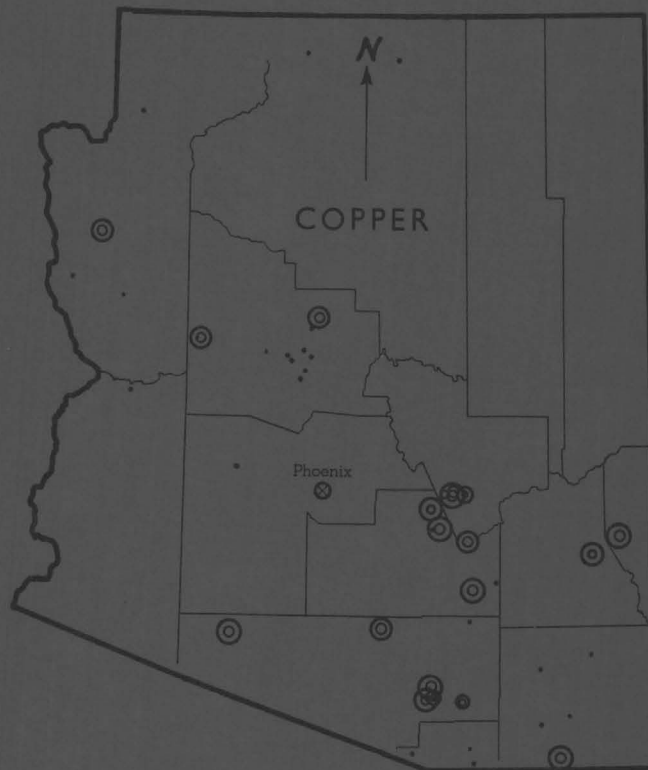


**DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
PHOENIX, ARIZONA**

FRANK P. KNIGHT, DIRECTOR

OFFICIAL FILE



26TH ANNUAL REPORT

FOR

YEAR ENDING JUNE 30, 1965

Honorable Samuel P. Goddard
Governor of Arizona
Capitol Building
Phoenix, Arizona

Dear Sir:

The Annual Report of the Department of Mineral Resources, covering the fiscal year July 1, 1964 to June 30, 1965, 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 of Arizona mining and the maintenance of the health of the present 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 1964 was \$534,364,000, the first year to be above one-half billion. It was 10 percent above the record in 1956, a year of abnormally high copper prices, and 9 percent above the record year of 1963. Copper accounted for \$450,524,000 or 84.3 percent of the 1964 total. The tonnage of copper produced in Arizona in 1964 was 690,988 short tons or 4.4 percent above that for 1963. Record tonnages of copper have been produced by Arizona in each year since 1959.

The total value of Arizona's mineral production to the end of 1964 is approximately \$10 billion, of which approximately 84 percent has come from copper. Arizona mined 55 percent of the Nation's copper production in 1964, and so ranked first among the United States, as it has done since 1910. It ranked second in silver, third in gold, 5th in lead and 11th in zinc production. It has the largest underground and the second largest open pit copper mines, and one of the largest lead-zinc producers 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 Five Principal Metals in 1964.
- II. Mineral Production of Large and Small Producers in Arizona in 1964.
- III. Arizona Metal Production, with Ten Year Records of the Five Principal Metals from 1954 to 1964.
- IV. Relative 1964 Production in the United States for the Five Principal Metals.
- V. Copper, Gold, Silver and Molybdenum Recovered from Mines in Arizona in 1962, 1963, and 1964.

ACTIVE MINES

The only major mine to come into production during the fiscal year was Duval Corporation's copper-molybdenum property at Mineral Park, north of Kingman. With this mine, and expansion projects at several major copper mines, total production capacity increased. However, the number of producing mines decreased, as is shown in Table VI in page VII of the Appendix. In April, 1965, a department survey showed 35 active copper mines 6 of them with ores containing considerable lead or zinc; 6 lead and/or zinc mines; 6 gold or silver; 11 uranium; and 37 other producers of metallic or non-metallic minerals, making a total of 95, compared to 98 in April 1964. Sand, gravel, stone, clay, and the solid and liquid fuel producers are omitted from these lists.

EMPLOYMENT

The Arizona Employment Security Commission reported for 1964 that there were employed in Arizona mining, quarrying and smelting an average of 18,070 covered employees with total covered wages of \$135,642,265, or an average of \$7,506 per year per employee. Fringe benefits are estimated to be an amount equal to over 25 percent of the regular payroll. Of this amount, an estimated \$6,000,000 or \$332. per employee was not included in the payrolls for the year. This \$6,000,000 is the employer's cost for unemployment, social security, hospital, recreation and other benefits to the employees.

COPPER

Arizona's copper production in 1964, 690,988 tons, was an all-time record for the fifth consecutive year. It was 55 percent of the Nation's total mine production of 1,246,780 tons, and Arizona again was first among the United States, as it has been since 1910. Over one-half of the State's total came from Pima and Pinal Counties, with Pima first in rank and Pinal a close second. Greenlee, Gila, Cochise, Mohave, and Yavapai, are the other important copper producing counties. Arizona's production of recoverable copper for the first half of 1965 has been 365,390 tons, according to reports of the U. S. Bureau of Mines. This equals an annual rate approximately 40,000 tons greater than in 1964 and indicates another all-time record year in 1965.

Consumer demand for copper was strong throughout the fiscal year. The London Metal Exchange price was equivalent to 59 cents in mid-September and the domestic producers raised to 34 cents, following increases by Chile, Africa and Canada. Strikes at all of the domestic operations of Kennecott Copper Corp. in the summer of 1964, at White Pine Copper Co. in September and October, short strikes in Chile and Africa, and a 4 months' strike at Mt. Isa, Australia, all increased the pressure for price increase. By March, the L.M.E. price reached 62-1/8 cents. The major producers fearing substitutions, held at 34 cents until May 5th when they raised to 36 cents. Dealer's prices averaged higher but fell off somewhat in the second quarter of 1965. At the end of the fiscal year demand for copper still was strong and appeared likely to be so for sometime.

Copper production at the Morenci mine of Phelps Dodge Corporation in 1964 also was an all-time record at 129,406 tons. This largest of Arizona's mines, with its new \$18,000,000 leach-precipitation-flotation project in operation for much of 1965, promises another record output this year. "The new system, developed by Phelps Dodge engineers, involves substantial changes in the concentrator, a sulphuric acid plant, a concentrate roasting plant, a precipitant manufacturing plant, additional lime capacity, and some additions and alterations to the power plant." It will recover non-sulphide copper and is expected to add 10,000 tons of copper to the normal year's production of the mine.

The New Cornelia Branch of Phelps Dodge at Ajo produced 70,818 tons of copper from a record 10,352,000 tons of ore milled. Relocation of the mine buildings and installation of four 3,000 KW gas-diesel generators was completed in the year.

Phelps Dodge also produced 74,033 tons of copper in 1964 from the Lavender Pit and underground mines of the Copper Queen Branch at Bisbee. This corporation's total production in Arizona in 1964 was 274,927 tons of copper, or 40 percent of the State's total.

The San Manuel Division of Magma Copper Company produced 92,588 tons of copper in 1964. Its average recovery was 14.88 pounds of copper per ton of ore mined. Construction of a primary crushing plant, additional mill grinding and flotation units, and a second reverberatory furnace at the smelter, included in a \$14,000,000 expansion project for about 12 percent additional capacity was practically completed in mid-1965.

The Magma mine at Superior again operated at a loss in 1964, but was operating on a profitable basis at the end of the year, and was expected to continue at a profitable level in 1965. Meanwhile an accelerated development program and study of a modernization program were to be carried on.

At the Ray Mines Division of Kennecott Copper Corporation, improved 1964 costs reflected more efficient operation following its modernization program. Stripping of ore east and south of the old town of Ray was continued through the year. A \$1,000,000 plant for recovery of molybdenite was started at Hayden in early 1965 and is scheduled for completion in 1966.

The major copper development in Arizona in 1964 was the start of operations at the new Mineral Park property of Duval Corporation in November. Operations up to mid-1965 have indicated that this \$28,000,000 project started in 1962, will have better than expected metallurgical performance in both the copper and molybdenum sections and a mill capacity well above the rated 12,000 tons of ore per day. Copper leaching facilities for oxide copper ores went into operation at Mineral Park early in 1965.

Duval's Esperanza property south of Tucson also improved its copper-molybdenum recovery process, with use of a new reagent. Stripping of the west extension ore at the Esperanza pit was continued.

Operations at the Mission and Silver Bell copper mines of American Smelting and Refining Company in Pima County, were at or near capacity in the fiscal year. At the Mission mine, a new plant for recovery of molybdenum and zinc minerals began operations in the latter part of 1964. The company's smelter at Hayden also operated at near-capacity.

Bagdad Copper Corporation announced late in 1964 that a \$4,000,000 plant to refine copper powder from acid solutions with use of hydrogen would be built at Bagdad by Arizona Chemcopper Co., owned jointly by Bagdad and Chemetals Corp. of New York City.

In mid-1965, Inspiration Consolidated Copper Company's program to increase the capacity of its Inspiration mine to 20,000 tons of oxide-sulphide ore per day was nearing completion. At its Christmas mine, "underground support problems had sharply reduced underground copper production." Mining methods

were being changed to allow more rapid extraction; and feasibility of limited open pit mining to increase mill feed and also provide more tailings for underground fill, was being investigated.

In April, 1965, Pima Mining Company decided to triple the production capacity at the Pima mine 22 miles south of Tucson, at a cost of approximately \$20,000,000. The planned facilities for handling 18,000 tons of ore per day are scheduled for completion in July, 1966. Utah Construction and Mining Co. started work on the project right after the decision was made.

Miami Copper Company's Copper Cities open pit mine has produced about the same amount of ore for the past several years, but since 1962, the amount of stripping has more than tripled in order to uncover ore found below the present pit towards the west. The company continued leaching operations at the Miami and Castle Dome mines.

Anaconda Copper Company started sinking a shaft at the Twin Buttes property, leased from Banner Mining Company in the third quarter of 1964. In March, 1965, it stopped sinking and started drifting on the 880 level from which sample material was to be taken for testing in the Banner Mill. Equipment was ordered for stripping overburden ranging from about 200 to 500 feet in thickness. The company announced plans for mine and plant at Twin Buttes with capacity of at least 15,000 tons of ore per day.

Late in the fiscal year, it was announced that Revere Copper and Brass, Inc., manufacturer of various metal products, had optioned the property of Zontelli Western Mining Company in the White Mesa district, near Page, where the Zontelli company has been leaching copper from its deposit of copper oxides and carbonates in sandstone.

Ranchers Exploration and Development Corporation of Albuquerque, New Mexico, resumed work at its Blue Bird mine near Miami in the latter part of 1964. New equipment was added and in the spring of 1965 it had built five leaching dumps. Shortage of water prevented capacity operation, but steady production was being shipped to a San Francisco concern for export to Japan.

A heap-leaching operation was started at the Emerald Isle mine between Kingman and Chloride in the fourth quarter of 1964, by C. G. Patterson. Production of cement copper continued through the balance of the fiscal year.

R. E. Chilson of Tucson, with McAlester Fuel Company of McAlester, Oklahoma, completed a drilling program at the Zonia mine near Kirkland Junction, Yavapai County, and reportedly found a substantial deposit of low-grade oxide copper ore. Three leaching tanks were completed and operations begun in June, 1965.

Continental Materials Corporation of Chicago announced in October, 1964 that its drilling program at the CWT mine (its Helmet Peak project) south of Tucson, had indicated over a million tons of copper-zinc ore. In February, 1965, a 3-compartment shaft was started, using a Cryderman mucker. The planned depth was 975 feet. Steel shaft sets with lagging, or concrete where needed, were used. At mid-1965, size of operation and mill design were being studied and an operating company called Continental Exploration, Inc. with offices at Tucson, had been formed.

Open pit leaching operations at the Mineral Hill mine northeast of Parker stopped in the latter part of 1964 and the property was stripped of equipment by the end of that year.

Bob Burney mined a small tonnage of ore from Childs-Aldwinkle mine at Copper Creek and treated it in the mill at Mammoth. In January, 1965, he began to separate and market molybdenite concentrate.

Copper exploration in Arizona continued at a high level throughout the fiscal year. Probably well over 60 companies or groups were in the field, most of them in the Tucson area. However, it was estimated that exploratory drilling in May, 1965 was off about 25 percent from the 1964 rate. Among the many areas in which exploration work was done in 1964-65, were: Pima County - Mineral Hill, Twin Buttes, Helvetia, Empire, Silver Bell, Sierrita, Quijotoa; Pinal - Mineral Hill, Casa Grande, Vekol, Superior, Owl Head, Bunker Hill; Yavapai - Humbug, Mayer, Black Hills, Bagdad, Kirkland; Cochise - Dos Cabezas, Johnson, Pearce, Lone Star, Willcox area; Yuma - Ellsworth, Bouse, Cemetery Ridge, Cienega, Dome Rock, Plomosa; Mohave - Wallapai, Mineral Park, Cedar Valley, Hualpai Mts.; Santa Cruz - Harshaw, Palmetto, Duquesne; Gila - Miami, Globe, Summit; Graham - Safford and Greenlee - Metcalf.

Siliceous fluxing ores for copper smelters were produced at the Orizaba, Pico 1-3, Freeman Lease, Tiger and Del Oro Mines, Pinal County; Sheridan Anderson and Ballesteros Mines, Pima County; Nancy # 2 and Burro Mines, Cochise County; Commerical Mine, Yavapai County; Copper Hill Mine, Gila County; Brick Mine, Santa Cruz County; Red Rover Mine, Maricopa County; Metate Mine, Yuma County; and others.

The largest mineral patent for multiple lode claims ever granted was issued for 118 claims northeast of Safford to Phelps Dodge Corporation.

LEAD - ZINC

The price of pig lead, f.o.b. New York, rose from 13 to 14 cents per pound in late August, to 15 cents in mid-October, and to 16 cents in mid-December, where it remained for the balance of the fiscal year. Lead was in short supply at the end of the year.

Prime Western zinc, St. Louis basis, rose from 13-1/2 to 14 -1/2 cents per pound in mid-October, and held there for the balance of the fiscal year. Stocks were short at the end of the year but there were prospects of greater supply. Stockpile releases were being considered.

Lead production in Arizona in 1964 was 6,147 tons, 6 percent above 1963 and zinc production was 24,690 tons, 3 percent below 1963.

Iron King mine of Shattuck-Denn Mining Corporation, in Yavapai County, produced 75 percent of the lead and 57 percent of the zinc output of the state. It is one of the Nation's leading producers of lead-zinc, and also of gold and silver.

Cyprus Mines Corporation, early in 1965, was running the mill at its Old Dick zinc-copper property near Bagdad on about two-thirds Old Dick mine and one-third adjacent Copper Queen mine ores. At the time, it was expected that around mid-year, work would be largely exploratory.

E. W. McFarland operated the Hardshell mine and Trench mill in Santa Cruz County until the spring of 1965. He started dewatering the Trench and January mines, near by, in late 1964, and for a time in the spring, ore from the January was the feed for the Trench mill. Finally, after more than a decade of small mine operation in the area, he closed the Trench mill and started preparations to move to a prior copper operation in Pinal County.

The Atlas mine and mill of the B. S. & K. Mining Co., near Silver Bell, shut down in the latter part of 1964. It was one of the three Arizona producers of important quantities of zinc.

The Indiana-Arizona mine, also near Silver Bell, operated by the Waterman Mountain Mining Co., produced some lead-zinc ores in the latter part of 1964 and the first part of 1965.

The Indiana mine, in the Duquesne property, Patagonia District, Santa Cruz County, produced complex ore intermittently. The Duquesne property reportedly was purchased in late 1964 by Carl Sandberg of Tucson, and Fred Williams, Jr. of Indianapolis.

Arivaca Mining Company leased the Glove mine east of Amado, Santa Cruz County, and started mining in December, 1964. The lead-silver ore was shipped to the El Paso smelter. The Cerro Colorado mill, in which the company had installed added equipment operated at a rate of about 40 tons per shift on ore from the Arizona mine.

Some lead-silver ore was shipped from the Ora Fina mine about 20 miles south of Prescott, by Robert and Leonard Manifee.

Lead-zinc-silver exploration was reported in the Cerro Colorado, Martinez Canyon, Mineral Hill and Silver Bell districts, Pinal County; Wallapai, Signal and Chloride districts, Mohave County; Harshaw and Patagonia districts, Santa Cruz County; Big Bug and Bagdad districts, Yavapai County; Banner district, Gila County; Silver Bell, Twin Buttes and Helvetia districts, Pima County; Plomosa and Castle Dome districts, Yuma County; and in other districts of the state.

GOLD - SILVER - MOLYBDENUM

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

Gold

Arizona's gold mines were closed by executive order and have remained so. In spite of dwindling gold reserves and continuing adverse "balance of payments",

the Treasury continues to oppose all measures which might allow the gold miners to resume needed production, for the stated reason that any of them might upset the monetary situation.

In 1964 increase of 7 percent in both quantity and value of gold production, came from increased by-product gold from the Arizona copper mines. A few ounces were produced at placers in Yuma and Yavapai Counties, and possibly others; and some exploration work was reported in the Oatman and Goldfield districts of Mohave and Maricopa Counties. Small amounts of gold bearing **quartz** and larger amounts of silica flux carrying a little gold, were shipped to the copper smelters, but the Copper Queen, New Cornelia, San Manuel and Magma copper mines and the Iron King lead-zinc mine, are the ones that lead the State, and ranked among the top 20 in the United States, in gold production.

Silver

Treasury sales held the price of silver at the monetary figure of \$1.293. Legislation to eliminate silver from dimes and quarters and to reduce the silver content in half dollars to 40 percent was introduced in June, 1965 to enable the Treasury to hold the price level indefinitely. Loans by the Office of Mineral Exploration for silver exploration were raised from 50 to 75 percent of estimated cost of approved projects, in October, 1964.

Lyman Wall and Sons at the Linda Group and James W. Wright at the Ruby No. 2 Group, both in the Castle Dome District, Yuma County, shipped silver ores and concentrates intermittently. Metallurgical research on ores and tailings from the Commonwealth mine at Pearce, Cochise County, was continued. Silver exploration was reported in the Castle Dome district, Yuma County, Cerro Colorado and Quijotoa districts, Pima County; and Chloride district, Mohave County; and others.

Silver interest and exploration declined somewhat in the fiscal year.

Arizona's silver production in 1964 was up 8 percent in quantity and 9 percent in value above that in 1963.

Molybdenum

Arizona produced 9.8 percent of the domestic molybdenum in 1964. The quantity produced was 6,296,000 pounds, up 11.4 percent from 1963. Practically all of it came from the following copper mines: San Manuel, Mineral Park, Esperanza, Silver Bell, Inspiration, Morenci, Bagdad and Mission. The value of the 1964 production was \$9,532,000, 26 percent higher than in 1963.

The by-products plant for recovery of molybdenum and other minerals, started at the Mission mine in February, 1964 went into operation in October, 1964.

URANIUM - VANADIUM

Uranium

Arizona's production of uranium in 1964 was 102,258 tons valued at \$3,253,000. This is 32 percent in quantity and 33 percent in value below 1963. The Orphan

mine of Western Equities, Inc., at Grand Canyon, continued to be the major producer, and the chief source of feed for the Tuba City plant operated by El Paso Natural Gas Company's Mining Division.

Vanadium

Uranium plants outside of Arizona extracted vanadium valued at \$575,000 from ores from the Four Corners area in 1964.

IRON

The U. S. Bureau of Mines has reported 1964 production of 4,000 long tons of usable Arizona iron ore valued at \$32,000. This is an increase from 1963. Arizona Gypsum Co. shipped usable iron ore from the Seligman area and the Black Hills Mining Co. shipped some magnetite concentrates from the Omega property south of Florence. Both shipped to Kennecott's sponge iron plant at Hayden.

Colorado Fuel and Iron Co. took a second lease on iron findings in the northwest corner of the Fort Apache Indian Reservation in late 1964, and started preparations for shipment of ore from its explored area to its plant at Pueblo, Colorado for blast furnace testing. The first step was a trucking road from Young to the property.

Archean Iron Co. in mid-1964, signed an exploration loan contract with the Office of Mineral Exploration, for work between Young and the area explored by Colorado Fuel and Iron Co. The contract was for 10,850 feet of drilling estimated to cost \$94,050, of which the Government participation was to be 50 percent.

Cox and Alder of Sells put in some mill equipment for treating magnetite sands near Nolia, Pima County, but produced no concentrates in the fiscal year.

Further exploration of magnetite sands about 20 miles south of Aguila in the Big Horn district, Maricopa County, was reported.

MERCURY

The price of mercury increased about 50 percent in 1963-64, but in 1964-65 it zoomed from \$270 per 76-lb flask on July 1, 1964 to \$725 on June 30, 1965. Interest in Arizona mercury properties followed a less upward trend and production increase was small.

Chief interest was in the Sunflower district, Gila and Maricopa Counties. J.A. Bacon and W. Brunson operated the Gould furnace at the Pine Mt. mine intermittently with a yield of about 1.5 flasks per day. Frank K. Thompson began operations at the Mercuria mine in early 1965 and produced about 1.5 flasks per week. Early in 1965, Wells Cargo, Inc. leased and optioned the National mine and began a program of drilling, stripping and retort alteration. Open pit operation and retorting were under study near mid-1965, with early production anticipated. A short run was made on the Indian Maid claim of the Ord Group in early 1965.

MANGANESE - BERYLLIUM

No production in Arizona was reported in the fiscal year.

Aero Space Mineral, Inc. and United Nuclear Corp. were reported to have done some exploratory drilling for beryllium near Young.

NON-METALLIC MINERALS

The several major companies exploring for potash in the Holbrook-St. Johns area in 1963-64, continued such work in the 1964-65 fiscal year. Duval Corp. has reported occurrence of large quantities of potash of undetermined commerciability in this evaporite basin of Apache-Navajo County.

Jaquays Mining Corp. operated its asbestos mill at Globe at near capacity on ores from its Regal and Chrysotile mines. Principal shipments were of filter grade. Tailings were shipped for use as a moisture retardant in cement.

Metate Asbestos Corp. announced that on or after December 1, 1964, it would produce exclusively for Johns-Manville Corp. The Metate mill at Globe operated intermittently in the fiscal year.

R. C. Town produced asbestos ores from the Phillips mine owned by Mrs. Guy Phillips, and processed them at the "Town" mill at Globe. His operations were intermittent and shipments were mostly of filter fiber.

1964 sand and gravel production was up 20 percent in quantity and 44 percent in value. Pumice output increased 10 percent in quantity but was off 13 percent in value from 1963. Lime production dropped 2 percent in quantity and 39 percent in value.

again
Perlite production in 1964 from the Superior area/set a new high. Improvements at the Superior property of Harborlite Corp. nearly doubled its rate of production. Arizona production of cement, gypsum, and clays, also increased in 1964.

Marble producers suffered from decline in residential building, especially in the Tucson area, where the Marble Top, Sierrita and White Hope marble quarries and plants went down in the fiscal year. Production of stone was up 15 percent in quantity and 24 percent in value in 1964. Quarries yielding special building stone enjoyed similar increase.

A few cars of zeolite ores were shipped from the Willcox and San Simon districts. Arizona Gypsum Co. removed its mill from the Whitecliffs diatomite mine near San Manuel, in the fall of 1964, and the mine remained idle, due to litigation involving sub-lessees.

Production of helium gas was up 20 percent in 1964. The U. S. Bureau of Mines reported production of 35 million cubic feet by the Kerr-McGee Oil Industries, Inc. plant from its owned or controlled resources in the Pinta Dome field in Apache County.

Mineral Fuels

Drilling for oil and gas in Arizona, more than doubled in 1964. One producing gas well resulted. Natural gas production was up 52 percent and petroleum production was up 17 percent in the year. No coal production was reported, but coal exploration was active in the Black Mesa field in the Hopi-Navajo and Navajo Indian Reservation and also somewhat so in the Hopi Reservation. The value of mineral fuels produced in 1964 was \$1,796,000.

Arizona's nonmetallic mineral production in 1964 was valued at \$47.2 million, or 9 percent of Arizona's total mineral production value. The total value of nonmetallic minerals was about 17 percent above that for 1963.

DEPARTMENT ACTIVITIES

Laws, regulations and administrative procedures with bearing on mineral rights in the public domain, received increasing attention by the Administration, the Congress, and others, including the department. The Wilderness Bill was enacted in September, 1964, and after amendments, including extension of existing mineral rights in the areas to the end of 1983. Also enacted in the same month were a bill authorizing the establishment of a 19-member Public Land Law Review Commission; a related interim bill providing for classification and multiple use management of public lands; and another related bill providing for sale of lands classified as needed for certain public or industrial uses. The director testified at a public hearing on proposed regulations to implement these three bills, by the Department of Interior, in April, 1965.

The director participated with representatives of state and federal land agencies, in a panel discussion of mining law, at the annual meeting of the Arizona Cattle Growers Association in December, 1964. He spoke before conservation classes at Arizona State College and Arizona State University; gave a paper on the subject, Mine Safety for the Small Miner and Short Term Operator, at the September, 1964 meeting of the American Mining Congress; was a state member of the program committee for its western meeting in 1965; was appointed chairman, Open Pit Section, Mining and Exploration Division, Society of Mining Engineers for 1965-66; was chairman of the budget and advisory committees of the Maricopa Subsection, A.I.M.E. for a joint meeting of the S.M.E. and the Rocky Mountain Mineral Conference to be held in October, 1965, which the Subsection is sponsoring; and attended meetings of the Colorado Mining Association at Denver, the Arizona Section, A.I.M.E. and its Subsections at Tucson, and numerous meetings of the Maricopa Subsection at Phoenix and of Councils of the Arizona Small Mine Operators' Association, at which various mining matters were discussed.

The assistant to director wrote a number of papers on mining subjects for newspapers, magazines and other publicity purposes and spoke on mining before the Maricopa Subsection, the Phoenix and Tucson Councils of A.S.M.O.A., the Central Arizona Project Association, Operation L.E.A.P., and other organizations in the Phoenix area. He worked with the Mining Claims Review Committee of the Tucson Council, A.S.M.O.A., on matters relating to the Council's sponsorship and direction of questioning of a panel composed of regional officials of the U. S. Forest Service and the U. S. Bureau of Land

Management. The questions related to the administration and interpretation of the mining laws. He also did much of the publicity work for the meeting. He attended and reported on the Department of the Interior hearings at Phoenix on public land regulations, and attended meetings of the Maricopa and Tucson Subsections, A.I.M.E. and the 8th Annual Arizona Watershed Symposium. He was elected secretary of the Maricopa Subsection, A.I.M.E. and was a member of its Publicity Committee for the joint SME - RMMC meeting to be held in October 1965. He worked with the Pioneer Arizona Foundation in the setting up of a mining exhibit at the 1964 State Fair.

Department assistance was given to state agencies on mining questions relating to property tax study, welfare, park areas, rights-of-way, industry development, economic research, employment and state lands; to Federal agencies concerned with public lands, mining statistics, loans, old mine workings for bomb-proof shelters, mines which might benefit from atomic blasting as developed by Project Plowshare, and area use and development; and to the many companies, private agencies, and individuals in and out of state, seeking mining information. Among them were most of the more than 50 exploration teams of well known companies, at work in Arizona during the fiscal year searching for new commercial mineral deposits.

Publications

The following statistical reports were sent to a mailing list of legislators, companies, agencies, banks, newspapers, libraries and individuals; and upon request:

Copper Industry - Statistics for 1963 Compared with Other Years.

Lead and Zinc Industry - Statistics for 1963 Compared with Other Years.

The Gold and Silver Industries in the World - United States and Arizona - Salient Statistics Year 1963.

Mine Taxation in Arizona - Statistical Analysis for Year 1964.

Preliminary Estimate of Copper, Lead, Zinc, Gold and Silver Production In Arizona and the United States in 1964.

Review of Copper Industry in 1964.

Inventory of Arizona Lands As Of June, 1964.

Arizona Wage Statistics and Copper Output - Base Period 1947-1949 Compared with 1962-64.

Other statistics pertaining to mining were given upon request to people in the above categories.

The department booklet, Laws and Regulations Governing Mineral Rights in Arizona, by Victor H. Verity, was revised and republished as a 6th Edition.

The following papers were compiled and mimeographed for distribution:

Active Mine List, October, 1964
Active Mine List, April, 1965
Policies of Arizona Mining Companies Relating to Visitors
Directory of State and Federal Agencies in Arizona of Interest to Mining.

Information and Other Services

The department's files, maps and library on mining properties and mining; are in constant use, and information is perhaps the department's most important service. At least one field engineer is scheduled to be present each working day at the Phoenix office for consultation, and much of the time one is at the Tucson office. The engineers also are at announced places at announced dates during the year. The administrative assistant is available for consultation on public land matters.

During the fiscal year, the field engineers traveled 28,117 miles, attended 132 meetings of the Arizona Small Mine Operators Association, made 290 mine visits and discussed mining problems with individuals on 1864 other occasions - 368 in the field, 815 in the office and 681 by telephone. They also answered 225 mail inquiries. Their miscellaneous services included: Chairman and program committee chairman of Phoenix Council, A.S.M.O.A.; and member of Mining Law Review Committee, Tucson, Council, A.S.M.O.A.

There were 2084 visitors and 5294 telephone calls to the department during the fiscal year. Respective figures for 1963-64 were 1627 and 4535.

Mineral Museum

There were approximately 7,800 visitors to the Mineral Museum exclusive of an estimated 64,300 visitors during the State Fair. Special visits for 2297 school children (more than double the number in 1963) and special meetings with 1854 total attendance were held in the Mineral Building. The Museum curator answered 953 inquiries and sent out 524 specimen kits to school children.

Receipts and Expenditures - 1964-65.

APPROPRIATION		\$ 85,529.00
EXPENDITURES:		
Personal Services	\$ 59,924.00	
Professional Services	7,500.00	
Travel - State	5,633.99	
Travel - Out of State	735.85	
Current Expenditures:		
Utilities	1,363.32	
Telephone	1,362.72	
Postage	1,127.50	
Bldg & Equip. Mtnce.	1,054.84	
Printing	1,190.54	
Supplies: Office, etc.	1,886.11	
Fixed Charges	262.70	
Subscription & Organization Dues	181.81	
Capital Outlay	995.32	
TOTAL EXPENDITURES		\$ 83,218.70
Balance - Returned to General Fund		2,310.30
		<u>\$ 85,529.00</u>

DEPARTMENT OF MINERAL RESOURCES

STATE OF ARIZONA

BOARD OF GOVERNORS

Charles F. Willis, Phoenix - Chairman
(term expires January 31, 1966)

Stanley M. Secrist, Tucson
(term expired January 31, 1965)

Raymond L. Dye, Kingman
(term expires January 31, 1968)

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

Matt Danenhauer, Clifton
(term expires January 31, 1967)

PERSONNEL

Frank P. Knight	Director
E. H. Peplow, Jr.	Assistant to Director
Axel L. Johnson	Field Engineer - Southern District
Gerald W. Irvin (Successor as of June, 1965)	
Lewis A. Smith	Field Engineer - Central District
Ernest G. Williams	Field Engineer - Northern District
Fremont T. Johnson (Successor as of May, 1965)	
Mrs. Glenn W. Pare-Administrative Assistant	
Mrs. Pauline Halloren - Secretary	
Mrs. Ray E. Sparkes - Secretary	
Frank J. Tuck	Consultant

OFFICES

Mineral Building, State Fairgrounds, Phoenix
(Main Office)
State Office Building, Tucson

MINERAL MUSEUM, Mineral Building - Phoenix

Lee Hammons, Curator.

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 five principal metals in 1964, as reported by the United States Bureau of Mines were as follows:

690,988 tons copper	@	32.6 ¢/lb	\$ 450,524,000
6,147 tons lead	@	13.1 ¢/lb	1,611,000
24,690 tons zinc	@	13.6 ¢/lb	6,716,000
153,676 ozs. gold	@	\$35.00 /oz	5,379,000
5,811,000 ozs. silver	@	\$1.293 /oz	<u>7,513,000</u>
			<u>\$ 471,743,000</u>

This compares with the following final figures for 1963:

660,977 tons copper	@	30.8 ¢/lb	\$ 407,162,000
5,815 tons lead	@	10.8 ¢/lb	1,256,000
25,419 tons zinc	@	11.5 ¢/lb	5,846,000
140,030 ozs. gold	@	\$35.00 /oz	4,901,000
5,373,058 ozs. silver	@	\$1.2792/oz	<u>6,873,000</u>
			<u>\$ 426,038,000</u>

TABLE II

MINERAL PRODUCTION OF LARGE AND SMALL PRODUCERS IN ARIZONA IN 1964^{1/}

Source: U.S. Bureau of Mines Area Report for Arizona, 1964

LARGE COPPER PRODUCERS:*		PRODUCTION	VALUE
Copper	. . . . . lbs.	1,375,878,901	\$ 448,536,521
Gold	. . . . . ozs.	133, 983	4,689,405
Silver	. . . . . ozs.	4,915,362	6,355,563
Molybdenum (in concentrates)	. . . lbs.	6,296,000	9,532,000
			\$ 469,113,489
SMALL MINERAL PRODUCERS:			
Clays ^{3/}	. . . . . short tons	168,000	\$ 213,000
Copper ^{2/}	. . . . . lbs.	6,098,000	1,987,479
Diatomite	. . . . . short tons	450	16,000
Gem Stones	. . . . .	^{4/}	120,000
Gold ^{2/}	. . . . . troy ozs.	19,693	689,595
Gypsum	. . . . . short tons	147,000	770,000
Iron Ore (usable)	. . . . . long tons	4,000	32,000
Lead ^{2/}	. . . . . short tons	6,147	1,611,000
Lime	. . . . . short tons	177,000	2,920,000
Mercury	. . . . . 76-lb. flasks	77	24,000
Natural Gas	. . . . . cubic feet	2,025,000,000	241,000
Petroleum (crude)	. . . 42-gallon barrels	64,000	^{5/}
Pumice	. . . . . short tons	880,000	1,635,000
Sand-Gravel	. . . . . short tons	18,116,000	20,868,000
Silver ^{2/}	. . . . . troy ozs	895,638	1,157,437
Stone	. . . . . short tons	3,759,000	6,283,000
Tungsten concentrate (60% WO ₃)	. short tons	16	17,000
Uranium Ore	. . . . . short tons	102,258	3,253,000
Vanadium	. . . . . short tons	^{5/}	575,000
Zinc	. . . . . short tons	24,690	6,716,000

Value of items that cannot be disclosed: asbestos, cement, clays (bentonite & fire clay) feldspar, helium, mica (scrap), perlite, pyrites, and values indicated by footnote ^{5/}.

TOTAL - Small producers

TOTAL - All producers

Percentage due to small mines

^{6/} 16,122,000
 \$ 65,251,000
 \$ 534,364,000
 12.2%

^{1/} Production as measured by mine shipments, sales or marketable production (including consumption by producers).

^{2/} Recoverable content of ores, etc.

^{3/} Excludes bentonite and fire clay; included with "Value of items that cannot be disclosed."

^{4/} Weight not recorded.

^{5/} Figure withheld to avoid disclosing individual company confidential data.

^{6/} Value of mineral fuels, \$1,796,000; value of non metals, \$14,326,000.

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

TABLE III

ARIZONA'S METAL PRODUCTION
Source: U.S. Bureau of Mines

	GOLD ozs.	SILVER ozs.	COPPER lbs.	LEAD lbs.	ZINC lbs.	TOTAL VALUE
1955	127,616	4,634,179	908,210,000	19,634,000	45,368,000	\$ 355,928,786
1956	146,110	5,179,185	1,011,816,000	23,998,000	51,160,000	450,599,680
1957	152,449	5,279,323	1,031,708,000	24,882,000	67,810,000	332,081,963
1958	142,979	4,684,580	971,678,000	23,780,000	57,064,000	273,398,148
1959	124,627	3,898,336	860,594,000	19,998,000	74,650,000	282,977,000
1960	143,064	4,774,992	1,077,210,000	16,990,000	71,622,000	366,340,000
1961	145,959	5,120,007	1,174,106,000	11,874,000	59,170,000	370,101,000
1962	137,207	5,453,585	1,288,484,000	13,932,000	65,776,000	416,418,000
1963	140,030	5,373,058	1,321,954,000	11,630,000	50,838,000	426,038,000
1964	153,676	5,810,510	1,381,976,000	12,294,000	49,380,000	471,743,000

TABLE IV

RELATIVE 1964 PRODUCTION

	U.S.	ARIZONA			LEADING STATE	
			% of U.S.	Rank in U.S.		
Gold -ozs.	1,456,308	153,676	10.6	3rd	South Dakota	616,913
Silver -ozs	36,334,000	5,810,510	16.0	2nd	Idaho	16,483,000
Copper-tons	1,246,780	690,988	55.4	1st	Arizona	690,988
Lead -tons	286,010	6,147	2.1	5th	Missouri	120,148
Zinc -tons	574,858	24,690	4.3	11th	Tennessee	115,943

TABLE V
COPPER, GOLD, SILVER AND MOLYBDENUM RECOVERED
FROM MINES IN ARIZONA IN 1962, 1963, and 1964.

Source: U. S. Bureau of Mines Area Reports.

	1962	1963	1964
Tons copper concentrating and leaching ore mined	78,436,804	80,615,132	86,132,039
% Copper in ore (estimated)	0.89	0.90	0.88
Tons direct smelting copper ore	431,263	468,210	422,903
% Copper in ore (estimated)	4.20	3.79	3.78
TOTAL TONS COPPER ORE MINED	78,868,147	81,083,342	86,555,942
Ozs. gold recovered from all copper ores mined	117,362	121,177	133,983
Ozs. silver recovered from all copper ores mined	4,571,370	4,494,239	4,915,362
Lbs. molybdenum recovered from all copper ores mined	4,412,000	5,553,000	6,296,000
Lbs. copper recovered from all copper ores mined including all clean-up	1,201,172,000	1,226,472,100	1,280,272,100
Lbs. copper recovered from mine waters	<u>73,215,900</u>	<u>91,149,000</u>	<u>90,800,800</u>
TOTAL LBS. COPPER RECOVERED FROM ALL COPPER MINES	1,274,387,900	1,317,621,100	1,371,072,900
TOTAL LBS. COPPER RECOVERED FROM ALL OTHER MINES	<u>14,096,100</u>	<u>4,332,900</u>	<u>10,903,100</u>
GRAND TOTAL LBS. COPPER RECOVERED FROM ALL MINES	1,288,484,000	1,321,954,000	1,381,976,000

TABLE VI
ACTIVE MINES IN ARIZONA

<u>Mines</u>	<u>During 1964 *</u>	<u>April 1964 **</u>	<u>April 1965 **</u>
Copper	39	34	29
Copper, with lead or zinc	3	5	6
Lead and/or Zinc	<u>14</u>	<u>10</u>	<u>6</u>
Sub-total	<u>56</u>	<u>49</u>	<u>41</u>
Dry gold lode	6	1	-
Dry gold-silver lode	5	-	-
Dry silver lode (Ag-Pb)	<u>11</u>	<u>3</u>	<u>4</u>
Sub -total	<u>22</u>	<u>4</u>	<u>4</u>
Gold placer	1	1	2
Uranium		12	11
Mercury		-	2
Silica (with or without metal content) . .		6	12
Asbestos		3	4
Gypsum		3	4
Lime, limestone, cement		6	5
Marble		7	4
Perlite		2	2
Bentonite		1	1
Mica		1	2
Diatomaceous earth		1	-
Feldspar		1	1
Iron ore or concentrate		1	-
Sand, rock, stone, clay	<u> </u>	<u>Listing incomplete</u>	
Totals	79	98	95

* Source: U. S. Bureau of Mines

** Source: Department of Mineral Resources Lists