet and Arizona.
- 1930 Leaching plant at Ajo abandoned after producing 345,000,000 pounds of copper.
- 1931 New Cornelia becomes a Branch of Phelps Dodge Corporation.
- 1932 Operations at Ajo are suspended in April and the property remains idle until July, 1934.
- 1950 New Copper smelter blown in at Ajo in July, and New Cornelia begins to treat concentrates instead of shipping them to Douglas.
- 1954 Total production to end of 1954 - 179,758,686 tons of ore and approximately 2,883,170,000 pounds of copper.

CLIFTON-MORENCI MINING DISTRICT

- 1864 Henry Clifton and a group of prospectors from Silver City, New Mexico, re-discover rich copper carbonate ore, formerly mined by Mexican explorers in eastern Arizona.
- 1872 A prospector named Isaac Stevens, together with Bob Metcalf and six others, locates the first mining claims and founds the town of Clifton.
- 1873 Leszinsky Brothers build a one-ton copper furnace at Clifton, and organize the Longfellow Copper Company.
- 1874 Wm. Church, who came to Joy's Camp (now Morenci), obtains an option on four patented claims, including the Copper Mountain, and organizes the Detroit Copper Mining Company, with Capt. E. B. Ward and others from Detroit.
- 1880 Detroit Copper Mining Company builds smelter on the San Francisco River, three miles below Clifton, and later a 20-in. gauge railroad is built, using the first locomotive (1881) ever operated in the territory of Arizona.
- 1882 Phelps Dodge, on recommendation of Dr. James Douglas, contributes toward the building of a new smelter by the Detroit Copper Company, and acquires a half-interest in the property.
- 1883 A railroad is built from Clifton to Lordsburg, New Mexico.
- 1884 The Longfellow Group is acquired by a syndicate of capitalists who organize the Arizona Copper Company, Ltd. The Humboldt and Morenci mines are included in the Company's holdings.
- 1886 Church builds and operates the first copper concentrator in Arizona. A few months later, James Colquhoun built another and larger concentrator for the Arizona Copper Company.
- 1893 Colquhoun leaches the rich mill tailings from the old concentrators, and produces copper at a profit.
- 1895 The Arizona Copper Company pays its first dividend. Phelps Dodge Company purchases Capt. Ward's Detroit Copper Company and Clifton becomes for many years the greatest copper district in the southwest.
- 1897 Dr. Douglas becomes president of Detroit Company, and with Charles E. Mills and James Colquhoun, developed and expanded both the Detroit and Arizona Copper Company properties.
- 1906 Colquhoun constructs the No. 6 concentrator to handle the leaner sulphide ores.
- 1917 The Detroit Copper Company becomes known as the Morenci Branch of the Phelps Dodge Corporation.

- 1918 Shannon Copper Company, at Metcalf acquired by Arizona Copper Company. This property had produced 172 million pounds of copper from 1903 to 1918.
- 1921 Arizona Copper Company has a record of producing 870 million pounds of copper from 1873 - 1921. Detroit Copper Company - a record of 460 million pounds of copper from 1882 - 1921.
- 1922 The Arizona Copper Company absorbed by Phelps Dodge.
- 1929 Louis S. Cates becomes president of Phelps Dodge Corporation, and directs a thorough program of development and testing of the Morenci property.
- 1942 Open pit production at Morenci commences in January, with daily production of 25,000 tons ore. Mill and Smelter begin operations.
- 1943 Morenci concentrator capacity increased to 45,000 tons daily.
- 1951 Morenci begins production of molybdenum concentrates as a by-product at the rate of about 1,000 tons per year.
- 1954 To the end of 1954, the Morenci mine has produced 174,589,605 tons of ore and 3,084,205,160 pounds of copper.

UNITED VERDE, JEROME MINING DISTRICT

- 1876 United Verde ore-body discovered in Jerome by M. A. Ruffner. The first claim in the United Verde group is the Venture No. 1, located on Feb. 17th by John O'Dougherty, John Kelly and Josiah Riley.
- 1880 Phelps Dodge Company sends Dr. Douglas to Jerome to examine the district. The long 175-mile wagon haul to the Santa Fe Railroad discourages him from recommending exploitation.
- 1882 United Verde Copper Company organized by Fred Thomas, George Treadwell, and Eugene Jerome.
- 1883 Small smelter built at Jerome, and turns out nearly \$800,000 worth of copper in the first year.
- 1887 Dr. Douglas visits the United Verde a second time, when the railroad was only 45 miles away. He negotiates for an option, but his terms are opposed by Charles Lennig, the principal creditor of the United Verde.
- 1888 W. A. Clark, with his smelter man, Joe Giroux, takes a lease on the United Verde and buys it the following year.
- 1894 Clark builds a 27-mile narrow-gauge railway to connect with the Santa Fe running south from Ash Fork to Prescott.
Clark also builds a smelter and roast heaps like those at Rio Tinto.
- 1899 George Hull, assisted by Louis Wicher, form the United Verde Extension Mining Company.
- 1912 New smelter started at Clarkdale.
James S. Douglas becomes interested in United Verde Extension Mining Company, and development work is begun.
- 1915 New Smelter completed, and Santa Fe builds a branch of standard gauge to this point.
- 1916 United Verde Extension electrifies the mining world by cutting 300 feet of 15 percent ore.
- 1919 Beginning of open-pit operations at Jerome.
- 1927 United Verde begins operations in a 1000-ton concentrator. Capacity later increased to 1600 tons.
- 1931 United Verde purchases the Verde Central.
- 1935 Phelps Dodge Corporation purchases the United Verde.
- 1938 United Verde Extension ore-body is finally exhausted after paying over 42 million dollars in dividends. It had produced over three-quarters of a billion pounds of copper, which with gold and silver values, was worth over 125 million dollars.
- 1940 Open pit mining at United Verde completed, and underground mining continues to be employed chiefly in removing the pillars left in the mine.
- 1953 Mining operations at United Verde terminates on March 23rd, after producing over 2-3/4 billion pounds of copper, which, with gold, silver and zinc values, was worth almost one-half billion dollars.

BISBEE (WARREN) MINING DISTRICT

- 1877 Discovery of ore in the Bisbee district made in August by American Army Scout, Jack Dunn, who called his claim the Rucker, after an army officer of that name.
Copper Queen deposit discovered by Hugh Jones, and a claim named the Mercey is located by George Warren on Dec. 27.
- 1878 Warren's claim relocated as the Copper Queen by George Eddleman and M. A. Herring on Dec. 15th. A little copper furnace is erected by Warner Buck on the Robb claim and some matte is produced unprofitably.
- 1879 Copper Queen prospect is purchased by John Ballard and Wm. Martin with the advice of Ben and Lewis Williams. The San Francisco brokerage firm of Bisbee, Williams & Company sponsored the new company, and the town is named after Bisbee.
- 1880 Geo. Center builds a smelting furnace under the direction of the Williams brothers, and does well for a time.
- 1881 James Douglas comes to Bisbee and obtains an option on the Atlanta claim, next to the Copper Queen.
- 1883 After one failure, Atlanta workings penetrates a great ore-body.
- 1885 Apparent exhaustion of the ore in the Copper Queen leads to merger of Atlanta and Copper Queen under the name of Copper Queen Consolidated Mining Company. Douglas, acting for the firm of Phelps Dodge Company is the moving spirit of the merger.
- 1888 A railway is built by the Copper Queen Company from Bisbee to Fairbanks, the site of its smelter, to which the ore had been packed on mules and burros for several years.
- 1893 Converters are added to the Copper Queen Smelting plant, improving the quality of the copper product.
- 1898-1901 Lake Superior and Western Development Company, which later became the Calumet & Arizona Mining Company, purchases the Irish Mag claim from Martin Costello.
Douglas arranges an amicable agreement over apex rights between the Copper Queen and the Irish Mag owners.
- 1900 Plans are made for new reduction works at Douglas, and the necessary railroad is constructed thereto.
- 1904 New Smelter at Douglas blown in. Organization of Shattuck Arizona and Denn Arizona Companies.
- 1908 First lead ore produced at Bisbee.
- 1916 First zinc ore produced at Bisbee.
- 1917 The name of Copper Queen Consolidated Mining Company is changed to Phelps Dodge Corporation.
- 1918 Shattuck concentrator built.

- 1923 The first unit of the 4,000-ton Warren plant is put in operation in April, to handle the Sacramento Hill ore, which had been developed off and on since 1916.
- 1925 Shattuck and Denn mines merged.
- 1931 Phelps Dodge absorb Calumet and Arizona.
- 1932 Sacramento Hill ore-body exhausted and the Warren mill is shut down. Open-pit glory hole and block caving had been used in exploration of this ore-body. Also heap-leaching as well as gravity and flotation concentration had been employed.
- 1939 Bisbee district produces zinc ore for the first time since 1927.
- 1947 Shattuck Denn Mining Company sells Denn Mine to Phelps Dodge and terminates its lease on Shattuck mine.
- 1950 Development of the Lavender Pit at Bisbee for open-pit mining is commenced.
- 1951 Copper Queen discontinues production of lead-zinc ore.
- 1954 Lavender Pit begins production in August. A 12,000 ton flotation concentrator is started, and concentrates are shipped to Douglas smelter.

RAY MINING DISTRICT

- 1873 Mineral Creek Mining District (Ray) organized by silver prospectors in 1873.
- 1880 A five-stamp mill was built by Mineral Creek Mining Company.
- 1883 Some copper mining done by Ray Copper Company.
- 1899 Ray mine acquired by an English Company, the Ray Copper Mines, Ltd.
- 1906 D. C. Jackling and associates, Philip Wiseman and Seeley Mudd obtain option at Ray.
- 1907 Jackling starts extensive development work on the Ray property.
- 1909 Louis S. Cates placed in charge of Ray Consolidated Copper Company.
- 1911 Cates develops use of underground caving system at Ray. Ray Consolidated hauls ore on own railroad to Ray Junction. Picked up by Arizona Eastern and hauled to new Ray Consolidated mill which begins concentrating operations at Hayden, using gravity concentration. Concentrates shipped to A. S. & R. Company smelter at El Paso.
- 1912 A. S. & R. Company starts copper smelter at Hayden to handle Ray Consolidated concentrates.
- 1914-1915 Ray Consolidated develops flotation concentration at Hayden, to supplement gravity concentration.
- 1921 Ray Consolidated shuts down its operations in March and remains down one year.
- 1924 Ray Consolidated and Chino merge.
- 1926 Ray Consolidated and Chino absorbed by Nevada Consolidated Copper Company.
- 1933 Ray Consolidated shuts down its operations in March 1933, and does not resume production until April, 1937.
- 1937 Ray Division of Nevada Consolidated Copper Company absorbed by Kennecott Copper Corporation.
- 1947 Kennecott constructs modern scrap-iron precipitating plant to recover copper from water-soluble ores.
- 1948 Kennecott decides to prepare part of Ray ore body for open-pit operations.
- 1950 Open-pit production commenced at Ray. Mill at Hayden enlarged to handle 15,000 tons ore daily.
- 1954 Kennecott makes pilot-plant tests to increase recovery of oxidized copper in its milling ores at Hayden. Plans to spend five million dollars on the new process.
To the end of 1954, Ray produced 96,442,602 tons of ore and 2,262,419,635 pounds of copper.

MAGMA (SUPERIOR) DISTRICT

- 1873 Discovery of Silver King outcrop at foot of Stoneman Grade by a soldier named Sullivan.
- 1874 Discovery of Silver Queen (Magma) vein by C. G. Mason.
- 1875-1889 Main production activity of Silver King mine, a famous silver producer.
- 1880-1893 Lake Superior and Arizona mine actively developed.
- 1910 Magma Copper Company organized by Wm. Boyce Thompson and associates, to work the Silver Queen property.
- 1914 Construction of Magma concentrator with about 200 tons per day initial capacity.
- 1915 Magma Arizona railway completed.
- 1916 Capacity of Magma concentrator increased to 300 tons daily. The additional section was of 50 tons daily capacity and designed for zinc-lead ores. After 3 months' successful use, it was converted to treat copper ores.
- 1917-1920 Renewed activity in Silver King mine.
- 1922 Capacity of Magma concentrator increased to 600 tons daily, and construction of a copper smelter started.
- 1923-1928 Principal development of Belmont mine.
- 1933 Lake Superior and Arizona mine become important gold producers.
- 1937 Refrigeration cooling plant installed in Magma mine. A new unit of 250 tons daily capacity for treatment of complex zinc-copper ore was added to the concentrator.
- 1943 Magma mine was the largest producer of zinc in Arizona.
- 1944 Magma Copper Company becomes interested in development of San Manuel ore-body, near Mammoth.
- 1945 San Manuel Copper Corporation organized in August. Production of zinc ore ceased in July, owing to labor shortage.
- 1946-1948 New Magma concentrator under construction.
- 1950 Magma resumes mining of zinc ores.
- 1952 Magma shuts down the copper-zinc section of its mill, and devotes entire plant to production of copper.
- 1954 The Superior area to the end of 1954 has been credited with the metal production of 556,207 tons of copper, 37,252 tons of zinc, 1,965 tons of lead, 35,837,027 ounces of silver and 360,521 ounces of gold.

GLOBE-MIAMI-INSPIRATION MINING DISTRICT

- 1874 Globe becomes a booming silver camp.
- 1881 Old Dominion Copper & Smelting Company starts operations at Globe. A small copper furnace is in operation at the present site of Miami. Old Dominion produces over 800 million pounds of copper from 1882 to 1930.
- 1886 Six furnaces in operation at Globe.
- 1888 Old Dominion Company reorganized at Globe.
- 1892 Phelps Dodge purchases United Globe Mines at Globe and also certain claims in the Miami district.
- 1901 Chrysocolla, a blue green copper silicate is mined at the Keystone Mine; also at the Live Oak.
- 1903 Phelps Dodge obtains control of the Old Dominion at Globe.
- 1904 The Warrior Mine in Gila County produces over 30 million pounds of copper from 1904 to 1919.
- 1906 The Gibson Mine produces 12 million pounds copper 1906 to 1918.
J. Parks Channing examines the deposits at Miami, and exploratory shafts are started.
The General Development Company sank a shaft on the Captain claim and another on the Red Rock, in the Miami district.
The Miami Copper Company was organized in November and development work was actively undertaken.
Arizona Commercial mine in Gila County produces 92 million pounds of copper from 1906 to 1930.
- 1907 Superior and Boston mine in Gila County produces 19 million pounds of copper from 1907 to 1926.
- 1908 Inspiration Copper Company is organized.
- 1909 Railroad extended to Miami from Globe. Inspiration began active development work.
- 1911 First concentrates produced at Miami.
- 1912 The Live Oak and Inspiration merged in January, as the Inspiration Consolidated Copper Company.
Iron Cap Mine in Gila County produces 60 million pounds of copper from 1912 to 1928.
- 1915 Inspiration began the production of copper in 1915 after six years of development and the expenditure of about fifteen million dollars. The International Smelting Company erected a three million dollar smelter at Miami. Flotation introduced at Inspiration, the first large scale Copper flotation plant in this country.
- 1921 Postwar depression and shut-down of copper properties.
- 1922 First systematic exploration work initiated at the Castle Dome Mine in Gila County by Pinto Valley Mining Company.

- 1924 Old Dominion shuts down its smelter permanently, and ships its concentrates to the International Smelter at Miami.
- 1926 Inspiration begins ferric-sulphate leaching of its ores, producing electrolytic copper.
- 1932 Complete shut-down of Inspiration mine begins in May 1932, and mining is resumed in late 1935.
- 1941 Miami Copper exercises its option on the Pinto Valley holdings (Castle Dome Mine) and organizes the Castle Dome Copper Company to take over the property.
- 1942 Bechtel Company commenced preliminary work early in January on the Castle Dome mine of the Miami Copper Company which had been churn-drilling the property since the thirties to determine the extent and grade of the deposit. Seventeen months later, in April, 1943, concentrates started moving from the company's mill to the International Smelter.
- 1943 In anticipation of the exhaustion of Castle Dome ore-body, the Miami Copper Company begins to delimit the Copper Cities ore-body by means of churn drills. It is interrupted until 1946, and is completed in 1948.
- 1946 Inspiration begins plans for open-pit mining and pit development.
- 1948 Inspiration starts producing a portion of its ore by open-pit mining in March.
- 1949 Inspiration completes all necessary work underground for leaching in place certain mined out and caved areas in the mine to recover part of the remaining copper. Production from this source began in 1950.
- 1953 Castle Dome ore reserves are exhausted in December, having been in production since April 1943, and having produced 514 million pounds of copper and \$777,024,000 in gold and silver credits from 41,442,617 tons of .725% copper ore.
Development of Miami's low-grade ore-body was started in the early part of this year and some production began during March 1954.
- 1954 Castle Dome's mill building is moved to Copper Cities, and production began in August. At full capacity in November.
Inspiration makes plans for use of a dual process of leaching and concentration, involving three million dollars for rehabilitation of its concentrator. Underground mining at Inspiration suspended in August.
Inspiration takes an option on the Christmas mine, 45 miles south of Inspiration. This property has been mined intermittently during the past fifty years, and has produced some 1,500,000 tons of ore averaging 2.4% copper. Under this option, together with an option on claims owned by the New Year Mining Company lying to the west of the Christmas mine, Inspiration is doing an intensive development program of underground drifting and diamond drilling.

Up to the end of 1954, the Miami mine had produced 150,914,000 tons of ore and 2,245,250,000 pounds of copper.

Up to the end of 1954, the Inspiration mine had produced 141,368,000 tons of ore and 2,733,800,000 pounds of copper.

Up to the end of 1954, the Castle Dome mine had produced 41,442,617 tons of ore and 515,205,507 pounds of copper.

Copper Cities produces during 1954 (it began production in August), 996,160 tons of ore and 12,514,108 pounds of copper.

BAGDAD (EUREKA) MINING DISTRICT

- 1886 The Bagdad claims in Eureka district, Yavapai County, discovered.
- 1906 Giroux Syndicate works Bagdad property with small success.
- 1908 Giroux Syndicate followed by Bagdad Copper Company.
- 1919 Arizona-Bagdad Copper Company takes over Bagdad claim, and churn-drills the property, proves a section of the ore-body and produces some ore.
- 1925-1926 Arizona-Bagdad tries leaching Bagdad orebody in place but without success.
- 1927 Bagdad Copper Corporation succeeds Arizona-Bagdad, and drills 130 churn-drill holes.
- 1930 Bagdad Copper Corporation completes a 200-ton mill.
- 1935 High-grade molybdenite mined at Bagdad.
- 1936 Block-caving project started at Bagdad.
- 1941 A 2,500-ton flotation mill erected at Bagdad.
- 1944 J. C. Lincoln of Lincoln Electric Company acquires stock control of Bagdad Copper Corporation, and appoints E. R. Dickie as general manager.
- 1945 E. R. Dickie converts Bagdad underground mine to open-pit with truck haulage.
- 1950 Mill expansion completed, bringing capacity up to 4,500 tons per day at Bagdad.
- 1954 Bagdad makes plans to double production.

SILVER BELL MINING DISTRICT

- 1865 Mammoth mine of the Silver Bell Mining Company, (also known as the Boot Mine) is opened.
- 1903 Imperial Copper Company buys old Silver Bell Mine, builds a railroad, and erects a smelter at Sasco.
- 1909 The Oxide and ElTiro copper sulphide deposits developed by churn-drilling. Low grade of ore permits only selective mining until 1930.
- 1913 Imperial Copper Company stops mining because of fire in mine shaft, and low price of copper
- 1915 A. S. & R. Company becomes interested in Silver Bell district, through acquisition of the Imperial Copper Company holdings.
- 1926 Imperial Mine produces 64 million pounds of copper between 1904 and 1926.
- 1927 El Tiro mine produced 14 million pounds of copper and one million pounds of lead between 1906 and 1927.
- 1928 El Tiro Corporation properties acquired by A. S. & R. Company. Sasco smelter and railroad abandoned.
- 1930 Total production of Silver Bell District to 1930 estimated at \$15,746,000.
- 1946 A. S. & R. Company begins extensive geological exploration and churn-drilling at Silver Bell.
- 1951 Development of the Oxide and El Tiro pits started in December.
- 1954 7,500-ton concentrator started April 1st.
Production new Silver Bell unit of A. S. & R. Company estimated at 13,400 tons of copper to the end of 1954.

HISTORY OF LEAD-ZINC MINING IN ARIZONA, BY DISTRICTS

Source: Arizona Bureau of Mines, Bull. No. 156

BISBEE OR WARREN DISTRICT

Prior to 1880, lead carbonate ore was mined from the Hendricks claim, about a quarter of a mile south of Bisbee, and smelted in a primitive furnace at a spring near the present main street of the town. Some oxidized lead ore from the Hendricks claim was used for flux at Charleston during the early eighties, but there is no available record of the quantity of lead produced by the district prior to 1908.

The Copper Queen company granted leases on lead areas in the Uncle Sam mine during 1908, and in the Gardner and Southwest mines during 1910. Subsequently the company carried on successful development of lead ore in the Gardner and Southwest mines.

During 1911-17 notable bodies of oxidized siliceous lead ore were discovered and worked in upper levels of the Shattuck mine.

The first zinc production of the district was in 1917-18; during those years Calumet and Arizona Mining Company shipped lead-zinc sulfide ore to paint manufacturers in Kansas. Shipment of zinc ore to smelters began in 1922.

In 1925 the Shattuck mill, which had been built in 1918, was converted entirely to flotation.

In 1927 Phelps Dodge Corporation built a flotation plant of 150 tons daily capacity for treatment of low-grade lead ore, and installed at Douglas a lead smelter of 200 tons daily capacity. Owing to low metal prices and resultant curtailment by custom ore shippers, the concentrator operated for only five months, and the lead smelter closed in April, 1930.

In 1939 the district produced zinc for the first time since 1927. Subsequently zinc-lead ore bodies were mined in the eastern part of the district. Part of the ore was sent to the Shattuck-Denn custom mill at Bisbee, and some to the Eagle-Picher mill at Sahuarita, until November 1945, when Phelps Dodge Corporation completed its present zinc-lead concentrator.

Mining of lead-zinc ores in this district discontinued in June, 1953, due to low lead and zinc prices.

The output of zinc and lead by periods was as follows:

	<u>Tons Zinc</u>	<u>Tons Lead</u>
1908 - 16	-	26,854
1917 - 18	305	6,726
1919 - 21	-	4,756
1922 - 27	7,118	31,862
1928 - 38	-	7,336
1939 - 48	115,119	51,768
1949 - 53	66,584	25,567
1954	-	-

JOHNSON CAMP AREA IN COCHISE COUNTY

Although this area was originally worked as a source of copper ores since 1881, it wasn't until 1942 that zinc concentrates were produced. At that time the Coronado Copper and Zinc Company, controlled by Harvey S. Mudd interests of Los Angeles, took over the Republic and Mammoth mines, and in 1945 they completed a 150-ton selective flotation concentrator and started shipping copper and zinc concentrates.

The ores produced from the district from 1902 to 1942 inclusive averaged about 4.3 percent copper, 0.9 oz. of silver per ton, and an unknown amount of zinc. Most of the ores produced since 1942 have carried less copper and silver, but up to 10 percent or more of zinc. Zinc produced from 1942 to 1954 inclusive has amounted to 28,000 short tons.

PIMA DISTRICT *

Silver-lead deposits in the San Xavier and other districts of the Sierrita Mountains were known to the Jesuits and early Spaniards, who probably worked them in a small way. Some development was carried on there prior to 1875.

In 1880, Colonel C. P. Sykes purchased the San Xavier mine and organized San Xavier Mining and Smelting Company. To treat the ore, a small blast furnace was erected on the Santa Cruz River, 9 miles south of Tucson, but it was unsuccessful. From 1882 until the demonitization of silver in 1893, silver-lead ore was shipped intermittently from the Sierrita Mountains to various reduction works. The principal mines worked were the San Xavier, Olive, Matchless, Silver Blende, Fortuna, Arizona Queen, Veta, Democrat, Banner, Santa Cruz, Patterson, Annie, Minor, Chloride, and Celia.

Emperor Copper Mining Company developed the Mineral Hill copper deposits from 1882 until the slump in the copper market of 1884.

During 1897, L. H. Manning shipped ore from the San Xavier mine.

In 1898, Azurite Copper and Gold Company built a water-jacket furnace of 30 tons daily capacity at the Mineral Hill mines and produced copper for about a year. After remaining idle for six years, the property was acquired by Mineral Hill Consolidated Copper Company which developed it until the 1907 panic. In 1916, the old smelter was enlarged, and production was resumed for three years, after which the mine was closed again.

During 1906-7, Calumet and Arizona Mining Company carried on development of the Red Carbonate group southwest of Twin Buttes. During World War I, low-grade fluxing ore was shipped from this property by Alfred Paul.

During 1908-13, Chesterfield Mining Company shipped lead-silver ore from the Esperanza and Annie mines.

The Twin Buttes copper deposits were worked in a small way during the nineties by Baxter, Ellis, and Irish. In 1903, Twin Buttes Mining and Smelting Company began extensive development in the district, and by 1906 had built a railway from Tucson through Sahuarita to the mines. Operating the Senator Morgan, Copper Glimpse, Copper Queen, and Copper King Mines, this company shipped ore to smelters at Sasco and elsewhere until 1914.

* For years prior to 1931, largely abstracted from unpublished notes of J.B. Tenney

Early in 1912, Pioneer Smelting Company completed a custom smelter of 150 tons daily capacity at Sahuarita, but it operated for only about a year.

In 1913, Bush-Baxter Company, which had been working the Minnie mine, leased the Senator Morgan and worked it for nine months. American Smelting and Refining Company operated the Minnie for a while prior to 1916. As Glance Mining Company, Bush and associates developed the Glance. As Midland Copper Company, they acquired the Queen and shipped ore up to the end of 1926. In 1929, Buttes Mining Company shipped ore from the Minnie.

Empire Zinc Company purchased the San Xavier mine in 1912 and shipped lead-zinc-silver ore from it until 1918.

In 1943 Eagle-Picher Mining and Smelting Company constructed at Sahuarita a concentrator of some 175 tons daily capacity and reopened the San Xavier mine. The capacity of the concentrator was doubled during the following year and later increased to 400 tons per day to take care of custom ores. Since 1943 the San Xavier mine has been one of the more important producers of zinc and lead in Arizona, and for 1948 its output of these metals ranked third in the State.

Zinc-lead ore was shipped from the San Xavier Extension property during 1943-45 by Chilson Mines Company. The Contention mine produced zinc-copper ore during 1944-47.

The production of the Pima District may be summarized as follows:

	<u>Tons Copper</u>	<u>Tons Zinc</u>	<u>Tons Lead</u>	<u>Oz. Silver</u>	<u>Oz. Gold</u>
1876 - 1907	1,050	-	2,000	613,000	850
1908 - 1948	18,917	25,845	16,246	1,447,446	827
1949 - 1954	7,256	21,886	11,937	806,433	133

Note: Lead-zinc production practically ceased in 1953 and 1954. Increase in copper production in three years accounted for by the Banner Mining Company and the Pima Copper Company.

ARAVAIPA DISTRICT *

1870-89 Mineral deposits were discovered in the Aravaipa district before 1880. A small smelter is reported to have been built here in the late seventies by Col. C. W. Birdwell, but little is known about production or operations prior to 1890.

1890-95 Aravaipa Mining Corporation, operating in northern part of the district, sank Arizona shaft to its present depth of 580 feet and shipped two cars of ore.

1890-1900 J. W. Mackay opened Grand Reef mine to a depth of 300 feet. Other properties in the district were worked, and presumably some lead-silver and copper ores were shipped.

1900-14 Small-scale operations, and mainly by lessees.

* Data for years prior to 1923 abstracted from C. P. Ross.

- 1915-19 Grand Reef mine leased by local people who built a small mill and shipped ore and concentrates.
- 1916 John Gleeson and T. C. Parker, lessees, reportedly shipped \$90,000 worth of lead carbonate ore from No. 1 claim.
- 1919-20 Aravaipa Leasing Company obtained Grand Reef property and made some production.
- 1921-24 Little activity in district. No production reported during 1921-22.
- 1925-28 Grand Central Mining Company, headed by Lewis Douglas, acquired the old Aravaipa property, including the Iron Cap and other claims near Aravaipa, in 1925 and built a mill with a flotation capacity of 90 tons per day. In 1927 this plant was operated for five months. Production from crude ore and concentrates shipped during 1926-28 was approximately 3,500,000 pounds of lead, 1,214,797 pounds of zinc, and \$20,000 worth of silver.
- 1929-31 Production was mainly oxidized lead ore from the Grand Reef which in 1931 ranked second as a producer of lead in Arizona.
- 1932 Little activity and small production.
- 1937-41 Base-metal production was resumed in the district. The Grand Reef Mining Corporation in 1939 installed a milling plant of 100 tons daily capacity. During 1941, the Calistoga Mining and Development Company treated Grand Reef tailings.
- 1942-49 Athletic Mining Company bought the Aravaipa group of claims, developed the Iron Cap and Head Center mines, and became the district's largest shipper of lead and zinc ores. This company built at Klondyke a flotation concentrator of 100 tons daily capacity, which was operated throughout 1948 and part of 1949 chiefly on Iron Cap ores, and subsequently on other ores.

The production of the Aravaipa District may be summarized as follows:

	<u>Tons Lead</u>	<u>Tons Zinc</u>	<u>Tons Copper</u>	<u>Oz. Silver</u>	<u>Oz. Gold</u>
1915 - 1948	8,365	2,550	394	229,289	777
1949 - 1951	4,062	3,108	147	50,492	2,562
1952 - 1954	Not published, but production somewhat curtailed.				

MAMMOTH (ST. ANTHONY) DISTRICT

The St. Anthony mine, operated by the St. Anthony Mining and Development Company, Ltd., has had a long and varied history of development and production. The camp actually was developed as three different mines - the Mammoth, Collins, and Mohawk-New Years - which have been consolidated since 1934 by the present operating company.

The first claims were located in 1879 and mining continued intermittently by several companies, mostly on the Mammoth vein, until 1901 when the workings on their vein caved from the 750 level to the surface. This early mining was done entirely for gold; production from the Mammoth and Collins mines through 1901 was over 150,000 ounces of gold valued at more than \$3,000,000.

The camp was largely inactive from 1901 until 1915 when the wartime demand for molybdenum and vanadium resulted in re-opening the mines for a short period. In 1919 prices fell, and the mines closed again.

Increase in the price of gold in 1933 caused renewed activity, and production of gold-vanadium-molybdenum ores began in 1934 from the oxidized part of the veins. Mining of this ore continued into 1943 when, stimulated by high prices and the need for base metals, the management developed sulfide ore bodies below the 650 level on the Collins vein. All lead and zinc production subsequent to 1944 has been from the sulfide vein where galena and sphalerite are the chief ore minerals.

The production of the Mammoth Mining Camp may be summarized as follows:

	<u>Gold Ounces</u>	<u>Silver Ounces</u>	<u>Copper Tons</u>	<u>Lead Tons</u>	<u>Zinc Tons</u>	<u>MoO₃ Pounds</u>	<u>V₂O₅ Pounds</u>
1881-1912	170,000	-	-	-	-	-	-
1916-1919	10,450	-	-	-	-	447,876	-
1934-1947	216,751	983,918	1,728	37,365	24,136	5,866,946	2,540,842
1948-1954*	9,213	545,809	1,876	26,328	20,563	-	-

* Negligible production in 1953 and 1954.

MAGMA (SUPERIOR) DISTRICT

(See under Copper for the history of this District.)

IRON KING MINE (BIG BUG MINING DISTRICT)

- 1906 First production from Iron King mine in Big Bug Mining District - gold and silver and a little copper.
- 1917-1918 Colvocoresses mines heavy sulphide at the Iron King mine for his Humboldt smelter.
- 1937 Iron King Mining Company purchases Iron King mine and begins development work on the lead-zinc veins.
- 1938 A 140-ton bulk flotation mill placed in operation at Iron King.
- 1939 Bulk flotation converted to selective flotation at Iron King.
- 1942 Shattuck-Denn Mining Corporation purchases the Iron King mine, and capacity is gradually increased to 500 tons daily. H. F. Mills in charge.
- 1947 Total production from 1906 through 1947 of the Iron King mine reported as: 926,802 tons ore mined from which have been produced 119,465 ounces gold; 3,765,850 ounces of silver, 57,727 tons of zinc, 18,589 tons of lead, and 2,230 tons of copper.
- 1954 Capacity of Iron King mill increased to 900 tons daily. This is estimated to produce over 12,000 tons of zinc, 5,000 tons lead and 300 tons of copper annually.
For the last five years the Iron King mine has averaged an annual production of 196,232 tons of ore, 10,488 tons zinc, 4,287 tons of lead, 216 tons of copper, 18,451 ounces of gold, 624,374 ounces of silver.
Since 1906, the Iron King mining in the Big Bug area has produced 2,230,713 tons of ore, 236,815 ounces gold, 7,894,152 ounces silver, 124,800 tons of zinc, 46,031 tons of lead, and 3,664 tons of copper.

HISTORY OF MISCELLANEOUS METALS AND NON-METALLICS IN ARIZONA

Until 1953, when the United States Bureau of Mines began to report Arizona's non-metallic mineral production in more detail, there was no good source of information on Arizona's non-metallic and miscellaneous metal mines.

ASBESTOS

Chrysotile asbestos mines in Arizona are in numerous localities over an area 60 miles long and 25 miles wide in the Salt River and Cherry Creek Basins, Gila County.

Production in Arizona has been as follows:

	<u>Tons of Asbestos</u>
1914 - 1939	11,938
1940 - 1944	7,668

Since 1945, production figures have been confidential, but are of approximately the same range as in the early 1940's. In October, 1952, the General Services Administration opened an Asbestos purchase depot at Globe, and this resulted in the opening and re-opening of several asbestos properties. The largest of these were the Regal, Phillips Asbestos, Crown Asbestos, Chrysotile, and American Fiber.

The Arizona Bureau of Mines has estimated the value of asbestos produced from 1914-48 to be \$4,240,000. It is safe to assume that this value has passed the 5 million dollar mark by the end of 1954.

BARITE

Although Arizona is not an important producer of Barite, one company, The Arizona Barite Company (now known as Macco Corporation) produced 9,750 tons in 1954 at its mine near Granite Reef Dam (Maricopa County). It has had a processing mill at Mesa for several years, and has produced in that time about \$3,085,000 worth of barite.

CEMENT

The State has only one cement plant, the Arizona Portland Cement Company, at Rillito, Pima County. The Company started its first plant in December, 1949, with a capacity of 2,000 barrels per day. The capacity was increased to 4,000 barrels per day in 1951 and plans are now being made to increase it again to 7,000 barrels per day. The enlarged plant will be ready to start in August, 1955.

The value of the Company's product up to the end of 1954 is estimated to be \$16,000,000.

CLAYS

Clay products have been produced in Arizona since 1894.

Of the 200,000 tons of clays now produced annually in Arizona, two-thirds of it is bentonite, produced from the McCarrell open-pit near Sanders, Apache County. The remainder is chiefly miscellaneous clay produced by three brick companies in Maricopa and Pima Counties. The value of clay and clay products, according to the Arizona Bureau of Mines, was \$14,287,000 to the end of 1948.

Production to the end of 1954 passed the 17 million dollar mark.

FELDSPAR

Feldspar production in 1954, (not published), was virtually the same as in 1953. As in past years, the entire production came from the Consolidated Feldspar Corporation's property near Kingman, Mohave County.

The Arizona Bureau of Mines estimated the value of Feldspar produced from 1923 to the end of 1948 to be \$2,200,000. To the end of 1954, this value has passed the three million mark.

FLUORSPAR

Fluorspar production increased slightly from 1911 tons in 1953 to 2,000 tons in 1954. Most of it was recovered from the treatment of several thousand tons of old tailings and waste dump material at the old DeLuce property in the Castle Dome District, Yuma County. Some fluorspar was produced also from properties in Graham and Greenlee Counties. The Lone Star mine in Cochise County was a big producer in 1951. Maricopa and Pima Counties have also produced some fluorspar.

The Arizona Bureau of Mines estimate the value of fluorspar concentrates produced in Arizona from 1902-48, to be \$295,000. Production since that time has increased the value by the end of 1954 to \$700,000.

GYPSUM

Arizona's gypsum production, which is used mostly in the manufacture of cement, continued to expand - it has increased from 6,686 tons in 1951 to 15,000 tons in 1954. As in past years, the total output came from the Arizona Gypsum Corporation's property near Feldman, Pinal County.

The Arizona Bureau of Mines estimated the value of gypsum production to be \$1,357,000 to the end of 1950. Production to the end of 1954 has increased this value to \$1,500,000.

LIME

Lime, for building purposes has been produced in Arizona since 1894. Since 1915, the larger proportion of the lime produced has been used in the flotation process at all the large copper concentrators. The principal plants are: the Paul Lime Plant, Cochise County; Hoopes & Company, Gila County; Phelps Dodge Corporation, Greenlee County; and the Grand Canyon Lime-Cement Company, Yavapai County.

The Arizona Bureau of Mines has estimated the value of lime produced in Arizona from 1894-1948, to be \$12,046,000. From 1949 to the end of 1954, the value of lime produced was \$5,150,000, making the total since the beginning of production, \$17,195,000.

MANGANESE

In 1954, Arizona mines produced more manganese ore than in any year in the State's history. All of the output was shipped to the Government's stockpile depots at Wenden, Arizona, and Deming, New Mexico. The principal producing counties were Mohave, Yuma, Santa Cruz, Gila and Pinal. Before 1953 the output was largely from the Bisbee and Tombstone district.

The manganese deposits of the Artillery Peak area have been rated as the second largest in the United States. Although below present commercial grade, they may be regarded as a potential reserve for the future.

The Arizona Bureau of Mines reports that Arizona's production of manganese ore up to the end of 1950 was approximately 83,800 tons valued at \$2,100,000. The U. S. Bureau of Mines converts this tonnage to 35% Manganese, and reports production as follows:

35% Manganese Ore		
	<u>Long Tons</u>	<u>Value</u>
Years 1915 - 1934	52,971	\$ 1,378,790
1940 - 1950	2,467	547,822
1951 - 1952	461	29,363
1953 - 1954	179,694 *	14,375,520
	<u>235,593</u>	<u>\$16,331,495</u>

* Based on the conversion of 6,289,283 units of manganese into long tons of 35% Mn, and valued at \$80 per long ton, (the average for 1952).

The Wenden buying depot began receiving ores early in 1953 and was closed May 10, 1955 after receiving six million units of recoverable manganese.

MERCURY

Arizona has several mercury deposits, but none of them, according to "Mineral Resources of the United States", has made an appreciable production. At best, the yield probably does not exceed a few hundred flasks.

The quicksilver deposit in the Dome Rock Mountain near Quartzsite, was probably discovered as early as the year 1878.

The quicksilver veins in Copper Basin, between Prescott and Skull Valley, were mined in the late eighties and early nineties, and the report is that the mercury was produced to supply the local demand of gold mines for quicksilver needed for amalgamation. Cinnabar, a mercury mineral, was first discovered in the Mazatzal Mountains in 1911 by E. H. Bowman. Since then, occurrences of this metal have been found on Sycamore and Slate Creeks. There has been a small production of quicksilver from these ores, seldom over a few flasks per year, and during some years, no production.

Quicksilver was discovered in the Phoenix Mountains in 1916 by J. A. and Henry Porterie; and during the latter part of the same year cinnabar was found by Sam Hughes and associates. A few flasks of quicksilver were produced in a small retort built by Mr. Hughes.

World War II created a demand for mercury, and production, which had been dormant in Arizona for many years, picked up a little. The principal producing mines during this period were the Ord Mine in Gila County, and Pine Mountain Mine in Maricopa County. Production and value were as follows:

1941	-	876 flasks worth	\$ 161,522
1942	-	701 " "	137,641
1943	-	541 " "	105,609
1944	-	548 " "	64,861
1946	-	95 " "	9,333

The Arizona Bureau of Mines estimates the value of mercury production up to the end of the year 1950, at \$880,000. In 1954, some mercury was produced in Arizona for the first time since 1951; production was reported by a lessee working the property of the Ord Mercury Mine near Payson, Gila County.

MICA

The mica produced in Arizona has been of the scrap variety. Four operations in Maricopa, Mohave, Pima and Yuma Counties, have accounted for most of it. Although some mica has been produced for many years, no published records are available before 1953. In that year, 3,721 tons were reported produced, with a value of \$114,870. In 1954, 2,000 tons were produced with a value of \$114,250.

MOLYBDENUM

The first record of molybdenum production in Arizona, was in 1916, when war time demand for the metal brought about production of molybdic oxide at the Mammoth-Collins mine in Mammoth, Pinal County. From 1916 to 1919, this mine produced 447, 876 pounds of MoO_3 . Production on the Mammoth mine was resumed in 1934 and continued through 1944. In 1938 the Miami Copper Company reported the recovery and shipment of a small quantity of molybdenite concentrates from the re-treatment of copper sulfide concentrates. In 1940 the Miami Company began roasting the molybdenite concentrates to make molybdic oxide.

In 1944 Bagdad Copper Corporation began shipments of molybdenum concentrates. Also the Squaw Peak Copper Mining Company, Camp Verde Arizona began shipments to the Metals Reserve Company.

In 1946 the San Manuel mine reported the presence of an economical quantity of molybdenum in their immense copper ore-body.

In 1951 the Morenci Branch of Phelps Dodge Corporation began production of molybdenum concentrates as a by-product, at the rate of about 1,000 tons per year.

Record of Molybdenum Production in Arizona

	<u>Pounds Molybdenum</u>	<u>Value</u>
1916 - 1934	1,000,000	\$ 900,000
1935 - 1950	14,500,000	10,000,000
1951	1,173,000	1,102,000
1952	2,023,000	1,987,000
1953	1,450,000	1,450,000
1954	1,500,000	1,500,000
	<u>21,646,000</u>	<u>\$16,939,000</u>

PERLITE

Perlite deposits near Superior first became of interest in 1944 and commercial production commenced in 1946. The production from 1946 to the end of 1948 was estimated by the Arizona Bureau of Mines to be worth \$65,000. There was a decline in production in the following years, due to technical problems connected with its use, but for the last three years, production has averaged 2,000 tons annually with a value of \$13,000.

PUMICE & PUMICITE

Pumice and Pumicite (Volcanic Ash), used mainly as an aggregate for making concrete blocks, have come into prominence only in the last four years. There was only one property producing it in 1952, the Haigler property in Coconino County, where 14,500 tons were produced, worth \$87,000.

Three properties, 2 in Coconino County and 1 in Graham County, produced 123,797 tons in 1953, worth \$425,985. 120,000 tons worth \$412,800, were produced in 1954.

SAND AND GRAVEL

Sand and gravel are a product of all States in the Union, and Arizona is no exception. Records of production were first reported statistically in 1917, and the Arizona Bureau of Mines reports the production from 1917 to 1948 inclusive to be worth \$15,668,000. Details of tonnage and value since that time are as follows:

	<u>Tons</u>	<u>Value</u>
1949	1,511,953	\$ 970,813
1950	2,498,777	1,590,001
1951	2,691,100	2,203,345
1952	1,824,330	1,635,903
1953	3,446,821	2,680,470
1954	3,450,000	2,690,000
Total Value 1917 - 1954		27,438,532

SILICA

Fine lump or crushed quartz and quartzite of high silica content have been employed extensively in Arizona smelters for lining furnaces and converters. Data as to the amount and value of silica produced in Arizona were not available until 1953, when the U.S.B.M. began to report production and value. The record for the last two years is as follows:

	<u>Tons</u>	<u>Value</u>
1953	264,582	\$ 334,340
1954	260,000	327,600

In the late 30's and early 40's Paul Lime Plant west of Douglas, produced finely ground quartzite for reverberatory furnace linings. In 1943-44 Arthur Enders mined a few thousand tons of silica from the Dixie claims, 40 miles N. E. of Phoenix.

Relatively pure deposits of silica necessary for glass-making are not common, and are not developed because of their location far from large centers of glass manufacture.

An outstanding deposit of silica sand of high quality occurs in Coconino County, near Meteor Crater.

STONE

Commercial stone is broadly classified as dimension stone, slate, and crushed stone. Dimension stone is used in buildings, walls, pavements, curbs, flagging and ornaments.

Commercial shipments of sandstone have been made from Coconino, Navajo and Yavapai Counties. Coconino sandstone of various colors is quarried near Ash Fork, Selegman and Drake. Granite rock for building and monumental purposes has been quarried in several Arizona localities, chiefly near Prescott, Phoenix, Casa Grande and Salome. Volcanic tuff is a popular building stone and has been quarried in Cochise, Gila, Maricopa, Mohave, Pima and Yavapai Counties.

Marble was quarried many years ago in the Chiricahua Mountains of Cochise County. Onyx Marble has been produced in Coconino, Maricopa, Pima and Yavapai Counties.

No slate has been produced commercially in Arizona.

Crushed stone, used for concrete, road material, railroad ballast, and smelter flux, has been the chief source of income for Arizona Stone producers.

The Arizona Bureau of Mines estimates the value of stone produced in Arizona from 1889 - 1948, to be \$14,234,000. From 1949 to the end of 1954, Arizona produced 1,493,323 tons of stone, worth \$1,764,958.

TUNGSTEN

Tungsten is used chiefly to produce superior cutting tools, and minerals containing tungsten are found in many counties of Arizona. Most of the early production came from lode deposits in Mohave County, and from Pima, Pinal and Cochise Counties. The Dragoon, Campo-Bonito, Aquarius, Yucca and Huachuca mines were the principal mines before 1930. From 1930 to 1940, the Borianna, Camp Wood and Las Guijas were the chief producers. The Las Guijas property near Arivaca was the largest producer in 1953, and the Black Pearl and Tungstena Properties at Bagdad, Yavapai County, were the chief producers in 1954.

Tungsten Production Record

60% WO₃ Tungsten Ore

	<u>Tons</u>	<u>Value</u>
1910 - 1934	1,400	\$1,000,000
1935 - 1950	2,459	2,787,596
1951	11	37,000
1952	73	258,000
1953	134	474,836
1954	117	411,500
Total Production	4,194	\$4,968,932

URANIUM AND VANADIUM

The U. S. Government does not permit the publication of Uranium and Vanadium statistics.

One of the important uses of vanadium is in the production of high-quality steels. The total value of vanadium that has been produced in Arizona is estimated at \$460,000 up to 1950. Prior to 1945 it was obtained largely from gold-mining operations in the Mammoth mines, near San Manuel, but more recently it has been recovered from uranium ores of the northeastern part of the State.

Uranium is being discovered nearly every week in some part of the State, but the biggest developments so far have been in the northeastern part.

SUMMARY OF PRODUCTION OF ARIZONA MINES 1860-1954

	<u>Quantity</u>	<u>Value</u>
Copper (tons)	14,265,856	\$ 4,778,932,458
Gold (ounces)	11,754,084	298,888,095
Silver (ounces)	330,864,159	251,816,133
Zinc (tons)	667,041	161,694,179
Lead (tons)	544,705	101,319,980
Sub-total - 5 Principal Metals		<u>\$ 5,592,650,845</u>
Manganese (Long tons 35% Mn)	235,593	\$ 16,331,000
Mercury (estimated)	-	900,000
Molybdenum(pounds)	21,646,000	16,939,000
Tungsten (tons 60% WO ₃)	4,194	4,970,000
Uranium	not published	
Vanadium (to 1950 incl.) not published thereafter		460,000
Sub-total - Misc. Metals		<u>\$ 39,600,000</u>
Grand Total All Metals exc. Uranium		<u><u>\$ 5,632,251,000</u></u>
Asbestos (estimated)	-	\$ 5,000,000
Barite		3,085,000
Cement (estimated)		16,000,000
Clays and Clay Products	-	17,000,000
Feldspar		3,000,000
Fluorspar(estimated)		700,000
Gypsum (estimated)		1,500,000
Lime		17,195,000
Mica (years 1953-1954) Other years not available		229,000
Perlite		104,000
Pumice-Pumicite (1952-1954) Other years not available		926,000
Sand - Gravel (1917-1954)		27,439,000
Silica (1953-1954) Other years not available		662,000
Stone (Dimension & Crushed) (1889-1954)		16,000,000
Sodium Sulfate, Coal, Rare Earths, Gems (estimated)		2,000,000
Grand Total All Non-metallics		<u>\$ 110,840,000</u>
GRAND TOTAL All Metals and Non-Metallics		<u><u>\$ 5,743,091,000</u></u>

Arizona Department of Mineral Resources
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