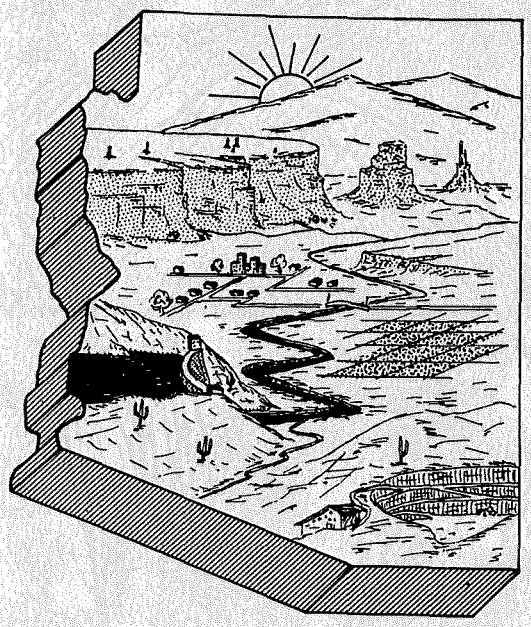
STATE OF ARIZONA BUREAU OF GEOLOGY AND MINERAL TECHNOLOGY

Earth Science and Mineral Resources in Arizona



A DIVISION OF
THE UNIVERSITY OF ARIZONA
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1979-80
ANNUAL REPORT

BUREAU OF GEOLOGY AND MINERAL TECHNOLOGY

Contents:

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SUMMARY OF ACTIVITIES DURING 1979-80

Data and Assistance. The Geological Survey Branch sells geological maps and publications, maintains geological data on open-file, and provides expertise and professional assistance to the public about geology and mineral technology upon request. During 1979-80 publication sales totaled $19,078--10% higher than last year.

More than 3,086 persons visited our offices and many others telephoned or wrote for information and/or assistance on technical problems. Rising metal prices served to nearly double the number of inquiries concerning gold and silver mining prospects in Arizona.

Research and Data Collection. Much of the data and information provided to users are derived from special research and data collection projects focusing on Arizona's geologic framework, mineral commodity resources, geological factors that effect land use, and mineral processing. Federal funds (grants/contracts) are used to supplement the State appropriation insofar as practical. Total income from federal sources exceeded $700,000--over double the state budget for the Bureau. During 1979-80 three federally funded projects were completed, two were renewed, and funding for eight new projects was received. Projects valued at over $1.5 million were in effect during the past year.

Geologic framework projects completed or in progress include a state geologic map, surficial materials map, and terrain-corrected gravity maps. Mineral commodity studies include a compilation of molybdenum and uranium occurrences, metallogenic provinces, salt deposits, and industrial minerals of Arizona. A major effort to assess the geothermal potential of Arizona is in its fourth year. A statewide overview of geologic hazards is in progress. Seismicity has been emphasized during the year. The U.S. Bureau of Mines-sponsored project for the recovery of precious metals from abandoned mine dumps in Mojave County, Arizona was completed with the conclusion that at today's gold and silver prices these metals can be economically recovered using traditional heap-leaching technology. The industry-sponsored superalloy scrap recovery project continued through 1979-80.

Administration. A factor of great importance to Bureau operation was the leasing of additional office space for occupancy at the beginning of 1980-81.

During FY 1980 Dr. Gordon Geiger, Acting Director of the Mineral Technology Branch, resigned. Recruiting took place for the vice-Rudy and vice-Vuich positions. Mr. Tom Young, a minerals processing metallurgist with extensive copper processing experience, will be filling the vice-Rudy position, beginning August, 1980. The vice-Vuich search was re-opened in May, 1980, and the position will hopefully be filled during FY 1981.

Public Service Statistics

--Performed mineralogical analysis on 316 sample lots brought to the Bureau by members of the public

Summary of Activities During 1979-80 (continued)

--Performed metallurgical process amenibility tests on over 100 lots of ore for members of the public

--Provided consultative advice to 3,086 individuals who visited the Bureau seeking advice pertaining to geology, minerals, and mining.

--Distributed 5,191 technical bulletins; 5,122 maps; and 15,000 copies of FIELDNOTES

--Made 54 visits to 26 Arizona companies and to 3 hospitals on technical matters.

--Participated in deliberations of, and provided technical assistance to:

*Governor's Commission on Arizona Environment
*Pima County Planning and Zoning
*Arizona Oil and Gas Conservation Commission
*Arizona Department of Emergency Services
*Arizona Parks Department, Natural Areas Advisory Council
*Arizona Office of Economic Planning and Development
*Arizona Department of Transportation
*Arizona Water Commission
*Arizona Land Department
*Arizona Department of Mineral Resources
*Arizona Mining Association
*U.S. Geological Survey
*U.S. Bureau of Mines
*U.S. Forest Service
*U.S. Bureau of Reclamation
*U.S. Bureau of Land Management
*Central Arizona Project
*Representative Morris K. Udall
*Representative Jim Santini
*Representative Mike McCormack
*U.S. Nuclear Regulatory Commission
*U.S. Department of Energy

--Provided lectures on geology, minerals, and mining to:

*Arizona State University
*University of Arizona
*Arizona Geological Society
*Geological Society of America
*Youth Conservation Corps
*Pima Youth Development Project
*103 talks to Elementary and Junior High Schools around the state
*Tucson Gem and Mineral Society
*Audubon Society
*Association of Engineering Geologists
*Society of Mining Engineers
*American Institute of Mining Engineers
*American Geophysical Union

Summary of Activities During 1979-80 (continued)

*U.S. Geological Survey
*Old Pueblo Lapidary Society
*Mining Club of the Southwest
*Southern Arizona Minerals Exploration Association

--Provided field trip leadership at:

*Arizona Geological Society
*Geological Society of America

Research

Projects on-going or completed during the year:

--Compilation of the Geology and Mineral Resources for the Mesa $1^{\circ} \times 2^{\circ}$ NTMS Quadrangle, Arizona - DOE/duPont - $2,692*

--Low-to-Moderate Temperature Geothermal Reservoir Site Evaluation in Arizona - DOE/DGE - $656,970 ($344,455*)

--Radioactive Material Occurrences in Arizona - DOE/Bendix Field Engineering Corp. - $54,270*

--Identification and Assessment of Geothermal Systems and Their Associated Water Resources in Arizona - DOI/WPRS - $323,489 ($75,873*)

--Historical Seismicity of Arizona - DOE/NRC - $10,146*

--Statewide Assessment of Geological Hazards in Arizona - DOI/USGS - $30,000*

--Research on the Commercialization of Geothermal Energy Management - DOE/DGE - $73,000 ($9,093*)

--Survey of the Occurrence of Molybdenum and Molybdenum-Bearing Minerals in the State of Arizona - DOI/USGS - $18,000 ($3,000*)

--Leach Test Evaluation of WASPALLOY Grinding Dust - Special Metals Co. - $62,727 ($57,727*)

--A Market Potential/Penetration Analysis Report for Geothermal Direct Heat Applications in the State of Arizona - DOE/DGE - $9,000*

--Operation of Tucson Station of the Worldwide Standardized Seismograph Network - DOI/USGS - $10,298 ($3,881*)

--Interpretation of Historical Earthquake Reports and Seismically-Induced Surface Phenomena - DOI/USGS - $28,210*

--Evaluation of the Geothermal Resources of the Phoenix-Tucson Basin - DOI/WPRS - $64,846*

--Computerized Resources Information Bank - DOI/USGS - $14,799*

Summary of Activities During 1979-80 (continued)

--A Study of Uranium Favorability of Cenozoic Sedimentary Rocks--Basin and Range Province, Arizona - DOI/USGS - $30,000

--Arizona Geothermal Resource Potential - DOE/DGE - $343,937

Total Value of Projects On-going - $1,732,384

Total Value of New Projects Added or Supplemented This Year - $707,992

Major Publications

--An Oligocene (?) Colorado Plateau Edge in Arizona

--Stacked Overthrust Faults in West-Central Arizona

--Environmental Geology of McDowell Mountain Area (a 10 map series of land-use maps)

MAJOR STRENGTHS

The Bureau of Geology and Mineral Technology is the earth science and mineral resource experimental and information agency of the State. One such organization exists in every state except Rhode Island. Its major strength lies in its affiliation with the University of Arizona and the College of Mines. This affiliation affords the Bureau the freedom from the regulatory, promotional, and policy-making responsibilities of most state agencies and the opportunity to be objective in its scientific and practical interpretation of natural phenomena. Further, the Bureau as a public service agency requires accessibility to the public. Its location near the University campus in the heart of the major mineral-producing area of the State is a decided asset to its geological, mining, and metallurgical services. Changing the name of the organization from the Arizona Bureau of Mines to the Bureau of Geology and Mineral Technology, as was done in 1977, has helped to identify the mission and purpose of the organization. The relocation of the personnel of the Geological Survey Branch of the Bureau to the Arid Lands Information Building in the Marshall Foundation shopping center has helped the Bureau's public relations immeasurably.

The Bureau's expertise lies in the areas of energy and mineral resources, natural hazards and geologic history--all of which are of great importance to the state and to the nation as we approach energy and raw material shortages and increased population. More and more important decisions involving the land and its resources must be made by planners, administrators, and elected officials which should be based on all available information. Deriving and providing such information is the Bureau's main reason for existing. The need for geologic data and assistance has never been greater than it is now and that need is constantly increasing. We have a competent staff who, with adequate support, can work to meet these needs.

The state is the leading producer of metals in the nation and has tremendous potential for future discoveries of metallic and nonmetallic deposits. Exploration is active. New geologic interpretations have recently been proposed and are now being tested by drilling.

Population in the Sun Belt is increasing rapidly and, as a result, more demands are being made on our mineral, land and water resources. Mineral and water resources must be available for this growth and development to continue. Additional demands are being made for recreation and wilderness areas. With a limited amount of land and a conflict over what it should be used for, it is essential that we understand the geologic framework, know what and where the resources are located, and identify potential hazards and/or limitations to development. In short, the time is right - the opportunity is present - for us to make a real contribution to the citizens of Arizona in encouraging wise use of their land.

Lastly, the new expanded quarters of the Bureau, in the basement of the Park Avenue complex of the Marshall Foundation, will prove to be a major strength because for the first time the Bureau has space to house the majority of its professional staff at one location. As mentioned above, this address has already greatly improved the access of the public to the Bureau's resources.

OUTSTANDING RECOGNITIONS

William H. Dresher - Chairman, Committee on Mineral Technology, National Academy of Science and National Academy of Engineering

- Member, the Research and Development Council of the American Management Associations

- Consultant, Division of Policy Research and Analysis, National Science Foundation

- Member, Technical Auditing Committee, Occidental Research Corporation

- Member, Mineral Economics Committee, Cabot Corporation

- Chairman, Henry Krumb Distinguished Lecture Committee, AIME

- Member, Robert Earll McConnell Award Committee, AIME

- Member, Board of Directors, Mining and Metallurgical Society of America

Larry D. Fellows - Appointed Secretary, State Mapping Advisory Committee

MAJOR LIMITATIONS

Arizona is one of the largest states, is the leader in production of metallic mineral resources, is rapidly increasing in population, and has a variety of potential geologic hazards. In spite of this, the geologic framework is poorly understood and geologic maps and data of the type needed are not available. The State Geological Survey is grossly underfunded and its staff are spread thin. New Hampshire and Vermont are the only states in this nation in which the state appropriation to the state geological survey is lower than in Arizona. If it were not for the use of federal grants, Arizona's effort would be embarrassing. However, the effort required for the administration of these grants has significantly reduced the ability of our state-funded professionals to do research and collect data.

We lack expertise in geologic mapping and in identification of geologic hazards. Mapping needs will be met when the vice-Vuich position is filled. However, a state-funded position to identify geologic hazards and land-use limitations is desperately needed. Most of the expertise in this area is now being provided by federally-funded employees. The state has not yet recognized its responsibilities in this area.

Another major limitation is in the area of educating the public about the state's geology. We should be playing an aggressive role in providing this information--in non-technical terms for the non-geologist. Unfortunately, manpower limitations on the Bureau prevent us from doing an adequate job in this area.

Finally, one of the responsibilities specified in our statutes is to maintain a library of rock cuttings and cores. Because of space and personnel limitations, we are not meeting this responsibility. We need to plan and mount an aggressive program to accomplish this. By working cooperatively with mineral exploration companies, we could acquire, at no cost to the state, far more core than we could accommodate. This would not require legislation. All the State would be required to do would be to house the core. Such a core library would be valuable not only to mineral exploration companies, but also to those engaged in highway and other civil construction.

An additional space problem is that the Bureau has only one laboratory equipped to carry out research and ore testing. At times as many as five simultaneous projects are conducted in this laboratory. Such diverse and crowded use of one laboratory leads to confusion, low efficiency, mistakes, and represents a safety hazard. Ventilation in this laboratory is grossly inadequate and the problems seem to be unsolvable by the Division of Physical Resources.

Lastly, the budgeting treatment of the Bureau as a research unit of the University is a detriment to its operations in times of budget restrictions to education. This is well demonstrated by the funding restrictions the Bureau has suffered in support of its professional staff. The Bureau is a statutory unit of the State government and is a research and information arm of the State as well. While funding is sought and obtained from non-state sources (1978-79 and 1979-80 non-state funds have exceeded state funds by a factor of two!), in view of the Bureau's mission, it is entirely appropriate for the State to be the major contributor to the Bureau's budget.

FUTURE PLANS

Geological Survey Branch

On two occasions we have asked the State legislation for funding to produce an up-to-date series of geologic maps at a scale of 1:250,000 (one inch equals four miles). Both times our efforts have been unsuccessful. Clearly this is the Geological Branch's top priority and efforts will be continued during the 1980-81 Legislation Session to obtain this funding. The still vacant vice-Vuich position will be filled this year with a person experienced in Arizona geology, skilled at geologic mapping, interested in field work and geologic mapping, and willing to accept responsibility for geologic mapping and working closely with the mapping program.

Once an accurate, up-to-date geologic map series is available, other companion maps should be produced at the same scale. Such a series should include gravity, aeromagnetic, surficial materials, faults, tectonic features, structure contours, seismicity, lithofacies, mineral occurrences, potential hazards, etc.

The cadre core of state funded employees should be modestly expanded to include a position responsible for urban geology activities (we have requested such a position for three years without success), and a position to inform the public, in non-technical terms, about Arizona's geological attributes. Federal funds should be relatively easy to obtain in support of hazards identification; however the state must also share in this responsibility.

Arizona is the nation's leading producer of copper and ranks high in production of other metals. Much of the geologic framework effort being made by the Bureau relates directly to these resources. In addition, Arizona has an abundance of non-metallic or industrial mineral resources (limestone, clay and shale, sand and gravel, zeolites, etc.) and energy resources (coal, oil, and gas, uranium, etc.) that need much more definition.

Better methods of making geological concepts, data, and interpretive reports available to the public must be considered. Printing costs have escalated and careful consideration must be given to what should be printed, what should be printed in color, and what should be placed on open-file and made available to users in a timely, economical way.

Finally, much more effort must be given to reach out to the public (particularly elementary and secondary school teachers), industry, and other state agencies in order to provide the necessary geologic information and data and to do it in a cooperative, participative fashion. Cooperation and coordination must be our theme. We must continue to be objective, to provide the types of data required, and to maintain credibility and accountability. Special emphasis will be given to maintaining and expanding our interactions and cooperation with other local and state agencies that are in need of geologic data and assistance.

Mineral Technology Branch

With the addition of an experienced mineral processing specialist to the Bureau staff, we are now in a better position to respond to the copper industry's needs of technical assistance and innovative research. Mr. Tom Young will have the responsibility of developing these programs in the coming year.

Future Plans (continued)

The major new activity to be initiated by the Bureau during 1980-81 is a Mine Safety and Health educational, research, and public service program to be operated in cooperation with the Arizona Center for Occupational Safety and Health (ACOSH) and the College of Mines. The program has been initiated under the sponsorship of the National Institutes of Safety and Health (NIOSH) of the U.S. Department of Labor and is the only one of its kind in the country. An industrial hygienist with mining experience is being recruited to operate the program.

Dr. Douglas Robinson of the Bureau and Dr. Thomas O'Keefe of the University of Missouri-Rolla have scheduled the presentation of a short course on electrometallurgy during the semester break. In addition, Dr. Robinson will be teaching a course in engineering design and cost analysis replacing Dr. Geiger in the Department of Metallurgical Engineering