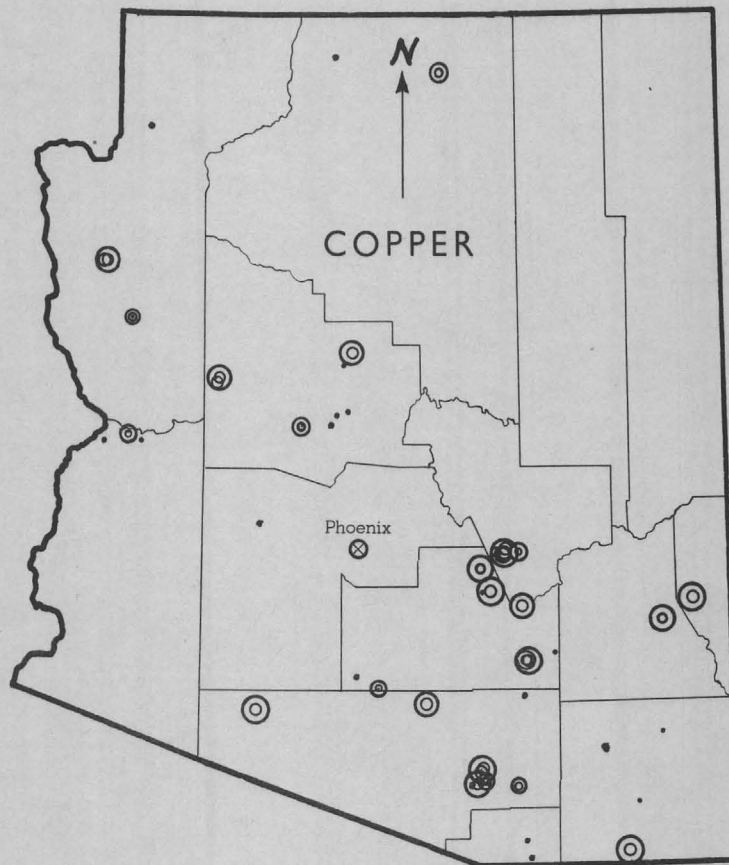


DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
PHOENIX, ARIZONA

FRANK P. KNIGHT, DIRECTOR

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29TH ANNUAL REPORT

FOR

YEAR ENDING JUNE 30, 1968

Honorable Jack Williams
Governor of Arizona
Capitol Building
Phoenix, Arizona

Dear Sir:

The Annual Report of the Department of Mineral Resources, covering the fiscal year July 1, 1967 to June 30, 1968, is submitted herewith.

The report contains, as formerly, a review of mining activity in the State and of this department's activities, which are directed towards the development and welfare of Arizona's mining industry.

Very truly yours,

Frank P. Knight

FRANK P. KNIGHT,
Director.

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ARIZONA MINERAL PRODUCTION

The value of Arizona's mineral production in 1967 dropped to \$463,858,000 because of the copper strike which began July 15 and continued into 1968. It was 25.4 percent below the record year of 1966, and in terms of 1957-59 dollars, about equal to the total value of 1957 production. Copper accounted for \$383,591,000 or 82.7 percent of the 1967 total mineral production value. The tonnage of copper produced in Arizona in 1967 was 501,741 short tons - 237,828 tons less than in 1966, and about 300,000 tons less than would have been produced if the mines had operated at anticipated capacity rate.

The total value of Arizona's mineral production to the end of 1967 is more than \$11.6 billion, of which approximately 83.9 percent has come from copper. Arizona mined 52.6 percent of the Nation's copper production in 1967, ranking first among the United States as it has done since 1910. It ranked 3rd in silver, 4th in gold, 5th in lead, 13th in zinc and 3rd or 4th in molybdenum production. Although Arizona ranked 8th in total value of all minerals produced in 1966, it was first in value of metal production in the Nation. The first seven states were large producers of fuels. Arizona has at San Manuel the largest underground copper mine, and at Morenci, the second largest open pit copper mine in the Nation.

Details of mineral production are to be found in the following tables of the Appendix to this report:

- I. Arizona Production and Value of the Six Principal Metals in 1967.
- II. Mineral Production of Large and Small Producers in Arizona in 1967.
- III. Arizona's Mine Production of the Six Principal Metals, 1958 to 1967.
- IV. Relative 1967 Production in the United States for the Six Principal Metals.
- V. Value of Mineral Production in Arizona, by Counties, 1966-1967.
- VI. Copper, Gold, Silver and Molybdenum Recovered from Metal Mines in Arizona in 1965, 1966, and 1967.

ACTIVE MINES

No major copper mine came into production during the fiscal year, but a major expansion project was completed; another major and several smaller developments were started; and other developments or expansions were continued through the year, including the strike period. The number of producing mines of all kinds is shown in Table VII on page VIII of the Appendix. In April 1968, a department survey showed 40 active copper mines, 5 of them with ores containing also lead or zinc; 4 lead and/or zinc mines, 9 gold and silver, 7 uranium and 37 other producers of metallic or non-metallic minerals, making a total of 97, the same as the total in April 1967. Sand, gravel, stone, clay and the solid and liquid fuel producers are omitted from these lists.

EMPLOYMENT

Information supplied by the Arizona Employment Security Commission is that in 1967 (1966 in parentheses) there were employed in Arizona mining, quarrying and smelting an average of 14,789 (18,542) covered employees with total covered wages of \$118,073,881 (\$147,439,443) or an average of \$7,984 (\$7,952) per year per employee. The annual wages paid by the copper producers are the highest in the State. The "total covered wages" reported by the Commission represent only the amount paid by the employer directly to the employees as compensation for employment including compensation paid during time-off for vacations, jury duty, holidays, etc. and including additional premium wages paid for hours worked in excess of a standard work-week of 40 hours and for shift differentials. In addition to those above stated "fringe benefits" there are additional fringe benefits consisting of labor costs not paid directly to the worker, such as statutory employer payroll taxes for social security and unemployment compensation, supplementary unemployment compensation reserves, group life and health insurance, retirement plan contributions, etc. Exclusive of payroll insurance and taxes paid by the employer, this group of fringe benefits alone is estimated to cost well in excess of \$15,000,000 per annum. In addition, in 1967, over \$5,000,000 was spent by employers as the cost of operating hospitals and recreational facilities for the benefit of employees of the companies, their families, and other residents of the community. It is conservatively estimated that the total "fringe benefits" will amount to well in excess of 25 percent of the total labor costs for hours actually worked on a straight time basis. This does not include costs of workmen's compensation and disability expenses which are regarded as business operating costs included in insurance against injuries.

COPPER

Over one-half of the State's 1967 copper production of 501,741 tons came from Pima and Pinal Counties, with Pima first in rank, Pinal second, followed by Greenlee, Gila, Cochise, Yavapai and Mohave in the order named. Arizona's production of recoverable copper for the first half of 1968 has been 248,736 tons, 36.6 percent below that of the first half of 1967, according to reports of the U. S. Bureau of Mines.

The start of the fiscal year coincided with the expiration of nearly all of the labor contracts of the major copper companies. The most serious, wide-spread copper strike was to start July 15th. World production was high; foreign demand had eased; and domestic demand for inventory build-ups was absorbing what otherwise would have been excess supply. Domestic stocks of refined copper were the highest ever.

The copper strikes started in mid-July and lasted into April 1968. Fortunately for the United States copper consumers, some of the major domestic mines (5 in Arizona) kept going, and together with continued imports, supplied needed copper, albeit at higher prices.

Arizona's metal production loss from the strike was approximately 450,000 tons of copper; 4,000,000 ounces of silver; 72,000 ounces of gold and 2,800,000 pounds of molybdenum; with a total gross value of over \$350 million. Arizona employees lost approximately \$60 million in wages and gained wage increases of approximately \$1.10 - 1.15 per hour over a three year period.

Copper production recovered rapidly following the strike. Mine output in April 1968 was 93 percent of April 1967. By mid-May, employment nearly equaled the record for June 1967 and by mid-June, it exceeded the record June 1967 total. Phelps Dodge was the first major producer to resume operations, in mid-March 1968, and it quickly raised its price 4 cents to 42 cents. Others soon followed and this "producers" price held for the remainder of the fiscal year.

11,052,000 tons of ore mined in 1967 at the Morenci mine of Phelps Dodge Corp. yielded 82,034 tons of copper, 42 percent below its all-time record of 141,178 tons in 1966. The Morenci pit rapidly advanced to the southwest, to gobble up Hill AC with its goodly portion of the town. New houses, shopping center, hospital and offices were well along towards replacing the old. At its New Cornelia Branch at Ajo in 1967, Phelps Dodge produced 40,118 tons of copper from 6,078,000 tons of ore; 41 percent less copper than in 1966. The Copper Queen Branch at Bisbee produced 34,122 tons of copper, 14,436 from the Copper Queen mine and 19,686 from the Lavender pit. The Bisbee total was off 44 percent from that in 1966. The total copper production of Phelps Dodge's Arizona properties in 1967 was 156,274 tons, off 42 percent from 1966 and was 31 percent of the State's total.

In June 1968, Phelps Dodge was drilling on the site of its proposed exploration shaft at its Safford project.

The San Manuel Division of Magma Copper Co. produced 53,963 tons of copper in 1967, down 47 percent from 1966. Magma's Superior Division produced 9550 tons of copper, off 51 percent from 1966. The assay grade of ore mined at San Manuel was 0.758 percent compared with 0.772 in 1966. Respective figures for Superior were 4.77 percent for 1967 and 4.70 for 1966.

In March 1968 Magma Copper Co. agreed to buy the Kalamazoo property of Quintana Minerals Ltd. for \$27 million. The property adjoins Magma's San Manuel mine and is estimated to have over 500 million tons of better than 0.7 percent copper ore; the ore body lying considerably below the San Manuel ore body. In June 1968, Magma was studying the feasibility of a \$20 million project to change mining methods and increase capacity at its Superior Division, Magma mine.

The American Smelting and Refining Co. (Asarco) produced a total of 60,582 tons of copper in 1967; 35,715 from its Mission mine south of Tucson and 24,867 from its Silver Bell property at Silver Bell. The Mission mine was closed July 17, 1967 because of the strike and remained closed except for a short period starting in mid-December. Its fifty percent expansion was completed before the strike and is the main reason for the decline of only 23 percent from 1966 production. The Silver Bell mine operated at full capacity through the strike period and its 1967 production was up 4.5 percent from 1966. Its concentrates were stacked during the strike.

At the end of the fiscal year, a new reverberatory furnace was completed and with two new 13'x 33' converters, an increase of 35 percent in capacity was expected.

The Ray Mines Division of Kennecott Copper Corporation produced 45,323 tons of copper in 1967, down 37 percent from 1966 because of the copper strike. The \$35 million Ray project involving facilities for production of 24,000 tons per year of copper from low grade silicate ores by open pit mining, vat leaching, and electro-winning was well along at the end of June 1968. Included in the facilities will be a 750 tons per day sulphuric acid plant which was expected to start up in late 1968, using sulphuric gases from the Hayden smelter. Copper production was expected to start in the early part of 1969.

Inspiration Consolidated Copper Co. in 1967 produced 31,621 tons of copper - 27,127 from its open pit mines at Inspiration and its new smaller Ox-Hide pit west of Miami; and 4,494 from its open pit mine at Christmas. The combined output was down 45 percent from 1966, because of the copper strike. In August 1967, Inspiration announced plans to build a plant to convert its refined copper into rod for wire-making at the rate of 15 tons of rod per hour. Production was scheduled to start early in 1969. At its smelter, new blister copper casting facilities were completed in 1967 and a new converter installation was finished in the first half of 1968.

Duval Corporation's Arizona mines produced a total of 51,242 tons of copper in 1967, up 4.7 percent from 1966. Its Mineral Park property north of Kingman produced 27,143 tons and its Esperanza mine south of Tucson 24,099. Both mines operated through the strike period. In November 1967, the General Services Administration entered into a contract with Duval Sierrita Corp. under the terms of which G.S.A. would advance up to \$83 million against future copper deliveries from a new copper-molybdenum ore body adjacent to the Esperanza mine; and Duval, with the help of \$48.75 million in bank loans, would provide the rest of the \$151 million total estimated need. Removal of 105 million tons of overburden and construction of facilities for handling 60,000 tons of ore per day, are underway. Operations are scheduled to start before the end of 1969.

Miami Copper Company Division of Tennessee Copper Corporation produced a total of 17,978 tons of copper from its three Arizona properties, a drop of 48 percent from 1966. Its Copper Cities, Miami and Castle Dome mines produced 12,554; 4,363; and 1,061 tons respectively.

Bagdad Copper Corporation produced 18,374 tons of copper in 1967 of which 5,533 tons derived from heap leaching of oxide ores. The total was off 9 percent from 1966 due to lower grade sulphide ores and iron interference in leaching. Production in the first six months of 1968 was 9,094 tons, up 11 percent above the first half of 1966 due largely to the return to rated production of the leaching operation.

Pima Mining Company produced 49,293 tons of copper in 1967 from its Pima mine south of Tucson, up 25 percent above 1966. The 16.6 million project to expand the mine's productive capacity from 16,000 to 30,000 ore tons was completed in July 1967. Pima operated throughout the strike period and reached agreement with

the union the first of September 1967. It continued to mine and mill for Banner Mining Co. ores from Banner's section of the Pima pit. It also completed a new molybdenum unit.

Ranchers Exploration and Development Corporation produced 3,343 tons of copper in fiscal 1967-68, a decrease of 19 percent below the previous year, from its Bluebird mine near Miami. Its new plant to upgrade its copper leach solutions by a solvent extraction process, the resulting solutions going to an electrowinning circuit, started up in March 1968. It was designed to produce 30,000 pounds per day of cathode copper.

At the Anaconda Company's Twin Buttes property south of Tucson stripping of overburden and construction of concentration and other facilities was ahead of schedule at the end of the fiscal year and start of production was expected by September 1969.

McAlester Fuel Co. at its Zonia mine east of Kirkland Junction, obtained better results in the fiscal year, with increased area of leach heaps and with spraying of leach solutions started in the last half of 1967.

White Mesa Co.'s White Mesa (Mardun) copper open pit-vat leaching operation south of Page was active in the first half of the fiscal year, but not in the last half.

In September 1967, El Paso Natural Gas Co. started open pit mining of its oxide copper ores, and extraction of copper therefrom, in the leach-precipitation-flotation mill at its Emerald Isle property south of and near to Chloride. The plant is designed to treat 1,000 tons of ore per day, but water shortage prevented capacity operation during the fiscal year. New wells were being driven to remove the shortage.

In the last half of 1967 M.M.Sundt Construction Co. of Tucson continued to develop the open pit mine, and proceeded with the construction of segregation process facilities, at the Lakeshore mine, under contract from the owner, El Paso Natural Gas Co. The mine is 30 miles south of Casa Grande. In January some 300,000 tons of ore were stockpiled and the kiln was fired for the salt-coke roasting which starts the segregation process. The El Paso company's program has included exploration drilling at the Lakeshore and other properties in the district.

Kennecott Copper Corp. and the Atomic Energy Commission announced a study of the feasibility of a "project Sloop" involving explosion of a nuclear charge at Kennecott's Lone Star property north of Safford. The resulting chimney of over a million tons of broken ore would be leached in place to extract the copper.

Royal Mining Co. was reported to be mining copper ores in the Big Horn Mountains north of Tonopah in the first half of 1968.

In July 1967 Minerals Exploration Co. optioned the Mame mine near Courtland. It stopped leaching and sold the equipment, but continued exploratory drilling.

The Scruggs Mining Company produced cement copper by heap-leaching of ores from the old San Juan property north of Safford in the fiscal year.

At the beginning of fiscal 1968, Clevite Corp. and Powdered Metals Corp. announced a joint venture called Harlan Metals Corporation, which proceeded with drilling at the Standard mine south of Casa Grande to prove copper ore reserves, and with testing of the Harlan process at the pilot plant at Phoenix. In mid-1968 the Economic Development Administration, Department of Commerce, approved a \$1.2 million, 15 year loan to Harlan Metals Corp. to help develop a small open-pit mining and leaching operation. Private and company financing of an additional \$650,000 was also involved. It is reported that the George E. Harlan electrolytic process of copper extraction will be used.

A group, including Freeman and Bale Lomelino of Blythe, California tried heap leaching of copper ore at the Shirt Tail mine in northern Yuma County until February, when two of the partners were killed in an airplane accident.

Copper-Zinc

Cyprus Mines Corporation neared completion of its new 2200 foot shaft to serve its Old Dick and Copper Queen mines in the Bagdad district of Yavapai County and did other development work in the fiscal year.

Standard Metals Corporation of Denver completed its 500 foot, 70 degree shaft at the Antler mine east of Yucca in March and did other underground development work in the first half of 1968. A water well was driven south of Yucca and construction of a 200 tons per day mill was due to start soon after the end of the fiscal year.

Standard Copper Corporation of New York increased milling capacity at the Copper World mine about 16 miles easterly from Yucca early in the fiscal year but water shortage and other troubles caused it to close the mine early in 1968.

Continental Materials Company shut down its CWT mine near Twin Buttes, south of Tucson, in December 1967.

G. H. Stoffers mined ores from the Moore Shaft at Johnson Camp in the Little Dragoon Mountains of Cochise County, and shipped them by truck to the American Zinc Co.'s old flotation mill at Klondyke 82 miles away.

LEAD - ZINC

The domestic price of pig lead f.o.b. New York at 14 cents per pound dropped to 13 cents in May 1968 because of a weakened market and low foreign prices. The domestic price for prime western zinc f.o.b. East St. Louis was 13.5 cents through the fiscal year. Both of these prices were down a cent from those in October 1966 (lead) and May 1967 (zinc), due principally to competitive low-priced metals.

Arizona's lead production in 1967 was 4,771 tons, 8 percent below 1966. Zinc production was 14,330 tons, 10 percent below 1966. Arizona ranked 5th in lead and 13th in zinc production among the United States in 1967.

The Iron King mine at Humboldt produced most of Arizona's lead and zinc output in 1967. In 1966 it ranked 13th in lead, 15th in zinc, 15th in gold and 19th in silver among the United States producers of these metals. At the end of 1967 this important mine was forced to close, after 26 years as one of the leading U. S. producers of these metals. However, the Iron King was reopened in March 1968 by McFarland and Hullinger of Tooele, Utah and at the end of June approximately 500 tons of ore per day were being mined, concentrated and shipped.

During the period of the copper strike, most of the lead and zinc smelters available to Arizona producers were closed. The Glove mine east of Amado in Santa Cruz County closed in the fall of 1967. Shipments of lead-silver concentrates by Lyman Wall from the New Chance and Linda mines in the Castle Dome district, Yuma County were intermittent. The concentrates were from treatment of dump material. In the spring of 1968, Maurice Hedderman started work at the Silver Coin lead-gold-silver mine northwest of Arivaca. Ores from development work were stockpiled at the Jamison mine operated by Chico Mining Co. in Mohave County, and a small pilot mill was constructed.

Yavapai County produced over 90 percent of the Arizona lead and 70 percent of the zinc in 1967. Small amounts of lead were produced in Pima, Santa Cruz and Yuma counties. Nearly 1/4 of the zinc tonnage came from Pima County - mostly from the Mission and CWT copper and copper-zinc mines. All but 1 ton of the balance of the zinc came from Mohave, Santa Cruz and Cochise Counties.

GOLD - SILVER - MOLYBDENUM

Practically all of Arizona's production of these metals comes as by-products from copper, lead-zinc and complex ores.

Gold

Gold Stocks of the United States at the end of June 1968 were \$10,681 billion down from \$13,169 billion at the end of June 1967. The "reserve ratio" of gold to Federal Reserve notes dropped to 31.6 percent at the close of the fiscal year, down from 34 percent in mid-1966. Short-term foreign liabilities were \$29,836 million at the end of June - down \$590 million in the month. The free market price of gold was \$40.90 per ounce at the end of June.

In 1967, Arizona produced 80,844 Troy ounces of gold worth \$2,830,000 or 43 percent less than in 1966. In the first half of 1968 it produced 36,140 ozs., off 49 percent from the first half of 1967, according to figures of the U. S. Bureau of Mines. The U. S. Bureau of Mines reported one placer gold mine in Arizona, which produced 2 ozs. only. Five dry gold lode mines produced a total of 29 ozs.

Seven of Arizona's larger base metal mines were in the top 25 gold producers in the Nation in 1966. They, with their ranks in parentheses, were Bisbee (8), New Cornelia (9), San Manuel (12), Iron King (15), Magma (16), Morenci (17), Christmas (24). All except Iron King are copper mines.

Silver

On July 14, 1967 the Treasury halted its sale of silver at \$1.293 per ounce and the resulting domestic free market prices rose with considerable fluctuation to \$2.49 at the end of the fiscal year. The period for Treasury redemption of silver certificates expired in June, however, and market demand for silver had already slackened.

Arizona's production of silver for the first half of 1968 was 2,010,000 ounces, down 40 percent from the first six months of 1967. The major Arizona silver producing mines, with their national ranking in 1966 in parentheses were Bisbee (11), Mission (12), Morenci (18), Iron King (19), Mineral Park (20), Pima (21), New Cornelia (23) and Magma (25).

The Tombstone silver district came alive in March 1968 with a rich silver showing developed by Ernest B. Escapule and son at the Santa Ana mine. Austral Oil of Houston, Texas purchased a lease and option agreement and proceeded with exploration and development work. The Escapules, an old family of Tombstone prospectors, had long held the property and had resumed mining and cyaniding to extract the silver when prices of the metal became attractive. Prospecting increased greatly in the area.

Peterson and Garland operated a small silver mine southeast of Christmas.

The U. S. Bureau of Mines reported 10 Arizona dry silver lode mines in 1967 with combined production of 37,995 ounces.

Molybdenum

Molybdenum has become the most important by-product of a number of the copper producers of Arizona. Its total value in 1967 was \$15,385,000, 14 percent below 1966 and 55 percent above the combined value of the gold and silver produced in 1967. It ranked third behind copper and sand-and-gravel in value. Pima Mining Company's new equipment for molybdenum recovery was ready early in the fiscal year, and was expected to recover approximately 900,000 pounds annually.

Tungsten

Fernstrom Mining Co. of Tucson mined a small tonnage of tungsten ore from the Carboloy mine, concentrated the tungsten minerals and shipped them to Kennametal, Inc. at Fallon, Nevada.

URANIUM - VANADIUM

Uranium

Arizona's production of uranium ore in 1967 was 15,723 tons with recoverable U_3O_8 content valued at \$666,000. The ore tonnage was down 75 percent in quantity and the value was down 66 percent from 1966. The drop was largely due to the idleness of the Orphan mine in the first 9 months of 1967 and of the permanent

closing of the Tuba City mill at the end of 1966. In September 1967 Cotter Corp. of Roswell, New Mexico, purchased from Westec Corp. the Orphan mine and started mining late in that month. The ore was shipped to Cotter's mill at Canon City, Colorado, for extraction of its U_3O_8 . Early in 1968, the Foote Mineral Co.'s processing plant at Shiprock was closed and Claim 28, operated by Gib Shumway, was the only active mine in Apache County in the 4th quarter of 1967-68. There was no reported uranium production from any county other than Coconino and Apache in 1967. U. A. Small of Spanish Fork, Utah, closed the Moonlight mine in Navajo County in the first half of 1968 after working with a couple men through 1967.

Vanadium

Processing plants outside of Arizona extracted from Apache County uranium ores an undisclosed amount of vanadium in 1967. However, the quantity is believed to have been much below that of 1966.

IRON

In 1965 Arizona produced 8,000 long tons of usable iron ore valued at \$51,000. The U. S. Bureau of Mines has reported that production and shipments declined in Arizona in 1966, and increased threefold in 1967 due largely to the iron ore mined by the C. F. & I. Steel Corporation from the Apache Iron deposit leased by it from the Fort Apache Indian Tribe, and shipped to its plant at Pueblo, Colorado, for testing, in the first and last quarters of fiscal 1967-68.

In the latter part of 1967, Sovereign Industries, Inc. reported the acquisition of the assets of the Arkota companies including rights on 140 square miles of iron bearing lands in the Black Mountain area southeast of Florence, and the sponge iron-steel plant at Coolidge. It also reported the retention of engineering services of Dravo Corp. In mid-1968 the iron property was inactive while Dravo Corp. was evaluating results of its investigations and exploration and test work.

Archean Exploration Corporation operated intermittently its small pilot iron reduction plant 18 miles west of Snowflake with ore from the Frog Pond iron deposit northeast of Young near the Fort Apache Indian Reservation.

Charles Pfizer & Co. shipped hematite ore from the Cowden mine near Seligman for use as a paint pigment.

MERCURY

The price of mercury rose from \$480 per flask at the first of the fiscal year to \$600 early in 1968 then dropped back and was \$510 at the end of June 1968.

During the fiscal year there were several small, more or less intermittent producers in the Sunflower district, Maricopa County. Total Arizona production was much lower in 1967 than in 1966 when 363 flasks (76 lb.) valued at \$160,000 were reported.

ALUMINUM

General Aluminum and Chemical Company with a plant at Goodyear melted and refined aluminum salvaged from airplanes or purchased drosses. Supreme Perlite Co., Inc. has a similar plant next to that of General Aluminum. Royal Aluminum and Refining Company and Thomas Enterprises each operated plants at Humboldt in which aluminum was separated from drosses and formed into ingots, in the fiscal year.

EXPLORATION

Exploration, especially for copper, continued to be very active in 1967-68.

Search for new uranium deposits increased markedly, in line with the rapid growth in use of nuclear energy for electric power generation.

The Heavy Metals Program of the Department of the Interior increased the OME participation in exploration loans to 75 percent for antimony, bismuth, gold, mercury, platinum group metals, rutile, silver, tantalum and tin, in September 1967.

Among the many areas in which exploration work was reported are:

Apache County:	Carrizo Mts. and Lukachukai districts; Four Corners, Pinta-St. Johns areas.
Cochise:	Tombstone, Huachuca, Turquoise, Swisshelm, Dragoon, Johnson Camp, Hartford, California and Dos Cabezas districts.
Coconino:	White Mesa, Francis, Warm Springs, Grand Canyon and Cameron districts.
Gila:	Dripping Springs, Pioneer, Mazatzal Mts., Miami, Sunflower, Globe, Banner, Sierra Ancha, Summit and Richmond Basin districts.
Graham:	Lone Star, Gold Mt., Arivaipa and Rattlesnake districts.
Greenlee:	Copper Mt., Metcalf, Copper King Mt., and Ash Peak districts.
Maricopa:	Magazine, Webb, White Tank, Sunflower, Cave Creek, Goldfields, San Domingo, Big Horn and Wickenburg districts.
Mohave:	Mineral Park, Cerbat, Wallapai, White Hills, Gold Basin, Lost Basin, Virginia, Thumb Butte, Bentley, Hacks Canyon, Maynard, Chloride, Oatman, Owens, Cedar Valley and Cleopatra districts; and Wikieup and Copper House areas.
Navajo:	White Mesa, Black Mesa, Monument Valley, Pink Cliffs and Holbrook areas.
Pima:	Growler, Gunsight, Ajo, Helvetia, Empire, Rosemont, Amole, Greaterville, Coyote, Silver Bell, Fresnal, Mineral Hill, Montezuma, Olive, Twin Buttes and Arivaca districts.
Pinal:	Ray, Mineral Hill, Superior, Copper Creek, Mineral Creek, Vekol, Silver Reef, Owl Head, Saddle Mt., Ripsey, Tiger, Pioneer, Black Mt., Gold Mt., San Manuel, Canada del Oro, Old Hat, Blackwater and Bunker Hill districts.
Santa Cruz:	Oro Blanco, Duquesne, Patagonia, Palmetto, Tyndall and Harshaw districts.

Yavapai: Walnut Grove, Peck, Martinez, Black Canyon, Agua Fria, Tiger, Verde, Copper Basin, Walker, Eureka and Humbug districts; Santa Maria area.

Yuma: Ellsworth, Plomosa and Planet districts.

FLUXING ORES

Siliceous ores, with or without metal content were produced for flux or slurry for copper smelters from the Nancy # 2 and Burro mines in the Turquoise and Johnson districts in Cochise County; the Copper Hill mine, Globe district, Gila County; the Harmony mine, Metcalf district, and Ash Peak mine, Ash Peak district, Greenlee County; the Anderson Pit and San Antonio mines in the Gunsight Hills and Ajo districts; Pima County, Orizaba, Tiger and Gold Hills mines in the Silver Reef, Mammoth and Canyon del Oro districts, Pinal County; the Commercial mine in Yavapai County; and others, including some operated by the smelting companies.

NON-METALLIC MINERALS

Arizona's production of non-metallic minerals exclusive of mineral fuels in 1967 was valued at \$40,109, down 6 percent from 1966. Production and values of individual items are given in Table II page IV of the Appendix.

Percent changes in 1967 production in value from 1966 for some individual items were: sand and gravel, down 17; stone, off 15; lime down 16; pumice, down 46.

Producers of Fluorspar, principally C. L. Whitelock, et al, operators of the Lone Star mine in the Whetstone district of Cochise County, shipped 10,000 tons valued at \$280,000 in 1967. The Lone Star was reported idle in March, 1968.

Jaquays Mining Co. added a section for reworking asbestos tailings at its Globe plant.

Work was stopped at the new Green Dragon (Big Reef) mica plant of Wong Associated Enterprises northeast of Morristown and equipment was removed from the property.

The Arizona Helium Corporation's new helium extraction plant at Navajo was completed in February, 1968. Arizona production for the first half of 1968 was 426,766 Mcf of raw helium gas, 7 percent less than in the first half of 1967. The major portion was processed at the plant of Kerr-McGee Corp., also at Navajo.

Peabody Coal Co. continued development of its Black Mesa coal deposit which is expected to start producing in 1970 to supply energy for the first of two 750,000 KW generators to be installed near Bullhead City.

The Dineh bi Keyeh oil field in the Lukachukai Mountains in the northeast corner of the State, discovered in February 1967, produced in the first half of 1968, 1,883,202 barrels, nearly 2-1/2 times the production in the first half of 1967, and equal to more than one third (35 percent) of the total Arizona oil production

up to July 1, 1968, In the same period of 1968 the new field also produced 642,283 Mcf of natural gas, or 8.6 times the amount yielded in the first half of 1967.

Apache County was the only producer of helium, oil and gas in the State in 1967.

DEPARTMENT ACTIVITIES

Laws, regulations and administrative procedures relating to mineral rights in Arizona and in the public lands of all of the western states, continued to be subjects of numerous inquiries as well as matters of concern to the department, whose primary objective is assisting in the development of the State's mineral resources. Many papers relating to these land matters and also to mine taxation, import controls, mine safety, gold, silver and monetary policies, air and water pollution, radiation, land classification, mineral land reclamation and mineral economics, were received from government agencies, Congress, State mining associations, the American Mining Congress and others. Many of them invited comment and required study.

The director was a delegate to the Western Governors' Mining Advisory Council and chairman of its committee on mining taxation, vice chairman of its committee on import controls and chairman of its nominating committee. He attended out-of-state meetings of the Council and of the western division of the American Mining Congress. Numerous sectional meetings in the State of the American Institute of Mining, Metallurgical and Petroleum Engineers (AIME), the Arizona Small Mine Operators Association, and professional and civic groups were attended, separately or at times together, by the director, assistant to director, administrative assistant and field engineers, at some of which mining talks were given or movies shown by them. Public hearings in the State on public land classifications and withdrawals, and on some State legislative matters, also were attended. The director served as one of two mining consultants for the Arizona Commission of Indian Affairs, the other being from the federal Bureau of Indian Affairs. The assistant to director closely followed mineral developments, especially in the copper industry worldwide and during the strike period, and his articles on copper and gold were favorably received. His outside services included that as secretary, Maricopa Subsection, A.I.M.E.

Department assistance was given to state agencies on matters pertaining to mining, including taxation, mineral rights, mineral properties, mineral production, industry development, industry problems and legislation; to Federal agencies concerned with legislation, public lands, Indian lands, mining statistics, mine and exploration loans and mining laws; and to the many companies, research and other private agencies, and individuals in and out of the state who sought information about Arizona mining properties and mining. Among them were most if not all of the more than 50 exploration teams of substantial companies which were seeking new mineral deposits during the year. The department has file information on approximately 3,000 properties.

Publications

The following department papers were mimeographed and distributed, to a mailing list of over 200 parties (over 20 percent out-of-state) including legislators, mining companies, government agencies, banks, newspapers, libraries and individuals, and to those requesting them:

Wage and Output Statistics; Arizona and the United States Copper Mines-6 pages

Copper Situation 2 pages

Inventory of Arizona Lands as of June 30, 1966 8 pages

Copper Imports 2 pages

Copper Industry - Statistics for 1966 Compared with Other Years; Arizona, the United States and World 46 pages

Copper Industry; Observations and Statistical Data Pertinent to Arizona and the United States as of December 31, 1967. 2 pages

Arizona Mineral Production - 1967 - Preliminary Annual Figures 4 pages

Arizona Copper, Year End Outlook 3 pages

Arizona Minerals - 1967. A Preliminary Report. 2 pages

Lead and Zinc Industry - Statistics for 1966 Compared with Other Years
Arizona, the United States and World 12 pages

Arizona and the Lead Zinc Industry 2 pages

Lead and Zinc Statistics. 1967 Compared with 1965 and 1966; the United States and the World; Preliminary Figures. 4 pages

Gold Report. A Discussion of the United States' Gold Problems 16 pages

Arizona's Role in Gold and Silver 2 pages

Gold and Silver Industry - Statistics for 1966 Compared with Other Years
Arizona, the United States and World. 12 pages

Copper Production Record of Large Arizona Mines Years 1966 and 1967 - 2 pages

Aftermath of the Copper Strike 1 page

Also mimeographed and distributed were:

Active Mine List, October 1967

Active Mine List, April 1968

Directory of State and Federal Agencies in Arizona of Interest to Mining

Revised list of registered Arizona mining engineers and geologists
available for consulting work.

The department booklet, Laws and Regulations Governing Mineral Rights in Arizona continued to be much in demand and was reprinted (3,000 copies) in June.

Information and Other Services

The Willis Library

This important addition to the department's library on Arizona mining was donated by Charles F. Willis, prominent Arizona mining engineer, publisher, executive and citizen, in December 1967.

The department's library, files on approximately 3,000 Arizona mining properties, and maps pertinent to Arizona mining, were in constant use. Information was perhaps the department's most important service. Most of the requests came to the main office at Phoenix, but the field engineer for the southern district had an office at the State building at Tucson. The field engineers were available for consultation at announced places and times. During the fiscal year, they travelled 30,294 miles, attended 125 meetings of the Arizona Small Mine Operators Association, visited 460 mines, and discussed mining problems with individuals on 1773 occasions - 424 in the field, 490 in the offices and 859 by telephone. Reports of activities and findings were written and filed.

There were 2224 visitors and 5505 telephone calls to the department during the fiscal year. The administrative assistant was consulted daily on public land matters.

Mineral Museum

There were approximately 13,000 visitors to the Mineral Museum exclusive of 70,000 visitors during the 11-day State Fair, according to Museum Curator Lee Hammons. Special visits for school children with total attendance of 3,500 were held. The museum continued to be supported by six copper companies; the support including employment of the curator. The department continued to furnish utilities and janitor. Museum attendance has increased greatly in recent years.

APPROPRIATION

\$ 87,572.00

EXPENDITURES:

Personal Services	\$ 61,028.85	
Professional Services	4,645.00	
Travel - State	5,387.01	
Travel - Out of State	600.00	
Current Expenditures:		
Postage	622.00	
Tel & Tel	1,435.02	
Utilities	1,413.03	
Maintenance & Repairs	620.88	
Office Supplies	1,072.29	
Printing	1,264.50	
Maintenance Supplies	78.90	
Other Contractual	109.56	
Other Supplies	43.39	
Subscription & Dues	194.52	
Fixed Charges	35.00	
Building & Equipment Insurance	231.00	
Capital Outlay	<u>997.92</u>	
TOTAL EXPENDITURES		\$ 79,778.87
Balance - Returned to General Fund		<u>7,793.13</u>
		\$ 87,572.00

Unused appropriations for personal and professional services (\$3,673); in and out-of-state travel (\$1,963); and current expenditures (\$2,040); were the principal items in the \$7,793 returned to the General Fund.

DEPARTMENT OF MINERAL RESOURCES

STATE OF ARIZONA

BOARD OF GOVERNORS

Charles F. Willis, Phoenix - Chairman
(term expires January 31, 1971)

Jack W. Still, Prescott
(term expires January 31, 1969)

Matt Danenhauer, Clifton
(term expires January 31, 1972)

Kenrick L. Lamb, Kingman
(term expires January 31, 1973)

Stephen H. Congdon, Tucson
(term expires January 31, 1970)

PERSONNEL

Frank P. Knight	Director
B. H. Gerwin	Assistant to Director
C. Leroy Hoyt (dec'd 5-20-68)	
K. N. Garard	) Field Engineer - Central District
Gerald W. Irvin	Field Engineer - Southern District
Fremont T. Johnson	Field Engineer - Northern District
Mrs. Glenn W. Pare	Administrative Assistant
Mrs. Pauline Halloren	Secretary
Mrs. Ray E. Sparkes	Secretary
Leonard Klein	Consultant

OFFICES

Phoenix Office - Mineral Building, State Fairgrounds
Tucson Office - Room 144, State Office Building

STATUTORY POWERS AND DUTIES

"Aid in the promotion and development of the Mineral Resources of the State.

Conduct studies of the economic problems of prospectors and operators of small mines for the purpose of assisting in their solution.

Assist in discovering sources of supply for persons desiring to buy minerals.

List and describe available mining properties.

Make mineral resource surveys and conduct other investigations which may interest capital in the development of the state's mineral resources.

Serve as a bureau of mining information in conjunction with the Arizona Bureau of Mines.

Publish and disseminate information and data necessary or advisable to attain its objectives.

Cooperate with the state land department to encourage mining activity on state lands.

Cooperate with the corporation commission in its investigations and administration of laws relating to the sale of mining securities.

Cooperate with the Arizona Bureau of Mines, and deliver to the Bureau problems which the field work of the division shows to be within the scope of the activities of the Bureau.

Cooperate with federal and other agencies designed to develop mines and minerals.

Oppose congressional acts favoring reciprocal or duty free imports of foreign minerals.

Use its authority in other ways to assist in more extensive exploration and development of the mineral resources of the state."

TABLE I

Arizona production and value of the six principal metals in 1967, as reported by the United States Bureau of Mines were as follows:

501,741 tons copper	@	38.2¢/lb	\$383,501,000
4,771 tons lead	@	14.0¢/lb	1,336,000
14,330 tons zinc	@	13.8¢/lb	3,967,000
80,844 ozs. gold	@	\$ 35.01/oz	2,830,000
4,588,081 ozs. silver	@	\$ 1.550/oz	7,112,000
9,261,000 lbs. molybdenum	@	\$ 1.661/lb	15,385,000
			<u>\$414,131,000</u>

This compares with the following final figures for 1966:

739,569 tons copper	@	36.170¢/lb	\$535,004,000
5,211 tons lead	@	15.115¢/lb	1,575,000
15,985 tons zinc	@	14.50¢/lb	4,636,000
142,528 ozs. gold	@	\$ 35.00/oz	4,988,000
6,339,000 ozs. silver	@	\$ 1.293/oz	8,196,000
10,161,000 lbs. molybdenum	@	\$ 1.753/lb	17,812,000
			<u>\$572,211,000</u>

TABLE II

MINERAL PRODUCTION OF LARGE & SMALL PRODUCERS IN ARIZONA IN 1967 1/

LARGE COPPER PRODUCERS: *		PRODUCTION	Value (Thousands)
Copper	tons.	494,201	\$ 377,827
Gold	ozs.	66,933	2,343
Silver	ozs.	3,996,587	6,195
Molybdenum (Content of Concentrates)	lbs.	9,261,000	15,385
			<u>\$ 401,750</u>
SMALL MINERAL PRODUCERS:			
Clays 2/	short tons	67,000	\$ 37
Copper (recoverable content of ore)	short tons	7,540	5,764
Diatomite	short tons	W	W
Fluorspar	short tons	10,000	280
Gem Stones		NA	150
Gold (recoverable content of ores)	troy ounces	13,911	487
Gypsum	short tons	W	W
Helium 3/	thousand cubic feet	73,800	2,066
Lead (recoverable content of ores)	short tons	4,771	1,336
Lime	short tons	186,000	3,142
Mercury	76-pound flasks	W	W
Natural Gas (marketed)	million cubic feet	1,255	193
Petroleum (crude)	42-gallon barrels	2,924,000	8,188
Pumice	short tons	1,064,000	904
Sand & Gravel	short tons	16,580,000	17,017
Silver (recoverable content of ores)	troy ounces	591,494	917
Stone	short tons	1,910,000	3,491
Tungsten Concentrate (60% WO ₃ basis)	short tons	W	W
Uranium 4/ (recoverable content U ₃ O ₈)	pounds	83,000	666
Vanadium	short tons	W	W
Zinc (recoverable content of ores)	short tons	14,330	3,967
Value of items that cannot be disclosed; Asbestos, clay (bentonite), feldspar, iron ore, mica (scrap), perlite, pyrites, and values indicated by symbol W . . .			<u>13,503</u>
Small Mine sub-total			\$ 62,108
Total			<u>\$ 463,858</u>
Total 1957-1959 Constant dollars			<u>\$ 370,189</u>
Percentage due to small mines			13.4

* Phelps Dodge (Morenci, New Cornelia, Bisbee), Kennecott, Inspiration and Christmas, Miami, Copper Cities, Castle Dome, Magma, and San Manuel, Asarco's Silver Bell and Mission, Pima, Bagdad, Duval's Esperanza and Mineral Park.

NA-Not available. W-withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed".

1/ Production as measured by mine shipments, sales, or marketable production.

2/ Excludes bentonite-included with "Value of items that cannot be disclosed."

3/ Bureau of Mines estimate from non-company sources.

4/ Method of reporting changed from short tons of ore and f.o.b. mine value to recoverable pounds of uranium oxide and f.o.b. mill value.

Source: USBM reports.

TABLE III

ARIZONA'S MINE PRODUCTION OF

	<u>GOLD</u> ozs.	<u>SILVER</u> ozs.	<u>COPPER</u> tons	<u>MOLYBDENUM</u> (Thousands) Lbs.	<u>LEAD</u> tons	<u>ZINC</u> tons	<u>VALUE</u> (Thousands)
1958	142,979	4,684,580	485,839	2,320	11,890	28,532	\$ 276,225
1959	124,627	3,898,336	430,297	3,181	9,999	37,325	286,996
1960	143,064	4,774,992	538,605	4,359	8,495	35,811	371,551
1961	145,959	5,120,007	587,053	4,878	5,937	29,585	376,333
1962	137,207	5,453,585	644,242	4,412	6,966	32,888	422,282
1963	140,030	5,373,058	660,977	5,553	5,815	25,419	433,622
1964	153,676	5,810,510	690,988	6,296	6,147	24,690	481,275
1965	150,431	6,095,285	703,377	9,399	5,913	21,757	535,215
1966	142,528	6,338,696	739,569	10,161	5,211	15,985	572,211
1967	80,844	4,588,081	501,471	9,261	4,771	14,330	414,221

TABLE IV

RELATIVE 1967 PRODUCTION

		<u>U. S.</u>	<u>ARIZONA</u>			<u>LEADING STATE</u>	
			<u>% of U.S.</u>	<u>Rank in U.S.</u>			
Gold	ozs.	1,584,187	80,844	5.1	4th	South Dakota	601,785
Silver	ozs.	32,118,694	4,588,081	14.3	3rd	Idaho	17,033,330
Copper	tons	954,064	501,741	52.6	1st	Arizona	501,741
Lead	tons	316,931	4,771	1.5	5th	Missouri	152,649
Zinc	tons	549,413	14,330	2.6	13th	Tennessee	113,065
Molybdenum-lbs.		88,930,000	9,261,000	10.4	3rd or 4th	Colorado	57,289,000 (p)

(p) = Preliminary

Source: U. S. Bureau of Mines

TABLE V

VALUE OF MINERAL PRODUCTION IN ARIZONA, BY COUNTIES

County	1966	1967	Minerals produced in 1967 in order of value
Apache . . .	r/\$ 5,783,021	\$ 11,894,526	Petroleum, helium, uranium, sand and gravel, clays, natural gas, vanadium, pumice, stone.
Cochise . . .	51,094,213	30,668,887	Copper, lime, sand and gravel, stone, silver, gold, fluorspar, zinc, lead.
Coconino . . .	r/ 4,968,407	3,535,440	Sand and gravel, pumice, stone, copper, uranium.
Gila	72,186,623	43,679,807	Copper, sand and gravel, asbestos, lime, molybdenum, stone, silver, gold, clays, mercury.
Graham	148,568	310,985	Sand and gravel, copper, stone, pumice.
Greenlee	105,583,016	64,893,359	Copper, lime, silver, stone, gold, sand & gravel, molybdenum.
Maricopa	7,739,805	5,698,147	Sand and gravel, lime, mercury, mica, stone, clays, copper, silver, vermiculite, gold.
Mohave	24,412,574	26,681,969	Copper, molybdenum, silver, sand and gravel, zinc, stone, feldspar, gold, clays, lead.
Navajo	r/ 1,356,168	801,870	Sand and gravel, iron ore, stone.
Pima	162,020,777	150,770,174	Copper, cement, molybdenum, silver, sand & gravel, zinc, gold, stone, lead, clays, tungsten concentrate.
Pinal	151,631,186	91,298,718	Copper, molybdenum, sand & gravel, silver, gold, perlite, gypsum, stone, lime, pyrites, diatomite, iron ore, lead.
Santa Cruz	808,662	577,669	Sand and gravel, zinc, lead, stone, silver, copper, gold.
Yavapai	r/ 31,860,644	30,487,994	Copper, cement, zinc, sand and gravel, lead, silver, molybdenum, stone, lime, gold, gypsum, clays, pumice, iron ore.
Yuma	2,364,802	2,409,053	Copper, sand and gravel, stone, lead, silver, gold, zinc.
Undistributed . . .	120,000	150,000	Gem stones.
Total.	r/\$622,079,000	\$ 463,858,000	

r/ Revised.

Source: U. S. Bureau of Mines

TABLE VI

COPPER, GOLD, SILVER AND MOLYBDENUM RECOVERED
FROM METAL MINES IN ARIZONA IN 1965, 1966 and 1967

	<u>1965</u>	<u>1966</u>	<u>1967</u>
Ozs. gold from all copper ores mined	133,830	127,431	66,933
Ozs. silver from all copper ores mined	5,352,850	5,595,644	3,996,587
Lbs. molybdenum from all copper concentrates	9,399,000	10,161,000	9,261,000
Lbs. copper from all copper ores mined includ- ing all clean-up	1,308,986,600	1,359,580,900	902,150,000
Lbs. copper from mine waters	89,282,500	114,965,800	98,718,600
TOTAL LBS. COPPER FROM ALL COPPER MINES	<u>1,398,269,100</u>	<u>1,474,546,700</u>	<u>1,000,868,600</u>
TOTAL LBS. COPPER FROM ALL OTHER MINES	<u>8,484,900</u>	<u>4,591,300</u>	<u>2,613,400</u>
GRAND TOTAL LBS. COPPER FROM ALL MINES	1,406,754,000	1,479,138,000	1,003,482,000
TOTAL TONS COPPER ORES MINED	92,859,535	101,558,298	74,289,203
TOTAL TONS ALL ORES MINED	93,529,240	102,151,074	74,809,009

Source: U. S. Bureau of Mines Area Reports

TABLE VII

PRODUCING MINES IN ARIZONA IN 1967 AND 1968

<u>MINES</u>	<u>During 1967 *</u>	<u>April 1967 **</u>	<u>April 1968 **</u>
Copper	42	37	35
Copper, with lead or zinc	2	3	5
Lead and/or zinc	<u>10</u>	<u>5</u>	<u>4</u>
Sub-total	54	45	44
Dry gold lode	5	2	1
Dry gold-silver lode	4		1
Dry silver lode	<u>10</u>	<u>7</u>	<u>7</u>
Sub total	19	9	9
Gold Placer	1	1	
Uranium		8	7
Mercury		2	2
Silica (with or without metal content)		9	11
Asbestos		4	3
Gypsum		4	4
Lime, limestone, cement		5	5
Marble		3	2
Perlite		2	2
Bentonite		1	2
Mica		2	3
Feldspar		1	1
Iron ore or concentrate		1	1
Diatomite			<u>1</u>
Totals		97	97

* Source: U. S. Bureau of Mines

** Source: Arizona Department of Mineral Resources