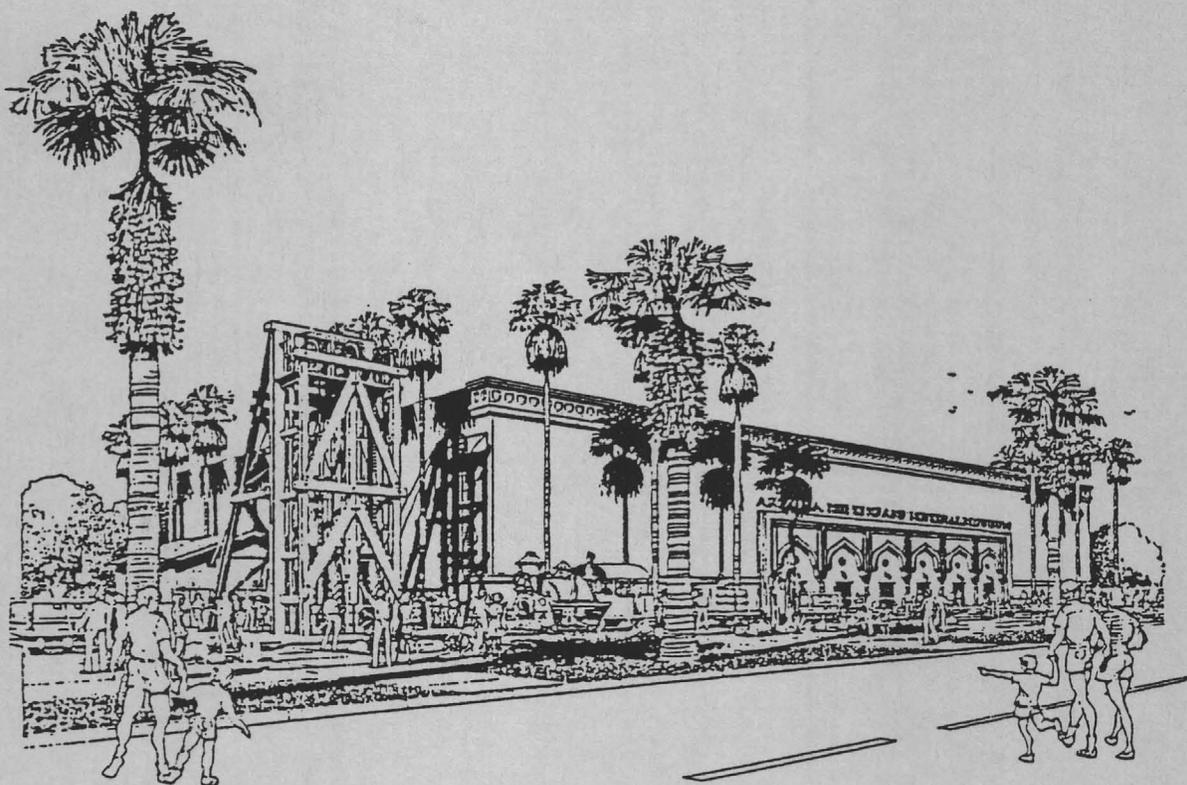


STATE OF ARIZONA
DEPARTMENT OF MINES AND
MINERAL RESOURCES



53rd Annual Report
1991 - 92



STATE OF ARIZONA
DEPARTMENT OF MINES AND MINERAL RESOURCES
ARIZONA MINING AND MINERAL MUSEUM

Phone (602) 255-3791 1-800-446-4259 (IN ARIZONA ONLY)
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August 15, 1992

Fife Symington, Governor
State of Arizona
1700 West Washington
Phoenix, Arizona 85007

Dear Governor Symington:

The Annual Report of the Arizona Department of Mines and Mineral Resources is submitted to you in compliance with A.R.S. Section 27-106.

The Department of Mines and Mineral Resources has the statutory obligation to promote the development of mineral resources in the state. The attached report is a summary of past efforts, especially for the fiscal year of 1992, to accomplish that task. The report also establishes realistic goals for the future and provides a plan to reach those goals. In deference to the severe fiscal problems being experienced by state government, those plans do not include any requests for additional funding or growth in full-time staff during fiscal years of 1993 and 1994. Instead, it is the intent of the department to rely on volunteers and donations from the private sector to fill the gap between the near skeleton staff of the department and what we believe is absolutely necessary to fulfill the obligations assigned to us. Much is needed to make a world class institution of which everyone in Arizona will be proud. We have faith that the plan, along with a lot of hard work, will make it so.

During the past year the DMMR including the Mining and Mineral Museum was moved to the newly renovated El Zaribah Shrine Auditorium at 1502 West Washington on the Government Mall. The building was renamed and dedicated "The Polly Rosenbaum Building" on May 4, 1992.

Because of continued budget constraints, the Tucson field office of DMMR was closed on April 30, 1992. The budget offices of both the administration and the legislature recommended that the mining engineer position that occupied the office be eliminated. Funding to pay that salary and operate the office was not appropriated for fiscal year 1993.

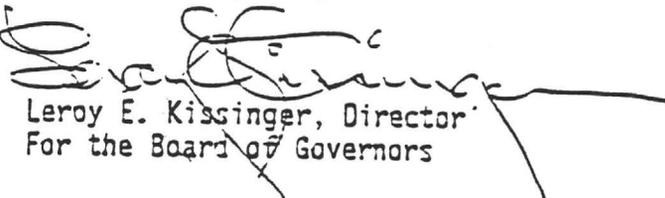
Arizona was second in the nation during 1991 in the production of non-fuel minerals with approximately \$3.1 billion in value. The state benefited directly from this activity with over \$100 million in direct taxes, a payroll of over \$400 million, and, when combined with the support industries activity, made a \$6 billion contribution to the overall economy of Arizona.

Most important of all, Arizona's mining industry produces a significant portion of metals (especially copper) and industrial minerals that are absolutely necessary for our civilization to continue to exist. It is critical that the State of Arizona maintain a positive attitude toward the development of new mining projects. Land use planning and environmental regulation must be done in a reasoned and reasonable way to assure that access to the storehouse of minerals in the state remains viable.

DMMR continues to develop an extensive minerals education-program to reach students and their teachers all over Maricopa County. Details of new programs are included in the report.

Mining must be an important part of any plan for a renewal of growth in Arizona. No other industry produces so much for so many. DMMR is a vital component of that effort.

Respectfully yours,



Leroy E. Kissinger, Director
For the Board of Governors

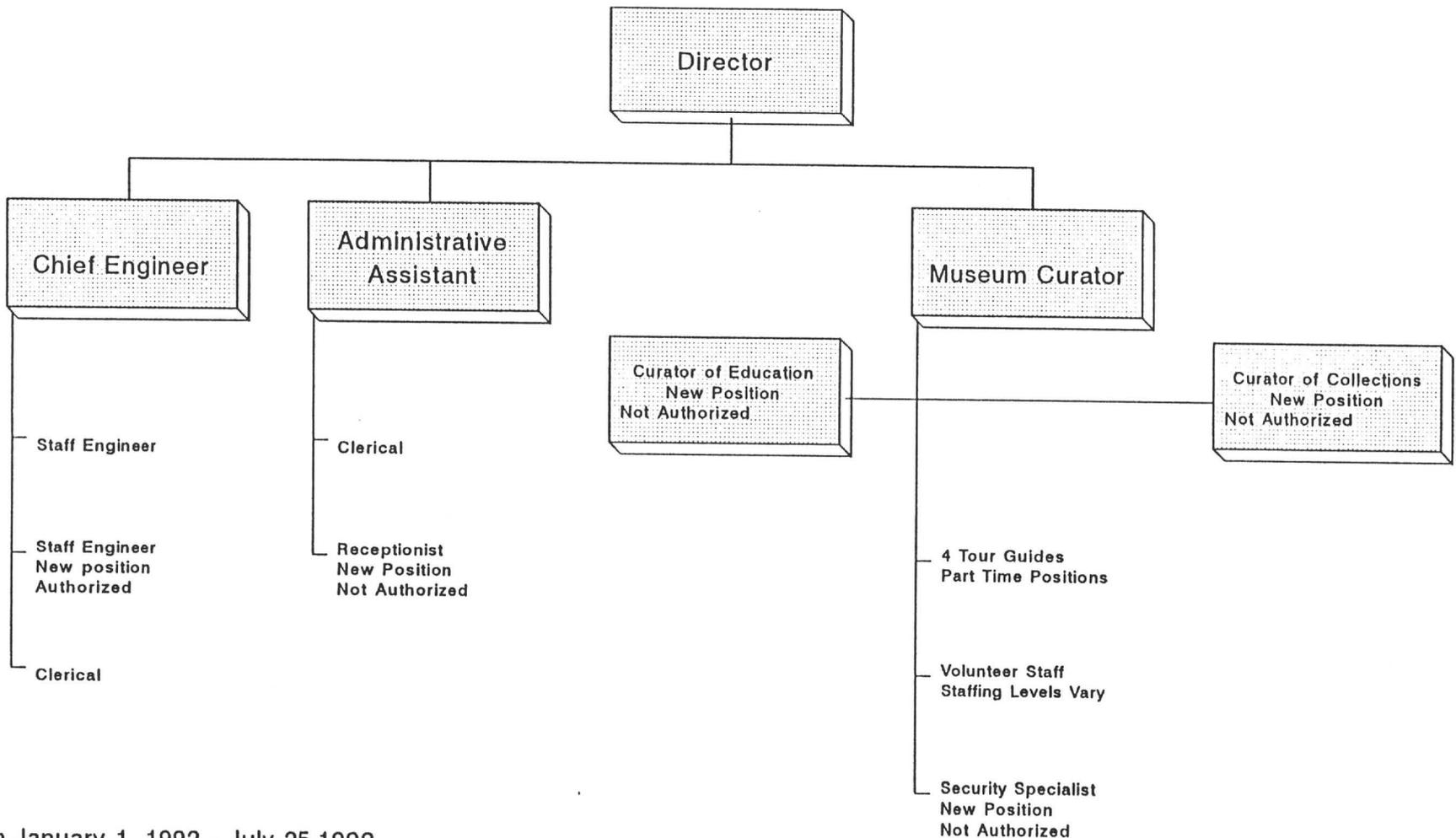
STATE OF ARIZONA
DEPARTMENT OF MINES & MINERAL RESOURCES

ANNUAL REPORT

FISCAL YEAR 1991-92

Arizona Department of Mines and Mineral Resources

Organization Chart



Between January 1, 1992 - July 25, 1992
The Volunteer Staff donated 3,710 Hours

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BOARD OF GOVERNORS

Roy Miller - Phoenix
Chairman
Term Expires 1/31/97

Edna Vinck - Globe
Vice Chairman
Term Expires 1/31/94

Clifford B. Altfeld - Tucson
Member
Term Expires 1/31/95

Doug Lindsay, Sr. - Phoenix
Secretary
Term Expires 1/31/93

Ken Bennett - Phoenix
Member
Term Expires 1/31/96

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Leroy E. Kissinger, Director
Ken A. Phillips, Chief Engineer
Glenn A. Miller, Museum
Nyal J. Niemuth, Engineer
Ann Turney, Administrative Assistant
Diane Bain, Secretary
Marianne Charnauskas, Secretary
Alice Rosenfeld, Museum Tour Guide
Joseph McIntosh, Museum Tour Guide
Les Wagner, Museum Tour Guide
Jeff Scovil, Museum Tour Guide

FINANCIAL STATEMENT

Appropriation	\$339,000
Expenditures	338,970
Reverted	30

MINES AND MINERAL RESOURCES FUND

Income	
Balance Forward	4,984
Donation Box Receipts	990
Donations (Other)	3,270
Donations Galleries	20,525
Museum Store Sales	25,751
Total Income	\$55,520
Expenses	
Personal Services	\$14,188
Employee Related Expenses	1,249
Resale Merchandise	10,036
Store Expenses	167
Museum Expenses	5,029
Gallery Expenses	20,500
Total Expenses	\$51,169
Balance Forward 7/1/92	\$4,351

PRINTING REVOLVING FUND

Balance Forward	\$ 3,183
Publications Sales	10,521
Publication Expenses	10,048
Balance Forward 7/1/92	\$ 3,656

THE DEPARTMENT OF MINES AND MINERAL RESOURCES

STATUTORY ASSIGNMENT

The Arizona Department of Mines and Mineral Resources is authorized by A.R.S. Section 27-101 to 27-111 to promote the development of the mineral resources of this state through technical and educational processes including field investigations, public seminars, forums, publications, public news media and other functions necessary to achieve its objectives.

IMPLEMENTATION OF ASSIGNMENT

Mineral Resource Information Center - The department maintains the most comprehensive set of files and library information on Arizona mining that is available anywhere. The information spans the period from the earliest activity in the mid-nineteenth century to the present day. The files are kept up to date with current information as it becomes available. The information is used to assist prospectors, mining companies, rockhounds, mineral collectors, educators and the general public in their efforts to locate and utilize the products that are made possible by this industry. The engineering staff is able to provide technical assistance in general mining and processing of minerals for those who need it.

The department provides a wide range of assistance on mining, processing, environmental effects and mitigation of those effects, in addition to information on other technical matters related to mining for the Governor's office, the State Legislature, and other city, county, state and federal agencies.

Mining and Mineral Museum - The department operates the State of Arizona Mining and Mineral Museum. The museum is the official repository for the identification, cataloging and displaying of mineral specimens, ores, gemstones and lapidary material found in the state. The museum also operates a small gift shop for the sale of mineral specimens, jewelry made from minerals, and publications related to minerals. The museum conducts classes and tours for students and teachers from Arizona's schools as a part of the effort to educate the public about the presence and uses of minerals in the state.

DEPARTMENT ACTIVITY

Introduction - The following is a general description of how the staff of the department accomplishes the task of "promoting the development of mineral resources". The projects that are underway mesh with the list of contacts with the mining industry itemized in the "Industry Activity" section of this report.

Mineral Resource Information Center - The department staff makes field contacts and mineral deposit evaluations, studies markets and technology to encourage private sector investment in prospecting, exploration, and development and production of mineral deposits. Encouragement and information is supplied through technology transfer methods of personal contacts, seminars, publications, and operation of the Arizona Mining and Mineral Museum.

The DMMR maintains current computer database records on approximately 10,500 mineral occurrences, mines and prospects in Arizona. Hardcopy files of about 6000 of those mineral occurrences are maintained in up to date, secure fashion. These files contain such data as location, bibliographies, mineral content, size, economics, complete feasibility studies, and other data. As new information is developed by DMMR studies and by industry exploration and mining activity, it is entered into the files. Additional files are also created as new mineral occurrences are discovered and evaluated.

The information contained is made available to and is used by members of the mining industry. Through the use of this information, the industry has been able to make significant discoveries and develop new mining projects. These new projects return revenue to the state's economy many times over what it costs to fund the DMMR.

The return to the state for these efforts must be measured against the results of the exploration and mining activity conducted by individuals and companies that make up the mining industry. Successful projects reap important benefits to the economy in general, and in the form of taxes paid directly to state and county treasuries. Even the failures, those exploration projects that don't find viable ore bodies, make a significant contribution to the state's economy. It is estimated that exploration activity alone spends over \$15 million each year in Arizona. This in turn generates in excess of \$1 million in sales and payroll taxes.

In summary, the DMMR continues to have a positive economic impact on the State of Arizona. The focused orientation of the department is to aid in the promotion and development of the state's mineral resources. The search for mineral deposits, the development, and production of metals and other minerals is a \$3.5 billion per year business in Arizona. That places Arizona among the top producers on non-fuel minerals in the United States. In 1991, only California produced more. By making contact with hundreds of individuals and companies around the world, the staff of the department collects, analyzes, and disseminates information to foster and expand this business.

Mining and Mineral Museum - The mission of the Arizona Mining and Mineral Museum is to demonstrate that mineral resources are the cornerstone of mankind's existence; that minerals are functional, and that minerals are aesthetic.

The Arizona Mining and Mineral Museum can be traced back to the first Territorial

Fair in 1894 when mineral specimens from the mines of the territory were displayed for the first time. It was not until 1917 that the State Legislature appropriated the funds to construct the original museum building. Additional funds to complete the building and construct display cases were provided by the major mining companies that were operating in Arizona.

Since 1919 the museum's collections have been on public display, except for a few years during the "great depression" and World War II. In the early years the display was open to the public only during the State Fair. Since 1953, the museum has been open to the public on a daily, year around basis. In 1973, the museum collections were donated to the State of Arizona by the Arizona Mining Association, and the museum was established officially as a part of the Department of Mineral Resources, an agency of State Government. The Mining Association had funded museum operations for a number of years just prior to that time.

During the period from early August to mid September of 1991 the museum collection, the resource information center and all subsidiary equipment were moved lock, stock and barrel to the newly renovated El Zaribah Shrine Auditorium at 1502 West Washington Street on the Government Mall. The first two of three planned reconstruction phases were completed with the funds appropriated by the legislature. While the third phase remains to be done, the work completed made it possible for the department to occupy the building. The main floor of the building houses approximately 3000 specimens of a 15,000 specimen collection. The design of the building interior, the presentation of the mineral collection and the simple fact of the relocation has had very positive effect on museum activity.

Excluding visitors from either the State or County Fair, there has been an average of approximately 16,000 people through the museum each year during the period from 1987 to 1991. The fairs added a similar number each year. Attendance since the move was made to the new location has more than doubled the previous amount. During the first six months of calendar year 1992, there has been approximately 17,500 people visit and tour the facility. There is every reason to believe that attendance will continue to grow gradually. In any event, the annual visitor count for the year will equal or be greater than the total at the old location including Fair visitors. It is important to note that there have been people from all fifty of the United States and over forty foreign countries during the five years just past.

Activity in the museum has had a similar increase since first opening the new facility on October 1, 1991. Classes have been conducted for over 5,000 students and their teachers and parents during from October 1, 1991 to June 30, 1992. These classes are designed to educate the students with the most basic understanding of minerals and their uses. Depending on the age of the children, they are exposed to how minerals are mined from the earth, and how they are used in everyday life.

Minerals Education seminars were conducted for two teacher training classes during the year. Each of these groups had as many as seventy teachers who were enrolled in Continuing Education courses sponsored by Ottawa University and conducted by the Principal of Indian Bend School in the Paradise Valley School District. This is the third year these sessions have been conducted by the staff of the DMMR.

The Museum Curator conducted classes on minerals for ASU professor Herb Cohen of the education department. These classes were held to help the students in education and teacher training develop curriculum units that will be used in their lesson preparation. The sessions are held each semester.

The museum prepares "Teacher Kits" that contain a variety of mineral specimens, identification technique and tools for the minerals, and a packet of printed material that gives teachers background to teach their students about minerals and how they are used. These kits are handed out free of charge to any school teacher who asks for one. Several hundred of these were distributed during the past year. The number of requests have increased primarily because of the increased exposure of our program to teachers and administrators in the education programs described above. While most of the teachers who have been involved in the museum program already had kits, many of them have requested new ones.

Staff members of DMMR and the museum conducted a lecture presentation for the Annual Convention of The Association of Science Educators of Arizona during the year.

Tours are conducted on a regular basis for small groups of mentally and physically handicapped.

Eight well organized clubs of hobbyists, collectors and prospectors hold regular meetings in the museum. The museum, with the help of these clubs has developed an extensive shop for lapidary and other work related to their hobbies. These clubs are the primary source for volunteers for the museum. A total of 5,225 hours of work was contributed by these people during the 1992 fiscal year.

Other major events hosted by the museum during the year included the luncheon for the annual meeting of the Arizona Arts Congress, a dinner for the International Society of Mining Engineers convention, the Central Arizona Museum Association, and the Arizona Tour Guides.

DEPARTMENT PROJECTS

AzMILS Database - AzMILS (Arizona Mineral Industry Location System) is a compilation of all known mineral deposits and mineral processing facilities in the state. It is the synthesis of DMMR's mine file collection and published technical literature. The continuous development of this knowledge base is a primary objective of the departments technical staff. The majority of industry inquiries begin with AzMILS. It is also distributed in paper and data diskette forms. Reductions in staff have slowed progress in enlarging and improving the database. DMMR is in danger of falling significantly behind in gathering information from industry and abstracting new research literature. Lack of access to this information hinders industry development efforts.

Recent efforts, in connection with the metallogenic project, are resulting in significant improvements to AzMILS location information. A detailed check of location data correlating legal description with latitude and longitude is currently underway in cooperation with Dietz and Associates. They are using a high resolution digital version of Arizona's township, range and section grid to provide us with a listing of properties that do not plot, by latitude and longitude, within the appropriate township, range and section. All counties, with the exception Pima and Pinal, have been checked identifying 641 conflicting locations. Errors have been corrected in La Paz, Maricopa, Mohave, and Yavapai Counties. Work on the remaining counties continues.

Copper Oxide Resource Project - Continued strong copper prices (\$1.00/lb. and higher) and wide spread industry acceptance of the solvent extraction electrowinning (SX-EW) process has resulted in numerous inquiries about properties that may have acid soluble copper ores. The SX-EW process produces marketable cathode copper directly from leach solutions. To encourage and facilitate exploration for deposits amenable to this process a report listing all known sites and a brief description of the process is being prepared. The economic benefits to Arizona of attracting capital to explore and develop these properties will likely be significant as it is expected that several new mining operations will result from these investigations during the next several years.

The starting point for this report was to review and update the AzMILS database. In the original compilation the distinction of sulfide or oxide character was not always made. Review of all copper deposits resulted in several hundred additional deposits being categorized as oxide bearing. For the report a listing of properties will be extracted from AzMILS and prepared along with maps showing deposit locations and distribution of deposit types. The report was released as OFR92-10 *COPPER OXIDE RESOURCES* in July 1992. A detailed listing of about 80 copper properties with known reserves was also prepared and is available as OFR92-11 *ARIZONA COPPER RESERVES*.

Industrial Mineral Development Project - Arizona, Southern California, and other Southwestern markets are an important key to development of industrial mineral deposits in Arizona.

The department is continuing to compile data to encourage the development of industrial mineral deposits in Arizona. The manufacturing industries of Arizona and those manufacturing centers within a reasonable shipping distance, especially Southern California, use a large quantity of industrial minerals that are currently shipped to the southwestern states at considerable transportation cost. The development of deposits and processing operations for these minerals in Arizona could have a number of beneficial effects. The State economy would benefit from increased employment and tax base and manufacturers would benefit from in-

creased availability of raw materials, and possible lower prices due to reduced transportation costs, increased competition, and potential substitution.

The department believes that by quantifying consumption, reporting specifications, and explaining uses of minerals in various industries, sufficient demand will be shown to justify new development of nonmetallic mineral deposits in Arizona. Both Pfizer Specialty Minerals and Georgia Marble Company have developed calcium carbonate mining and processing operations in Arizona due in part to data compiled by this continuing project. A news release describing the project in more detail and its current status was released during the year.

Again, as in fiscal 1990-1991, curtailments in travel funding severely limited continued survey of consumers. Insufficient funding of travel for the Department in fiscal 1992-1993 is causing further delay in continuing the project.

Even with interrupted progress on the project, contacts made previously had a beneficial impact on a number of Arizona projects, businesses, and developments.

Metallogenic Project - Camera ready text, data tables, and illustrations of *Primary Element Zonation of Veins Associated with Laramide Stocks in the Groom Creek and Poland Junction 7.5' Quadrangles, Yavapai, County, Arizona* were prepared by the department and supplied to the Arizona Geological Society for publication in Digest Volume 19. The paper was co-authored by George E. Ryberg, Patrick F. O'Hara, and department engineer, Nyal J. Niemuth. Using newly corrected AzMILS data, plots of selected metallic elements were made for the Prescott, Kingman, Needles, and Williams 1x2 degree quadrangles. Revisions to the preliminary metallogenic province and element zonation boundaries have been noted. When these drafting changes are completed, text and tables and text will be prepared.

PUBLICATIONS OF THE DEPARTMENT DURING THE FISCAL YEAR, 1991

- Directory 39, Directory of Active Mines in Arizona, 1992
- Special Report 17, The Primary Copper Industry of Arizona, 1990
- Open File Report 91-7, Arizona Copper Production
- Open File Report 91-8, Pumice and Pumicite in Arizona
- Open File Report 92-9, Status of Industrial Minerals Consumed in Arizona and Calif.
- Circular 33, County Agencies Concerned with Mining and Mineral Resources in Arizona
- Circular 34, State Agencies Concerned with Mining and Mineral Resources in Arizona
- Circular 35, Federal Agencies Concerned with Mining and Mineral Resources in Arizona
- Circular 36, Arizona Recordation Law Change
- Circular 37, Arizona Mining Update
- Circular 38, Federal Agencies Concerned with Mining and Mineral Resources in Arizona
- Circular 39, Pertinent Data for New or Prospective Mining Operations
- Circular 40, Earth Science Clubs, 1992
- Circular 42, Arizona Gem Shows, 1992-93
- Annual Report of the Arizona Department of Mines and Mineral Resources

Outside publications by department staff:

- Mineral Economics of Industrial Minerals in Southeastern Arizona, in Industrial Minerals of the Tucson Area and San Pedro Valley, Southeastern Arizona: Arizona Geological Society
- Arizona Exploration Review, 1991: **Mining Engineering**, May, 1992
- Primary Element Zonation of Veins Associated with Laramide Stocks in the Groom Creek and Poland Junction 7.5' Quadrangles, Yavapai County, Arizona: Arizona Geological Society Digest, Volume 19
- "The Arizona Mining & Mineral Museum" by Glenn Miller and Jeffrey A. Scovil; **Rocks and Minerals** Vol 67 No. 3, May/June 1992, pp 190-193.

Special purpose flyers, handouts, and program notes:

Newsletter - Arizona Mineral Resource, No.1, February, 1991

Flyer - Your House Comes Out of a Mine

Brochure - Arizona Mining and Mineral Museum

Brochure - *Images in Stone and Wood*

Handout - Packet of 5 Arizona minerals for special visitors

Handout - Rock Types for Teachers' Kits

Flyer - Rock and Gem Dealers List

News Release - Arizona and Southern California Markets As the Key to Development of Industrial Mineral Deposits in Arizona

Flyer - Mineral and Rock Information

Program Outline - Arizona State University Ed 401 Lecture Outline With Packet of Minerals

INDUSTRY ACTIVITIES

Descriptions of some of the projects and contacts in which the Arizona Department of Mines and Mineral Resources has been involved in fiscal 1991-92 are described below.

COPPER

Introduction

Interest in copper oxide/leach properties remains strong. Plans to develop the Carlotta mine were announced by Cambior USA. Acquisition and exploration activity by both major and junior companies is believed to be strongest in Cochise, Gila, Graham, and Pinal Counties.

Cambior USA - Cambior USA purchased Westmont Mining to acquire the copper reserves contained in the Carlotta property in Gila County. The property also includes reserves of the Cactus and Eder deposits. Cambior continued the on going drilling program to define reserves while announcing plans to develop a new mine and solvent extraction facility. Production is expected in the middle 1990's. When calculated, total reserves are expected to be at least 75 million tons grading 0.5% acid soluble copper.

Phelps Dodge - Exploration drilling was conducted to evaluate the leach potential of the company's properties near Safford. Reserves announced at the end of 1991 were 1,600 million tons of leach material grading .38% copper at Lone Star and 150 million tons of leach material grading .48% copper at Dos Pobres.

Orcana Resources - Orcana contracted with an engineering firm to prepare a resource estimate and preliminary economic evaluation of the supergene portion of the Sheep Mountain property, Yavapai County. A favorable report was received supporting the expenditure of additional funds to confirm the reserves.

Arimetco International - Arimetco constructed a new solvent extraction electrowinning plant at the Emerald Isle property, Mohave County. Startup plans include open pit mining and heap leaching in addition to renewing in-situ leaching. As permitting proceeds for in situ leaching at the Van Dyke Mine, Gila County, rehabilitation of the shaft is in progress.

GOLD

Introduction

Weak gold prices, below \$350/oz., are negatively affecting producing properties, and slowing new developments in this industry segment.

Fischer Watt Gold - Fischer Watt Gold began production at the Mystic mine in northern Maricopa County. Mine development was completed, a gravity mill was constructed on the site, and production began in early 1992. Mill Reserves are 50,000 tons grading 0.5 oz/ton Au.

Magma Gold Ltd. - The Gladstone McCabe mine in Yavapai County reopened producing 3,100 ounces of gold, and 16,800 ounces of silver, plus copper credits by the end of 1991.

Reserves total 137,000 tons grading about .33 oz/ton Au.

Republic Goldfields - Underground production at the Congress ceased in April 1992. Re-processing of turn of the century tailings is providing interim cash flow. An infusion of capital will be required to develop additional underground reserves. The company is interested in acquiring financing or possibly a major partner.

INDUSTRIAL MINERALS

Jerry Hoffer, University of Texas, El Paso - Jerry Hoffer of the University of Texas, El Paso Geology Department is authoring a report on pumice deposits in Arizona for our publication. The Arizona Department of Mines and Mineral Resources encourages outside authors to write on mineral deposits and related mine and mineral resource development subjects. His report was released as open file report OFR 91-8 so as to make the data available before the process of final editing and typesetting was to be completed. The 1:1,000,000 map that is to accompany the report was completed for release in July 1992. The use of pumice in the laundry industry, and as a light weight aggregate in concrete has spurred interest in that mineral resource

Dave Bellaire - Chemstone - Chemstone mines pumice as well as purchases additional pumice from another Arizona producer and foreign sources. Chemstone then processes the pumice for uses in stone washing and stone dying clothing. Mr. Bellaire continues to search for new sources of pumice in Arizona to develop and uses the DMMR's database and suggestions. His production in Arizona reduces his reliance on out of state and foreign imports. Further, his development of Arizona deposits has allowed him to expand his business from under \$1 million in annual sales to over \$12 million.

Arizona Silica Sand Company - Arizona Silica Sand Company has been actively producing silica sand for specialty uses for many years. They continue to receive inquiries from possible new customers who have been importing minerals into Arizona as a result of the department's ongoing industrial minerals market development project. They may be able to expand their operation and employment and Arizona manufacturers may have a closer source of silica sand.

Pfizer Minerals - Pfizer Minerals is part of the multinational Pfizer Corporation which ranks 84th on the *Fortune* 500 list of major U. S. corporations. They are interested in acquiring industrial mineral deposits and operations as part of expanding their market share of supplying speciality minerals to manufacturers. Pfizer had been supplied with mineral market data developed by the DMMR project to collect industrial mineral consumption information to encourage development of the minerals in Arizona. In late Fall 1991, they announced the acquisition of Calcium Products of Arizona, hired additional workers, and began a multimillion dollar improvement and expansion program at the mine.

Jimmy Vacek - 49ER Minerals - 49ER Minerals is a \$300,000 a year cottage business based on the mining, processing, and marketing of mineral specimen and specialty pigments. A major portion of his sales are to export markets. Mr. Vacek continues to obtain mineral deposit occurrence information from the staff of the DMMR and the Department's database.

Flagstone - Arizona is the flagstone capital of the world, and with the help of the department the state's dimension stone business is enjoying a period of quality growth. The department also serves as a source of information to the architectural industry in finding sources of Arizo-

na stone.

Georgia Marble Acquisition of Andrada Marble - Georgia Marble Incorporated acquired the Andrada Marble Company in late fall of 1990. Based on market data obtained from the DMMR, they funded and have nearly completed an expansion program at the mine.

Joint Cement Manufacturer - A major manufacturer of wall board joint cement continues to be interested in establishing a manufacturing plant in southern Arizona to serve the export market to Mexico. To be cost competitive they must have a source of mineral fillers close to their plant. The DMMR has gathered and disseminated information on deposits of industrial minerals to encourage prospecting and development of deposits that could serve a new joint cement plant in the area.

Minerals West - Minerals West is a small consortium of individuals involved in the production, distribution and consumption of industrial minerals. They have pooled very limited resources to search for opportunities in industrial mineral deposits. In the Spring of 1992 they made a small donation to the DMMR to assist in paying travel expenses to continue the gathering of industrial minerals market and deposit information.

Heatshield Technologies - The company is developing the Klanner-Doolin silica-clay mine near Topock to produce speciality fillers and heat resistant coatings. The department has assisted them in finding sources of financing for their processing plant and in community relations with the Fort Mohave Indian Tribe on whose land the processing plant is to be built.

Marble Con 92 - Through the generosity of Pfizer Specialty Minerals a department engineer was able to attend Marble Con 92, a cultured marble suppliers convention. This enabled the department to make direct contact with eight suppliers of industrial minerals to the cultured marble industry. All of these suppliers currently operate mines in other parts of the United States and might be interested in developing deposits in Arizona.

Industrials Minerals Field Trip and Authoring of Guidebook Chapter - Ken Phillips authored a chapter entitled *Mineral Economics of Industrial Minerals in Southeastern Arizona* for the Arizona Geological Society's *Industrial Minerals of the Tucson Area and San Pedro Valley, Southeastern Arizona - Arizona Geological Society Field Trip Guidebook*. He also attended the field trip.

Wapco's Gypsum Quarry at Salome - The company manufacturers blended landscape and horticultural materials. They acquired the Harquahala Gypsum deposit and have developed it to produce their own gypsum for use in their products.

Annabell Gypsum - Plans for New Operation - A company hopes to develop the Annabell Gypsum deposit in Gila County to supply agricultural gypsum to eastern Maricopa County and cement retarder to the Phoenix Cement Plant at Clarkdale. The department provided the potential developers with market information and specifications. Further the department assisted the Arizona Department of Transportation with valuation information in their effort to establish a fair value for the portion of the deposit which will be acquired for a new highway alignment. They had originally planned to only pay a nuisance value for their taking of a portion of the deposit.

NON-FUEL MINERAL PRODUCTION FOR 1991

Non-fuel minerals produced in Arizona during the year 1991 had a value of \$2.8 billion. The chart below shows the quantities of each commodity produced and their relative value.

MINERAL	QUANTITY	VALUE
Clay (Short Tons)	187,993	\$1,436,000
Copper (Short Tons)	1,116,366	2,456,094,000
Gemstones	NA	2,100,000
Gold (Troy Ounces)	181,745	67,247,000
Sand & Gravel (Short Tons)	23,7000	79,400,000
Silver (Troy Ounces)	4,919,238	19,723,000
Stone (Crushed Short Tons)	5,000,000	12,800,000
Combined value of cement, diatomite, gypsum (crude), iron oxide pig- ments (crude), lime, molybdenum, perlite, pumice, pyrites, salt, sand and gravel (in- dustrial), and stone (dimension).	NA	<u>152,030,000</u>
TOTAL		\$2,790,830,000

Note: Some production numbers are withheld for proprietary reasons, therefore some totals are estimated.

The statistics above do not include the coal mined on the Navajo and Hopi Indian Reservations. Because of federal policy assigning fuel minerals such as uranium and coal to the Department of Energy instead of the Bureau of Mines, production data is more difficult to obtain. Our source is the mining companies themselves. Coal production for the calendar year of 1991 in Arizona was 13.2 million short tons. All of this production was produced from the two mining complexes on the reservations. Depending on markets, the value of the coal mined is approximately \$300 million. It is difficult to measure the actual impact on the Arizona economy, but this effort combined with the suppliers to the mines and the users of the coal make it a very significant contributor. Except for a few tons used for domestic purposes, it is shipped via rail to the Navajo Plant at Page, or by slurry pipeline to the Laughlin, Nevada plant. The mine operator pays approximately \$25 million in taxes to state and county governments in Arizona. They are by far the largest employer of Native Americans in the state.

Only a small amount of uranium ore was produced in Arizona during the Year. Energy Fuels Nuclear produced about 235,000 pounds from the Kanab North Mine up to the time operations were suspended at the end of March, 1991. Extremely low uranium

prices persist worldwide. Supplies on the spot market are sufficient to enable suppliers of uranium fuel to buy on the market at prices below the cost of production, and then fulfill their contract obligations at rates contracted when the commodity was in a range three times current prices. The foreseeable future is not bright for this valuable natural resource in the United States. A major change in public opinion and understanding about nuclear power is necessary for any real return to the domestic mining of uranium. Aside from the positive economic impact in areas where the metal is mined, nuclear power is the safest, cleanest and could be the cheapest (without unending layers of regulations) source of power in existence. When the public clearly understands this, the country and the environment will reap great benefits.

GOALS OF THE DEPARTMENT

The Department of Mines and Mineral Resources has set several goals for the next three years to insure the continued viability of the department's existence. An important part of this plan is to show that, not only are appropriations justified by results, but that DMMR causes a return in state revenue greater than the cost of operation.

Public Education - The public at large in Arizona has little knowledge about the importance of minerals in everyday life. This strange phenomena for the "Mining State" is especially true in the Phoenix Metropolitan Area, and to a lesser degree in Tucson. Rural communities who are near to, and dependent upon, mining activity have at least an insight of how mining plays a large part in their lives. They understand that the products they produce are vital to the well-being of the state and nation. They also understand that their lives and the lives of their children are enhanced by the mines and the jobs they provide.

But far more important than this is the knowledge that the car they drive, the house they live in, the television set they watch, the computer they program, the telephone they talk on and listen to, and even the food they eat would not be available without the minerals that are dug out of the earth and processed into the products that make these things all possible.

DMMR believes that is an important goal to disseminate this information to school children and their teachers, but also to the general population of the state.

It is the goal of DMMR to continue to expand this education program to include upper levels of formal education and to adults. The new facility at 1502 West Washington that opened to the public on October 1, 1991, has exceeded our greatest expectations as a facility to serve that purpose. It has provided an opportunity to take advantage of the more than 100% increase in visitors that the museum has experienced at the new location.

One of our volunteers, an elementary school teacher with an interest in minerals and teaching her students about them, has developed a bilingual lesson series to teach children from kindergarten through grade eight about minerals, where they come from, and how they are used. Each level is geared to the ability of the children to assimilate the information. This work will be published in the early fall of 1992, thanks to a generous contribution from an industry donor.

Promotion of Mineral Development- The DMMR staff believes that the continued development of mineral resources, even the expansion of that effort, is a vital component in economic recovery and expansion in the State of Arizona.

Participation by the Director of DMMR in the Minerals and Mining Cluster of ASPED (now GSPED) has presented an excellent opportunity for the department to be a major contributor in work related to development of new projects beneficial to the state. The Mineral and Mining Cluster is a very active group with a definite direction that will lead to success of the process.

Through refinement of the data base of valuable resource information accumulated over the past 50 plus years by DMMR, we believe that the exploration for and development of minerals in the state can be greatly improved by use of the data base. Continued research and ultimate publication of reports on a wide range of mineral commodities will add to that base of information. These studies include broad based geologic and economic information to assist the industry in locating and developing mineral deposits. The studies also include market data that enhance the possibility of successful mining ventures.

With DMMR located on the Government Mall, access to the agency by other agencies of state government has been improved. The staff of the department is readily available to those agencies that have a need for the information held in our files. The Department of Water Resources, the Department of Environmental Quality, the Land Department, and the Governor's office have all made good use of the services that is provided by DMMR. The Corporation Commission Securities Division continues to rely on the expertise of the DMMR staff and the information available.

Museum Development- It is the goal of DMMR to make the Arizona Mining and Mineral Museum a world class exhibit of mining history, mining technology, and the wide range of minerals that occur in Arizona. The exhibit is an educational tool to illustrate the mission of the museum. That is, to show that "minerals are the cornerstone of mankind's existence". While the mineral collection is dominated by specimens from Arizona, most of the world domain of minerals is represented.

To accomplish that goal, DMMR has initiated a fund raising program designed to reach private sector donors who have an interest in the improvement of knowledge about the world of mineral resources. A goal to raise \$1,250,000 over a five year period has been established. The funds contributed to this program will be used in the design and construction of galleries, exhibits and educational media for the presentation of minerals, where they come from, why they are there and the uses of those minerals for the benefit of mankind.

Successes to date include equipment to be relocated and restored at the museum with an estimated value of \$100,000. We are encouraged with the promise of over \$200,000 that will pay for that restoration and relocation, and to construct and provide equipment for our multi-media theater. The latter facility is designed to provide orientation about the when, where and why of minerals that occur in Arizona. It will lead the visitor into the museum where they will learn about the uses of those minerals by society. They will learn about the history of mining in Arizona that has made those minerals available to us all.

Aside from the fund raising program for museum development, the program is primarily people dependent. With the reality that fiscal constraints make budgeting for adequate staff to accomplish these tasks nearly impossible, a volunteer program has been instituted at the museum that will provide people to get most of the work done. The volunteer program is already a success. During the fiscal year just passed, there has been a total of 5,225 work hours contributed to the museum program. This equivalent over two and one half full time employees and over \$50,000 in dollar value to the state. These dedicated people do everything from manning the reception center to constructing and equipping a lapidary shop. While the primary focus of the volunteer program is in the museum, it has also enabled us to use volunteers in the mineral resource information center. The department is able to survive only because we have had the benefit of these volunteers.

It must be understood, however, that the program of DMMR cannot function forever with a major portion of its work load performed by a volunteer staff. Volunteers will always be an integral part of the program, but full time paid employees of the state must be provided for through the appropriation process by the State Legislature at the earliest possible date. It is expected that as fiscal balance is established, and revenues are available to support a growth in staff, full time positions necessary for the engineering staff and the museum will be funded.

ARIZONA AND MINING

A Historical Perspective - "Mining is Basic." The slogan is commonly used by a variety of mining interests to promote the industry and to educate the public on how mining and its products effect everyone. There is nothing that is used by the human race that does not incorporate some product of the mining industry. Agriculture, automobiles, building construction, paint, computers, televisions, radio, paper products, aircraft, communications and everything else used by man has somewhere in its make-up at least one substance that was taken from the earth. This has been true since the beginning of man.

In Arizona, mining has been an important factor from the time of the early miners among the various Indian tribes. The ancient people used clays for pottery, pigments for decoration of their bodies and shelters, chert and flint for their tools and weapons, and turquoise, silver and gold for jewelry. Mining was crude and was done on a small scale, but it is still an example of how even the most primitive cultures were dependent on mining.

The primary reason for exploration of this part of the New World by the Spaniards was to find the treasures of gold and silver the natives had reportedly accumulated. As the missionaries established the settlements of Southern Arizona, mining became a part of the changing civilization.

Mining in Arizona lay dormant from the period of the Mexican Revolution for independence from Spain (1810-1812) until after the U.S.-Mexican wars and the Gadsden Purchase. With a slowdown during the Civil War years excluded, mining activity has been an important part of the Territory and State ever since. The first Territorial Governor believed minerals were the most important factor in being able to establish a civilized society in Arizona. Minerals are equally important to the maintenance of civilization.

From the end of the Civil War to the beginning of World War II, as many as several thousand mines operated and produced copper, gold, silver, and other metals. The value of these mines to the new state in terms of jobs, commerce, revenue, and money into the economy are almost incalculable. Without this effort, it is difficult to envision what Arizona would have become.

Following World War II, the copper mining industry was renewed to higher than ever levels by the onset of several large open pit mining operations that now span the state from the southeast to the northwest. With several cycles of boom and bust, improved technology and new efficiencies developed by company-wide restructuring, the copper industry had come full circle by 1987, and is now competitive with the rest of the world. Production and revenue have reached the peak years of 1979-82, but after the low point in 1986 it is still on a positive climb. Copper prices have remained strong through the spring of 1992 and are expected to remain that way for the immediate future. World supplies of copper are still not in abundance. A variety of problems, political and technical, continue to impede production from several large projects around the world. And as the former Soviet Empire is rebuilt into a free market system, the demand for the raw materials from mining will increase drastically on a worldwide basis. Arizona can and should be in the forefront of the efforts to meet that demand.

THE FUTURE OF MINING

Predicting the future is a risky endeavor, particularly when it comes to mining. This is especially true when the decisions of whether to explore for and develop new mines is so heavily influenced by factors not related to mining or the marketing the products of mining. Mining decisions of today are based on factors not related to the boom and bust cycles of the past.

Mining in the United States and in Arizona has become a very complex business influenced as much by environmental regulation and land use planning as by prices, costs and the fluctuations in the demand for mineral products. While the industry has solved most of the technology problems related to environmental protection and mitigation, the permitting process required to assure that procedures become a part of mine planning, is a serious obstacle to the success of every new or revised project coming on stream. There must be relief built into the process that will speed up the time necessary to get new projects underway. Interference by environmental radicals just for the sake of preventing new mining projects as well as legitimate concerns of individual citizens and groups of people who worry that a new mining operation will have a negative effect on their way of life, must be tempered in a way that will allow timely approval for those projects to proceed. Unnecessary delays in the process add cost that in most cases cause a burden too heavy for the project to bear. The cancellation of these projects will not only have a very negative effect on Arizona's economy, but will cancel jobs and commerce that would otherwise benefit everyone, including those who have caused the delays.

The availability of lands with potential for mineral deposits is under severe threat by the continued expansion of wilderness status of Arizona lands. The wholesale designation of large acreages as wilderness without consideration of other resources and uses should not be allowed. It is informative to note that throughout history, approximately 190,000 acres of Arizona land have been affected by mining. This compares to 5.5 million acres that have been removed from public access by wilderness designation since the passage of the Wilder-

ness Act in 1964. How much wilderness is enough to satisfy the appetites of the so-called preservationists?

With the combined lands encompassed by the National Forests, the National Parks, BLM managed public lands, Wildlife Reserves, Indian Reservations and land withdrawn for military uses, the Federal Government controls 69% of all the land surface in Arizona. In addition the State Land Trust has total control of over 9 million acres of land. That leaves only 17% of the land in the state in private hands.

Legislation to modify or outright repeal of the General Mining Law of 1872 has again been introduced in the current session of Congress. The arguments that are being used are the same ones that have been proven inaccurate in the past. The primary reason for retaining the Mining Law essentially as it exists is that it has worked well for over 120 years, and it still works today. It works not only for the mining industry, but it works to the benefit of all citizens of these United States, except for those who would return us all to a lifestyle that includes living in caves. The taxes paid and the jobs provided for people by the development mineral deposits on public lands acquired under the Mining Law far exceed any imagined gain from royalty payments or any other fees. The Mining Law allows for a safe, environmentally sound development of mineral resources that are sorely needed to maintain the living standard the country desires and to fill the strategic needs of the nation.

The Federal Environmental Protection Agency has yet to complete an acceptable plan for the management of mined waste under subtitle D of the Resource Conservation and Recovery Act (RCRA). The Western Governors Association Mined Waste Task Force continues to work with the various states and the EPA to develop a plan that is acceptable to all parties involved. The Director of DMMR is an active member of the Mined Waste Task Force.

Land use planning, environmental regulation, withdrawal of public lands from mineral entry, and radical changes in mining law are coming together to make America a nation dependent on and at the mercy of imported natural resources. It is already true that most of the active minerals exploration programs currently being conducted by United States and Canadian companies is taking place in the northern states of Mexico. The nation must rethink its priorities in relation to natural resources.