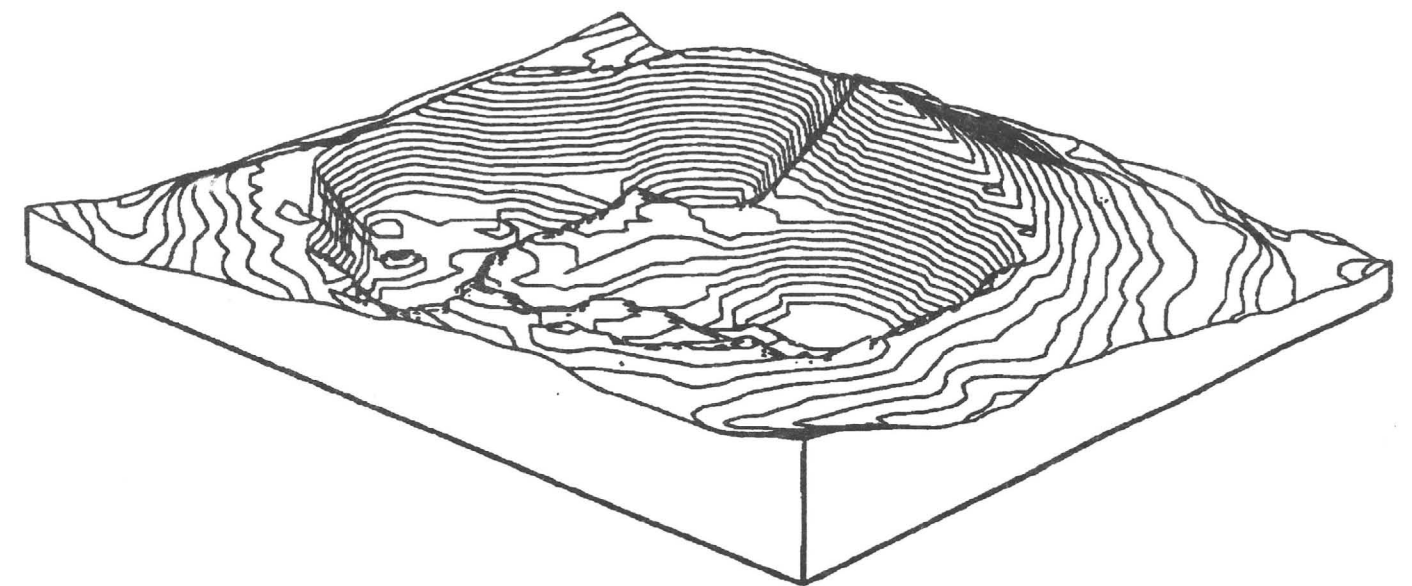


# **STATE OF ARIZONA**

## **Department of Mines and Mineral Resources**



**Annual Report 1988-89**



STATE OF ARIZONA

## DEPARTMENT OF MINES AND MINERAL RESOURCES

Mineral Building • State Fairgrounds • Phoenix, Arizona 85007

(602) 255-3791

October 1989

The Honorable Rose Mofford, Governor  
The State of Arizona  
1700 West Washington  
Phoenix, Arizona 85007

Dear Governor Mofford:

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

The statutory obligation of the Department is one of service. The Department is fully funded by the Legislature to promote the development of mineral resources of this state through technical and educational processes including field investigations, public seminars, publications, conferences, mineral displays and by providing mining, metallurgical and other technical information and assistance to prospectors, operators of small mines, the mineral industry and to others interested in the mineral resources of this state.

The activity of the Department of Mines and Mineral Resources assists in the creation of economic activity by various phases of the mining industry in the State of Arizona. During 1988 the mining industry directly and indirectly generated in excess of \$9.3 billion of economic activity. Included in that figure was approximately \$700 million in state and local taxes.

Ongoing work by the Department staff on resources evaluation projects has generated one new mining project that has had in excess of \$1 million activity in the past six months. This project is only one example of many projects generated by the Department that have contributed revenue to the state far in excess of funds appropriated to support the agency.

The most urgent current need of the Department is the remodeling and renovation of the El Zaribah Shrine building, so the Department and the Arizona Mineral Museum can be moved to that location.

Respectfully yours,

Leroy E. Kissinger  
Director

For the Board of Governors

Disregarding interests other than the mineral potential the majority of the lands proposed for wilderness fall within the Arizona mineral belt that traverses the Transition and Basin and Range geologic provinces across the State of Arizona.

In the past 2 years a new, economically important mine has been put into production in this region. It is the Copperstone gold mine. This mine is in a geologic environment that has excellent potential for several, similar discoveries during the next 10 years. The potential for critical minerals is also high in the desert areas of Southern California and Western Arizona.

The availability of lands with potential for mineral deposits is under severe threat by the wilderness proposals. With proper regulation and management of these lands, all interests can be served. The permitting process can require necessary environmental protection of areas that are ultimately developed for their mineral resources. If, in fact, there are areas that have unique, natural and pristine values as defined in the 1964 Wilderness Act, they should be set aside and given thorough evaluation on an individual basis. The wholesale designation of large acreages as wilderness without consideration of other resources and uses should not be allowed.

There are other threats to the mining industry being discussed Congress and the federal bureaucracy. Two of the more important ones are proposals to repeal or drastically revise the 1872 Mining law and efforts by the EPA to write rules and regulations for the management of mined wastes.

Senator Dale Bumpers of Arkansas has introduced S-1126 that would forbid surface patent, set limits on exploration claims and, among other fees, impose an eight percent royalty. Both this legislation and a less severe proposal in the House are being pushed for passage during this session of Congress. These attacks on the 1872 mining law were instigated by an inaccurate and biased report generated by the General Accounting Office in the Spring of 1989, and are being supported by a host of environmental groups that want to stop all mining on public land.

The EPA has been trying for more than a year to develop rules and regulations to manage mined waste under subtitle D of the Resource Conservation and Recovery Act (RCRA). A task force group formed by the Western Governors Association has been working with EPA trying to keep the regulations

reasonable, and to keep control at the state level. However, even the task force proposals would be damaging to the economics of mining projects, and would destroy the small miners' ability to operate.

The states that have mining interests must resist this Federal encroachment if mining is to remain viable.

## BOARD OF GOVERNORS

Clifford B. Altfeld - Tucson  
Chairman  
Term Expires 1/31/90

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

Roy Miller - Phoenix  
Secretary  
Term Expires 1/31/92

Arthur H. Kinneberg - Phoenix  
Member  
Term Expires 1/31/91

C. J. Hansen - Tucson  
Member  
Term Expires 1/31/93

## STAFF PERSONNEL

**Phoenix Office - Mineral Building, Fairgrounds, Phoenix 85007**  
Phone: 255-3791

Leroy E. Kissinger - Director  
Ken A. Phillips - Chief Engineer  
Richard R. Beard - Engineer  
Nyal J. Niemuth - Engineer  
Glenn Miller - Museum Curator  
Ann Turney - Administrative Assistant  
Diane Bain - Secretary  
Marianne Charnauskas - Secretary  
Connie Morgan - Maintenance  
Alice Rosenfeld - Part Time Museum Tour Guide  
Fred Rothermel - Part Time Museum Tour Guide  
Alice Smith - Part Time Museum Tour Guide

**Tucson Office - 416 W. Congress Room 162, Tucson 85701**  
Phone: 628-6340

Open and staffed Monday and Tuesday of each week.

Statewide Watts Line: (800) 446-4259

## **The Future of Mining**

Predicting the future is a risky endeavor particularly when it comes to mining. This is especially true in these times when the decisions on whether to explore and develop new mines is so heavily influenced by factors not related to mining or marketing of mine products. The boom and bust cycles of the past were largely a result of availability and markets.

Mining in the United States and in Arizona has become a very complex business influenced as much by environmental controls and land use planning as by prices and markets. While the mining industry has solved most of the environmental problems, the availability of new land for the exploration of minerals is questionable.

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 use, the Federal government controls 69% of all the lands in the State of Arizona. Lands already withdrawn from potential mineral exploration for all intents and purposes include the military and Indian Reservations, the National Parks, the Wildlife Reserves, and 49 areas totaling 2,031,877 acres already in the National Wilderness Preservation System. It is certain that otherwise exploitable, valuable mineral deposits are located within these withdrawn areas.

Legislation has been introduced in both houses of Congress to establish new wilderness areas in the southwestern half of Arizona. The Udall bill (HR2570), would set aside 1.4 million acres in addition to HR-2571 which would designate several wildlife preserves encompassing 1.3 million acres as wilderness. There are also serious conflicts over water rights associated with the wilderness bill.

A second proposal has been made in the Senate by Sens. Deconcini and McCain which would designate approximately 900,000 acres as wilderness. The BLM has also tentatively recommended over 900,000 acres.

None of these proposals give any consideration to the presence of high to very high potential for mineral resources in 80% of the areas. There simply has to be a reordering of priorities.

An aside to the discussion is the fact that the Arizona Wilderness Coalition has recommended that 4.1 million acres of critical Arizona land be brought into the wilderness system.

The only sensible solution is to take the time necessary to do a thorough evaluation of mineral potential and carve out those areas that have high potential. These, along with access and other rights, should be excluded from any wilderness designation.

Minerals	Quantity	Value in \$1000
Clay (Short Tons)	205,000	1,823
Copper (Short Tons)	950,000	2,513,700
Gem Stones	NA	3,300
Gold (Troy Ounces)	156,000	68,486
Gypsum (Short Tons)	265,000	1,853
Lime (Short Tons)	647,000	25,998
Moly (Pounds)	29,132,000	78,656
Pumice (Short Tons)	1,000	7
Sand & Gravel (Short Tons)	37,000,000	136,200
Silver (Troy Ounces)	3,181,000	20,832
Stone (Crushed Short Tons)	6,600,000	29,300
Miscellaneous	NA	100,517
<b>TOTAL</b>		<b>\$2,980,672</b>

The statistics above do not include the coal mined on the Navajo-Hopi reservations. Because of the federal policy of 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. However, coal production in Arizona was approximately 12,190,000 tons in 1988. All of this is produced from the two mining complexes on the Reservation. Depending on markets, the value of the coal mined is approximately \$240 million. It is difficult to measure the actual impact on the Arizona economy, but suppliers to the mines and users of the coal make a significant contribution. Most of the coal is used in the two power plants at Page, Arizona and Laughlin, Nevada. The operator also pays \$20 million in taxes each year.

Likewise, the production of uranium is not included in the table above. During the calendar year of 1988, Energy Fuels Nuclear produced 3.5 million pounds of uranium with a value of approximately \$35 million. Prices for uranium fluctuate as they do for other metals. Until there is a clear policy established by the Federal government, the future for the domestic uranium industry is uncertain.

Cyprus Minerals Company's Copperstone Gold Mine gold production was over 60,000 ounces in 1988. Gold production for Arizona in 1988 was approximately 156,000 ounces with market value of \$58 million. Previous gold production has been primarily a by-product from the copper industry. By-product gold production will remain high with high copper production.

Sand and gravel for construction and industrial mineral production had a combined market value in excess of \$295 million during 1988.

## **TABLE OF CONTENTS**

### **Transmittal Letter**

- The Department of Mines and Mineral Resource
- Statutory Assignment
- Implementation
- Mineral Museum
- Education
- Information to Public
- Assistance to Government Agencies
- Response to Inquires
- Project Work
- Goals of Department

### **Summary of Activity - 1988-89 Fiscal Year**

- Statistical Report
- Financial Statement
- Industry Activity

### **Mining and Arizona**

- Historical Perspective
- Mining Today
- The Future of Mining



are short. A variety of problems, political and technical, continue to impede production from several large projects around the world.

### **Mining Today**

During and since World War II there have been great strides in industrial development in Arizona. As a result, the mining industry is a smaller percentage of the total economy in spite of substantial growth in finite terms. Regardless of the relatively lower position in economic impact to the State, the mining industry and related businesses still contributed \$9.364 billion to the Arizona economy in the calendar year of 1988. Included in that is approximately \$700 million in revenue paid to state and local governments.

The industrial classification system used by the Arizona Department of Economic Security places some smelter and refinery workers in manufacturing employment so that an accurate accounting for employment by the mining industry is not possible. However, the approximately 11,000 people employed directly by the mines and mills grows to about 53,000 when factored for the ripple effect of service industries related to the mining industry. The copper industry alone was directly and indirectly responsible for more than 4% of all personal income received by Arizona residents in 1988. It follows that personal income tax to the state paid by employees in the copper industry would be a similar percentage of the total revenue from income tax.

Every major copper company has announced expansion plans. If prices hold, it is conceivable that copper production will soon exceed the historic high of 1981.

Two companies without previous copper production in Arizona have announced intentions to start projects in 1990. Aremetco has acquired the Johnson Camp Mine formerly operated by Cypress Mines with plans for early production. AZCO has acquired the Sanchez Property near Safford and plan production as early as mid 1990.

Both of these projects, in addition to the expansion projects announced by the major copper companies, will be using the solvent extraction-electrowinning technology only recently applied to copper extraction and production on a large scale. It has become an important factor with an excess of 25% of Arizona's total copper production coming from that source.

Non-fuel minerals produced in Arizona during the year 1988 had a value of \$2.98 billion. The chart below shows the quantities of each commodity produced and their relative value.

## MINING IN ARIZONA

### 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 affect 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, television, 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 the exploration of this part of the New World by the Spaniards was to find the treasures of gold and silver the natives had accumulated. As the missionaries established the settlements of Southern Arizona, mining became a part of the developing 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 hundred mines operated and produced copper, gold, silver, and other metals. The value of these mines to the new state in term 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 not yet reached the peak years of 1979-82, but after the low point in 1986 it is on a positive climb. Copper prices have remained strong through the summer of 1989 and are expected to remain that way for the immediate future. World supplies of copper

## THE DEPARTMENT OF MINES AND MINERAL RESOURCES

---

### Statutory Assignment

*The Arizona Department of Mines and Mineral Resources is authorized by ARS 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 Museum** - The Department operates the State of Arizona Mineral Museum. The museum is the official repository for the identification, cataloging and displaying of mineral specimens of ores, gemstones, and lapidary materials found in the state. The Museum also operates a small store to sell mineral specimens and publications relating to minerals.

**Education** - The Department conducts seminars and training sessions to assist the public in the proper staking of claims and locating and extracting of minerals. Through a series of publications, the Department has accumulated useful guides to mineral law, location of mineral occurrences in the State and technology to mine and extract minerals.

The Museum staff conducts programs on a regular basis to educate teachers and students of Arizona's schools from kindergarten through college about mining and its contribution to the general welfare of Arizona.

**Information and Assistance** - The Department maintains the most comprehensive records and resource library of mining activity, spanning the period of the earliest settlers to the present day, that is available anywhere. With these files and its library the Department is able to assist prospectors, mining companies, rockhounds and the general public in the efforts to locate and develop mineral resources. The engineering staff is able to provide technical assistance in general mining and processing of minerals for those who need it.

**Assistance to Government Agencies** - The Department staff spends a great deal of time investigating, sampling, acquiring assays of samples and providing a wide range of information to assist both state and federal agencies in their attempts to prosecute the many fraudulent "mining" promoters who are proliferating in Arizona. Recent national publicity has been given to the many schemes to defraud investors by selling them "ore" containing gold. Our Department staff has been in the forefront in acquiring evidence to build a legal case against the perpetrators. One such operation has been shut down during

the past year by these efforts. Both the Securities Division of the Corporation Commission and the Federal Trade Commission have been involved.

We provide technical assistance to the Governor's Office, the State Legislature, the State Land Department, the State Department of Environmental Quality, the Department of Revenue, the Attorney General's Office and the Department of Commerce.

The Department has worked with the U.S. Bureau of Mines on many projects over the years. Most recently, the Department has compiled a complete data base listing of all the known mineral occurrences in the state for the Bureau's Mineral Industry Location System (MILS). We have all of that data filed both on computer storage and hard copy.

The Department regularly performs services for, or works cooperatively with, both the U.S. Bureau of Land Management and the U.S. Forest Service.

**Response to Inquiries** - The Department staff responds to thousands of in person and telephone inquiries each year. The inquiries are about every conceivable subject related to rocks, minerals and lands on which they occur. A sample of these subjects are listed for example only:

1. Identification of rocks or minerals
2. Regulatory interpretation
3. How to stake a claim
4. How to do placer mining
5. How to find a placer deposit
6. Should I invest in a project  
(Usually after the fact)
7. Response to legitimate mining company geologists, engineers, and other prospectors reviewing our library and files for information that might lead them to locating and developing a viable mineral deposit
8. How do I file assessment work

**Project Work** - The engineering/geological staff of the Department does major projects to evaluate mineral resource potential over the State. These efforts result in printed publications that are available to the public.

There are three projects that are currently assigned to staff. It is planned that these will be completed with a resulting publication of the reports in 12 to 18 months. The greatest difficulty is in isolating the staff from the large number of public inquires long enough to do this work. This is particularly true with reduction in staff for the 1989-90 fiscal year due to

## Minerals Exploration Activity

During the fiscal year 1988/89 there were 25 Arizona based companies and 40 non-Arizona based companies conducting exploration activities in the state. Approximately 400 people were involved in this effort. Exploration activity includes drilling, geophysical surveys, claim staking, land surveying, surface and underground sampling, and assaying, among other activities.

As mentioned previously in this report, the majority of the people involved in the minerals exploration business in Arizona gather basic information for their efforts from the files and the staff of the Department of Mines and Mineral Resources.

It is impossible to determine an accurate account of economic impact this activity has on the economy of Arizona. However, some reliable assumptions can be made on the magnitude of expense involved.

Four hundred people in the field for 200 days, spending \$70 per day on food, lodging and transportation generates \$5.6 million.

There are 20,000 mining claimants that routinely work their claims on a regular schedule each year and spend \$200 per claim. This generates \$4.0 million.

There are 148,000 active claims in the state of Arizona that require annual assessment work of \$100 per claim. Some of the claims will have no work done at all; however, Approximately 60% of these claims will have a minimum of \$100 work done. This generate \$8.8 million.

In summary, minerals exploration activity in the State generates \$18.4 million of economic activity each year. Approximately \$1.3 million in state and local revenue are generated from this activity. Much of this activity is likely reported by other agencies. For example, the Office of Tourism reports the food, lodging and transportation part of this number. Gasoline sales are a factor in the other activities. It is all mining industry related economic activity none-the-less, and is directly related to the efforts of the Department of Mines and Mineral Resources.

The above discussion does not consider the economic impact of the major mining operation in copper, gold, sand and gravel and industrial minerals. These are summarized in the section on Mining Today.



## Financial Statement

	State Appropriation	
Appropriated Funds		\$468,100
Actual Expenditures		467,835
Reverted		265
Disappropriated Funds		4,700
	Mines and Mineral Resource Fund	
Income		
Balance Forward		\$6,221
Donation Box Receipts		1,080
Donations (Other)		375
Museum Store Sales		25,972
<b>Total</b>		<b>\$33,648</b>
	Expenses	
Personal Services		\$10,744
Employee Related Expenses		929
Resale Merchandise		6,903
Store Expenses		1,724
Museum Expenses		1,315
Department Expenses		37
Museum Mineral Collection		275
<b>Total</b>		<b>\$21,927</b>
<b>Balance 7/1/89</b>		<b>\$11,721</b>
	Printing Revolving Fund	
Balance Forward		\$4,350
Publication Sales		10,802
Publications Expenses		9,101
<b>Balance 7/1/89</b>		<b>\$6,051*</b>

\* Surplus funds in excess of \$5,000 have been transfered to the State General Fund.

a severe cut in appropriated funds. Because of that reduction, one major project has been delayed indefinitely. The three current projects are:

1. Gold and other precious metals
2. Oxide copper
3. Survey and development of markets for industrial minerals that occur in exploitable quantities in Arizona.

Two open file reports on industrial mineral markets have been published, and are available to the public. A series of metallogenic maps illustrating precious metals occurrences and the relationship to regional geological features are being prepared. An introduction to this program will be presented at the annual meeting of the Geological Society of America at St. Louis, MO in November, 1989.

The major administrative hurdle that needs to be overcome is the relocation of the Department offices and Mineral Museum. It is hoped that the El Zaribah Shrine Building on the Government Mall can be committed and remodeled for that purpose. The Facilities Management Division of the Department of Administration has completed work on the terms of the final settlement for purchase of the property from the Shrine. They have asked for bids for architectural and engineering design. Facilities Planning has predicted that remodeling and renovation will be completed and the building ready for occupancy sometime during the first half of fiscal year 1990-91.

### Goals of Department

The short goals of the Department of Mines and Mineral Resources are primarily related to moving the Department including the Mineral Museum from its present location on the State Fairgrounds to El Zaribah Shrine Building on the Government Mall, and to strengthen the engineering staff to be able to fulfill the commitment required by enabling statute.

The El Zaribah Shrine building will become the property of the State of Arizona on January 1, 1990. It is planned by the Department of Administration Facilities Planning Division to renovate and remodel the building to specifically house the Department and the Mineral Museum.

In order to prepare for the move and to be able to properly manage a vibrant new museum with the increased attendance expected at the new location, the Department will recommend that the Museum staff be expanded to include a curatorial assistant.

The Department engineering staff was reduced by two full-time employees as a result of the severe cut in appropriations for the 1989-90 Fiscal Year. While adjustments and restructuring has been done to improve productivity and still be able to meet the demands of the mining constituency served, the Department is working under severe constraints. One major resource evaluation project on sand and gravel has been delayed indefinitely. Coincidentally, the Department has been asked by the State Parks Department to do a

resource evaluation on sand and gravel associated with their Arizona Rivers Assessment Project.

One additional full-time engineer will be requested in 1990-91 Fiscal Year budget request. This position will enable the Department to do the sand and gravel and other projects that will help us meet the assigned task to promote the development of mineral resources in the state.

## **SUMMARY OF ACTIVITY**

### **Statistical Report**

The Arizona Department of Mines and Mineral Resources has a staff of eight full-time people and one half-time person. In addition to the director, there are three mining engineer/geologists, a museum curator, three administrative people and a half-time custodian. Three part-time tour guides are paid from the museum store funds for work in the Mineral Museum and to conduct classes.

During the fiscal year 1988-89, the staff responded to approximately 11,000 telephone inquiries and 4,600 visitors seeking information about rocks, minerals, mining projects, and mineral occurrences in their search for new mineral discoveries. These calls and visits are sometimes taken care of in a few minutes. More often, each inquiry requires the staff person to research the mine files or library for more detailed information about the area of interest. This can take from a few minutes to a few days. Many of the visitors spend hours of their time researching files for leads and information about mineral occurrences in the state. There were approximately 5,500 file and/or library searches conducted for this purpose during the year.

As a part of this association with the mining companies and prospectors, the staff acquires additional information that is added to our files. There were 437 new mine files created during this period.

There were 17 publications created and published by the Department during this year. These included the following: ( A complete list of publications is available at the Department offices.)

*Directory of Earth Science Clubs*

*Directory of Exploration Offices*

*Directory of Active Mines*

*Directory of Arizona Mining Consultants*

*49th Annual Report*

*The Primary Copper Industry of Arizona in 1987*

*Arizona Rockhound Guide*

*Mineral Show List*

*Maps and Books for Arizona Gold and Gold Prospecting (revised)*

*Industrial Minerals in Arizona's Paint Industry*

*Industrial Minerals in Arizona's Wallboard Joint Cement Industry*

The following list of federal and state agencies were assisted by the Department staff one or more times during the year. Work varied from a brief evaluation of a specific area to extended support for regulatory and law enforcement agencies investigating fraudulent mining schemes:

U.S. Bureau of Mines  
U.S. Forest Service  
U.S. Geological Survey  
U.S. Securities and Exchange Commission  
Federal Trade Commission  
Federal Bureau of Investigation  
State Land Department  
Bureau of Geology and Mineral Technology  
Department of Environmental Quality  
State Mine Inspector  
University of Arizona  
Department of Water Resources  
Corporation Commission - Securities Division  
Department of Commerce  
Arizona State Parks