Arizona Bureau of Geology and Mineral Technology
FIELDNOTES
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Geologic History of the South Mountains

Figure 1. Aerial photograph of the South Mountains near Phoenix, Arizona, looking southwest.

by Stephen J. Reynolds

Assistant Geologist
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The South Mountains, located immediately south of Phoenix, contain rocks that were formed by movement on a major, recently recognized fault. Geologists and other interested persons can find evidence of this faulting and other geologic events along paved roads and maintained hiking trails within the City of Phoenix South Mountains Park, which includes most of the South Mountains. This article presents a short summary of the geologic history of the South Mountains. An in-depth discussion of the geology of the area is contained in the Arizona Bureau of Geology and Mineral Technology Bulletin 195 (in press).

The South Mountains are composed of two main rock types, each of which forms approximately half of the range (Figures 1 and 2). The western half of the range contains metamorphic rocks that are dark colored with numerous light-colored bands (Figure 3). These rocks were formed under high temperatures and pressures during the Precambrian Era, approximately 1.7 billion years ago. The layering in the rocks was produced by compression within a volcanic arc that flanked some long-vanished, ancestral ocean.

The eastern half of the South Mountains contains granitic rocks that are salt-and-pepper colored on freshly broken surfaces (Figure 4), but are generally coated by a brown or tan veneer of

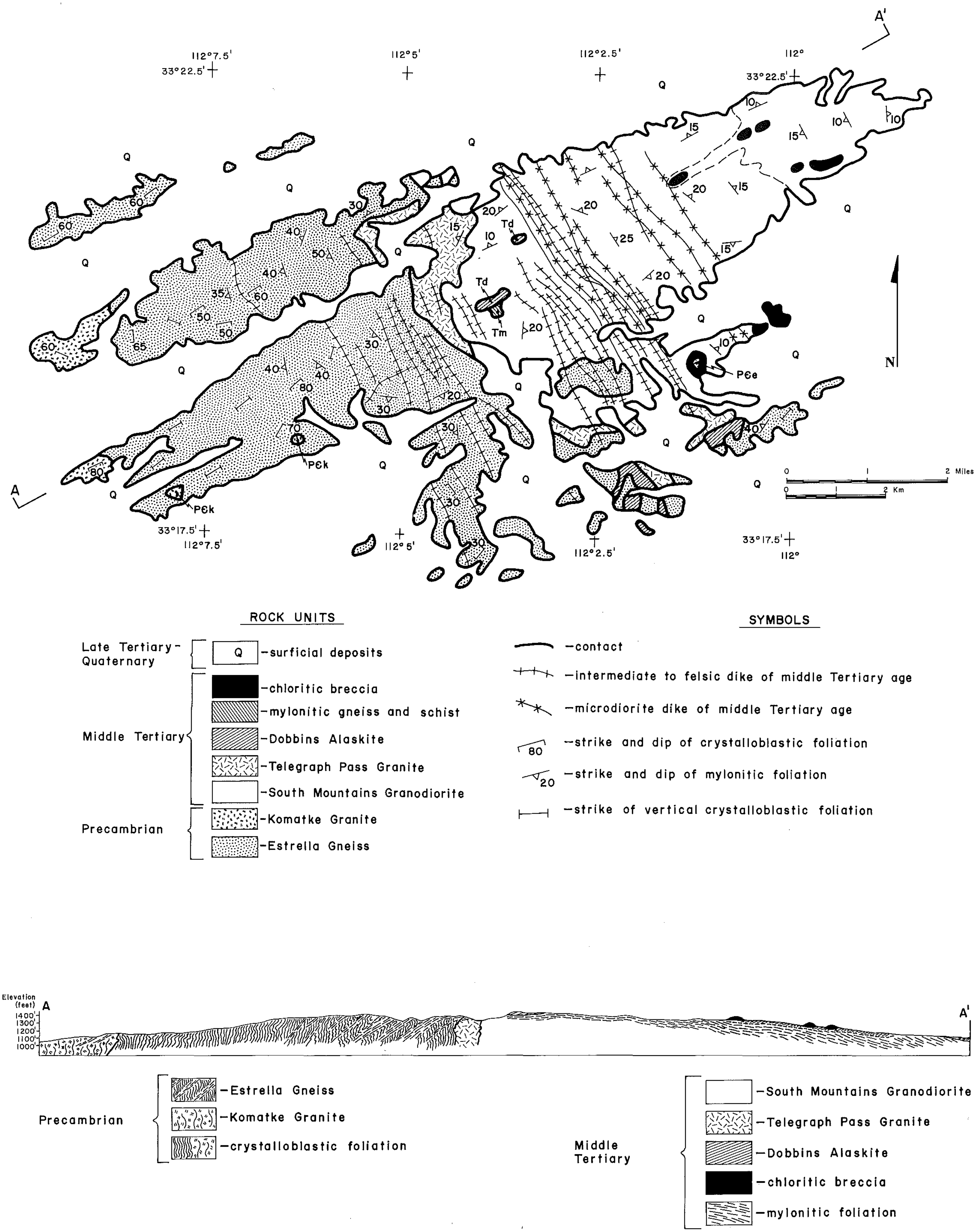


Figure 2. *Simplified geologic map and cross section of the South Mountains.*

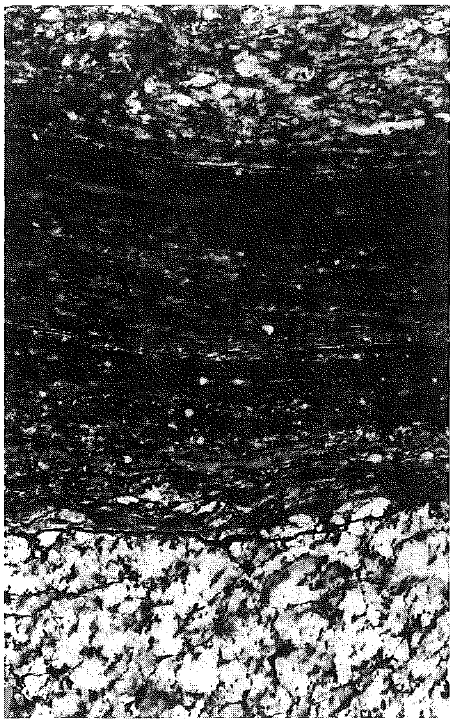


__Figure 3 (top left).__ Photograph of Precambrian metamorphic rocks (Estrella Gneiss). The rocks are strongly color banded due to an alternation of light-colored, quartz- and feldspar-rich layers, and dark-colored layers composed of biotite, hornblende, and epidote.

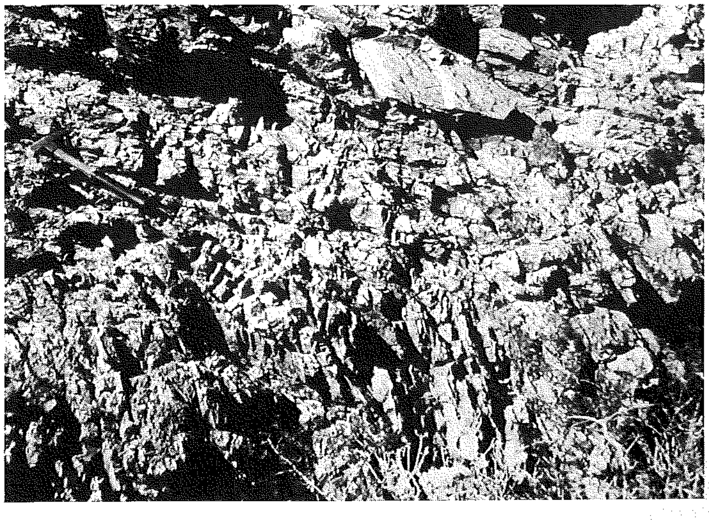
__Figure 4 (bottom left).__ Photograph of unsheared Cenozoic granitic rocks (Telegraph Pass Granite). Note the lack of foliation (planar orientation of minerals) in the rock, compared with the rock in Figure 5.

__Figure 5 (above).__ Photograph of 5-cm-thick sheared zone within Cenozoic granitic rock (South Mountains Granodiorite) from the top of the range. Note the well-developed foliation in the granite within the sheared zone. This sample illustrates how shearing can drastically alter the overall appearance of granitic rocks.

__Figure 6 (below).__ Photograph of breccia formed by continual faulting under brittle conditions. Note the numerous fractures and angular fragments in the rock.

desert varnish. These rocks were formed in the Cenozoic Era only 25 million years ago when molten rocks solidified in a large chamber several miles below the earth's surface. The granites are the same age as volcanic rocks of similar composition that dominate the landscape of the Superstition Mountains east of Phoenix.

While the granites were cooling and crystallizing, they were sheared by movement on a major, gently inclined fault zone that was discovered during geologic mapping of the range. The shearing took place at high enough temperatures, perhaps 300° to 400° C, to produce a foliation, or planar orientation of minerals, in granitic rocks on top of the range (Figure 5). As the granitic rocks continued to cool, the shearing became increasingly brittle and formed a breccia, a rock composed of angular fragments (Figure 6). The fault responsible for this shearing is no longer active and is not likely to cause earthquakes, but is probably present at depth below most of Phoenix, Tempe, and Mesa. Movement on the fault is responsible for the southwest tilt of the Cenozoic volcanic and sedimentary rocks of Camelback Mountain, Tempe Buttes, and Papago Park.



Cooperative Geologic Mapping

by Larry D. Fellows
State Geologist and Assistant Director
Arizona Bureau of Geology
and Mineral Technology

The U.S. Geological Survey (USGS) and the Arizona Geological Survey (Geological Survey Branch of the Arizona Bureau of Geology and Mineral Technology) have entered into a joint-funding agreement to do geologic mapping in the Phoenix quadrangle (scale 1:250,000). Figure 1 shows the location and status of geologic mapping at this scale throughout Arizona.

This project is part of the Federal-State Cooperative Geologic Mapping Program (COGEOMAP) initiated by the USGS in Fiscal Year 1984-85, which began October 1, 1984. Dr. Juergen Reinhardt is the USGS COGEOMAP coordinator; Dr. Stephen J. Reynolds, Arizona Geological Survey, is the project leader.

In Fiscal Year 1984-85, the Arizona Geological Survey will spend an estimated $64,626 in salaries and support for geologic mapping. That figure will be matched by the USGS, which will provide $45,685 to the Arizona Geological Survey and will spend $18,941 in salaries and support for geologic mapping by USGS geologists. In addition, the Bureau of Land Management has provided 1,100 color aerial photographs for use in the project.

The purpose of COGEOMAP, a component of the USGS' Geologic Framework and Synthesis Program, is to accelerate geologic mapping and production of high-quality geologic and geophysical maps in States that place a high priority on obtaining baseline geologic information. One aspect of the USGS' basic mission is to provide information about the geologic structure of the Nation. As outlined in their respective enabling acts, most State geological surveys have responsibility for determining the geologic framework of their States. This responsibility includes preparing geologic maps. By working together, State geological surveys and the USGS can jointly evaluate areas to be mapped so that both national and State needs are met. In addition, the possibility of duplicating efforts will be reduced.

In response to the USGS' request for COGEOMAP proposals in early 1984, 48 proposals from 35 States were submitted. Planning and discussion of the proposals took place during the year (Figure 2).

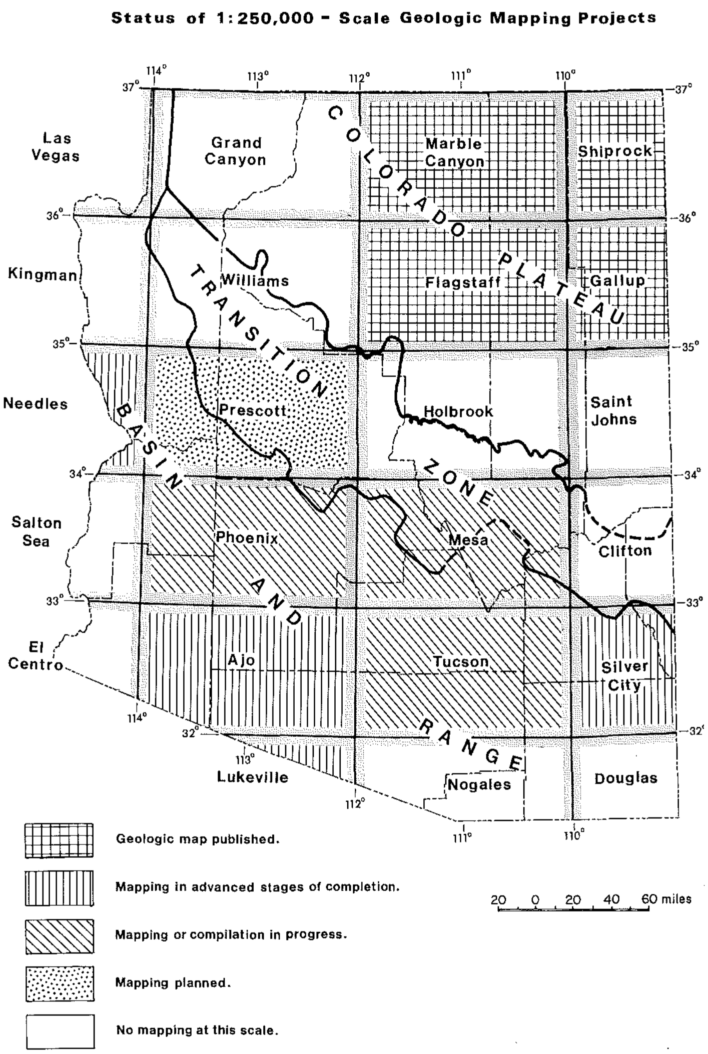


Figure 1.

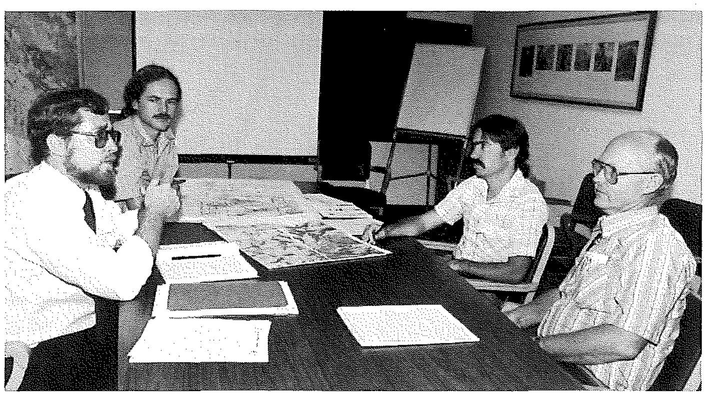


Figure 2. Representatives from the U.S. Geological Survey and the Arizona Geological Survey discuss the COGEOMAP proposal. From left to right: Juergen Reinhardt, USGS COGEOMAP Coordinator; Jon E. Spencer and Stephen J. Reynolds, research geologists, Arizona Geological Survey; and Larry D. Fellows, State Geologist and Assistant Director, Arizona Geological Survey.

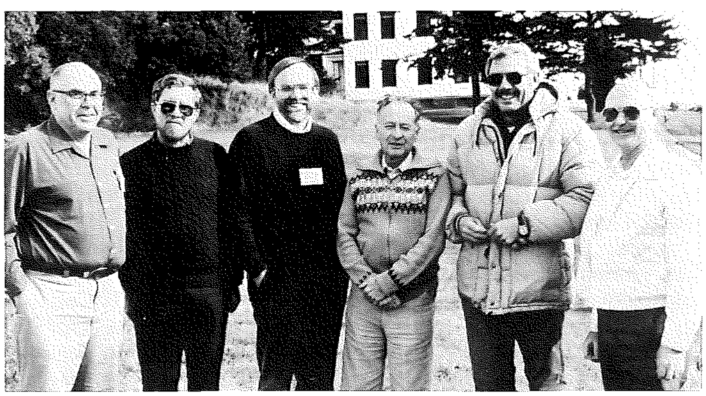


Figure 3. COGEOMAP participants from the U.S. Geological Survey and western State geological surveys meet in Port Townsend, Washington. From left to right: John H. Schilling, Director and State Geologist, Nevada Bureau of Mines and Geology; Juergen Reinhardt, COGEOMAP Coordinator, U.S. Geological Survey; Robert M. Hamilton, Chief Geologist, U.S. Geological Survey; Frank E. Kottlowski, Director, New Mexico Bureau of Mines and Mineral Resources; Ross G. Schaff, State Geologist and Director, Alaska Division of Geological and Geophysical Surveys; and Larry D. Fellows, State Geologist and Assistant Director, Arizona Bureau of Geology and Mineral Technology.

COGEOMAP was one of the discussion topics at the USGS-State Geological Survey Western States meeting in Port Townsend, Washington in November 1984. Other western State geological survey participants in COGEOMAP are Alaska, Nevada, New Mexico, Oregon, and Wyoming (Figure 3).

The Phoenix quadrangle was chosen because the geology is complex and not well understood. During the past 4 years, Arizona Geological Survey geologists Stephen J. Reynolds and Jon E. Spencer have completed 1:24,000-scale geologic maps in the Little Harquahala, Granite Wash, Merritt Pass, and South Mountains. This new mapping has resulted in the discovery of previously unknown rocks of Paleozoic and Mesozoic age as well as major, previously unrecognized, thrust faults that have regional tectonic and economic significance.

During this field season, Arizona Geological Survey geologists Reynolds, Spencer, George Allen, Curtis Kortemeier, Chris Capps, and James Stimac are working in the Bouse Hills and the Harcuvar, Harquahala, and Big Horn Mountains (Figure 4).

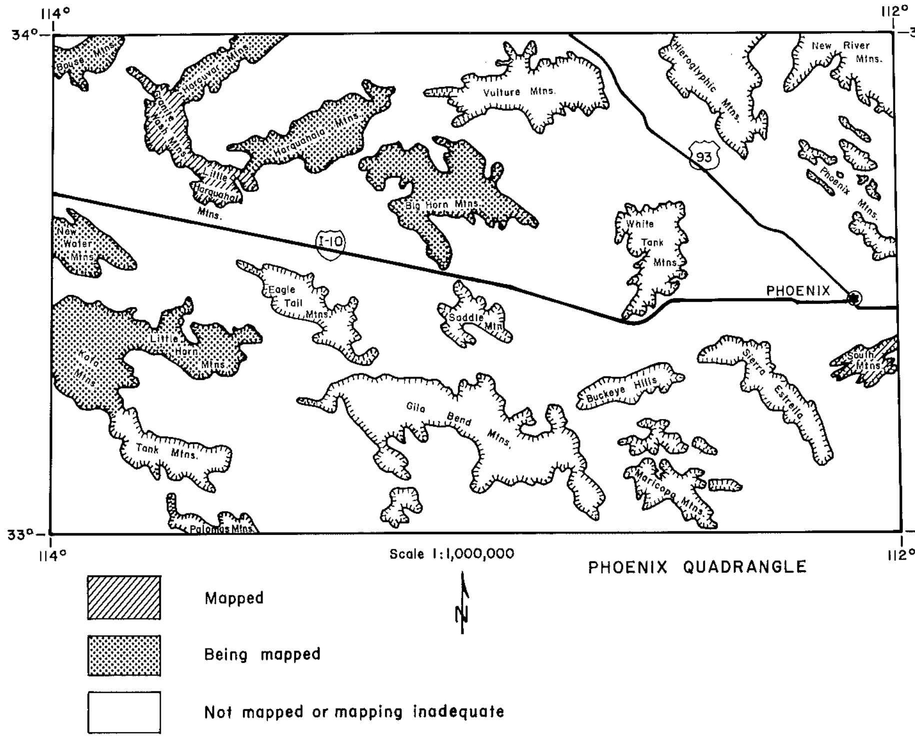
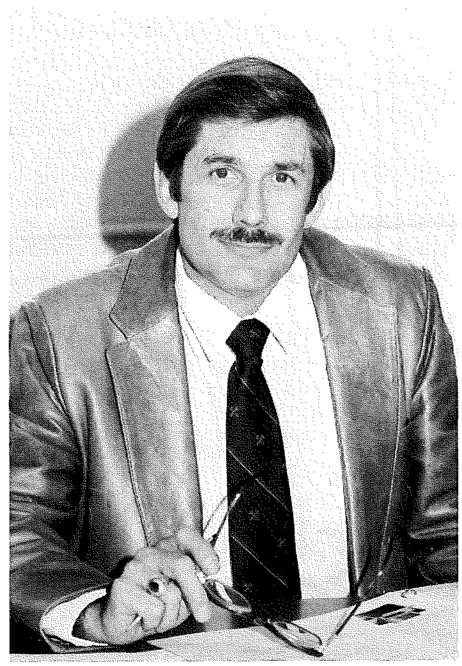


Figure 4. *Status of geologic mapping in the Phoenix quadrangle.*

Mineral Technology Branch Receives New Assistant Director



Ken Matesich

Dr. J. Brent Hiskey, research professor of metallurgy at the University of Arizona, has been named the new assistant director of the Mineral Technology Branch of the Arizona Bureau of Geology and Mineral Technology.

Dr. Hiskey joined the Bureau last July after 3 years of teaching experience at the New Mexico Institute of Mining and Technology and 8½ years of industrial research with ALCOA Laboratories, U.S. Steel Research Laboratories, and Kennecott. The latter position included 4½ years as Manager of Metallurgical Research. Dr. Hiskey has also served as a consultant to three major corporations.

In addition to heading the Mineral Technology Branch, Dr. Hiskey will assist Dr. Orlo Childs, Director of the Arizona Mining and Mineral Resources Research Institute (MMRRI). Dr. Hiskey will assume the directorship upon Dr. Child's retirement on June 30, 1985.

Dr. Hiskey is a member of the American Institute of Mining and Metallurgical Engineers (AIME), Sigma Xi (the national honorary scientific society), and the Canadian Institute of Mining and Metallurgy. He has served on numerous AIME committees, and has been an invited lecturer at two metallurgical symposia. He is the author or coauthor of 24 scientific papers and the editor of 4 books. *Gold and Silver—Leaching, Recovery, and Economics*, which he edited with W. J. Schlitt and W. C. Larson, received the 1981 SME-AIME Book Publishing Award. His most recent book is *Gold and Silver—Heap and Dump Leaching Practice*.

Dr. Hiskey received his B.S., M.S., and Ph.D. degrees in metallurgy from the University of Utah. His research interests include hydrometallurgy and mineral processing, specifically the physical chemistry of leaching, cementation, ion exchange, and solvent extraction. His current research includes novel methods for recovering gold and silver.

Dr. Hiskey succeeds Dr. William G. Davenport, who has served as acting assistant director of the Mineral Technology Branch for 3½ years. Dr. Davenport will remain as chairman of the Department of Metallurgical Engineering, a position he has held since 1981.

Recent Publications on the Geology of Arizona

The following publications were recently added to the Bureau library, where they may be examined during regular working hours. Copies may also be examined in or obtained from the respective offices:

U.S. Bureau of Mines

Mineral Land Assessment Reports: Intermountain Field Operations Center, Bldg. 20, Federal Center, Denver, CO 80225.

Open-File Reports: National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

U.S. Geological Survey

Maps: Western Distribution Branch, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225.

Open-File Reports: Open-File Services Section, Western Distribution Branch, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225.

Special Report: District Chief, U.S. Geological Survey, Box FB-44, Federal Bldg., 300 W. Congress St., Tucson, AZ 85701.

All other publications: Eastern Distribution Branch, Text Products Section, U.S. Geological Survey, 604 S. Pickett St., Alexandria, VA 22304.

Museum of Northern Arizona, Rt. 4, Box 720, Flagstaff, AZ 86001.

University of Arizona, Dept. of Geosciences, Tucson, AZ 85721.

U.S. Bureau of Mines

Mineral Land Assessment Reports

MLA 27-84 Harris, A. D., and Ryan, G. S., 1984, Mineral investigation of the Starvation Point Wilderness Study Area, Mohave County, Arizona and Washington County, Utah, 14 p., scale 1:24,000.

MLA 31-84 McDonnell, J. R., 1984, Mineral investigation of the Mount Trumbull Wilderness Study Area, Mohave County, Arizona, 7 p.

MLA 37-84 McDonnell, J. R., Jr., 1984, Mineral investigation of the Hack Canyon Wilderness Study Area, Mohave County, Arizona, 15 p.

Open-File Reports

OFR 179(1)-84 Hambley, D. F., Pariseau, W. G., and Singh, M. M., 1983, Guidelines for open-pit ore pass design, volume 1 – final report, 170 p.

OFR 179(2)-84 Hambley, D. F., and Singh, M. M., 1983, Guidelines for open-pit ore pass design, volume 2 – design manual, 159 p.

OFR 185-84 Pima Association of Governments, 1983, Ground-water monitoring in the Tucson copper mining district, 99 p.

OFR 201-84 Malhotra, S., and others, 1984, Recovery of manganese from low-grade domestic sources, 171 p.

U.S. Geological Survey

Circulars

897 Ege, J. R., 1984, Formation of solution-subsidence sinkholes above salt beds, 11 p.

930-B DeYoung, J. H., Jr., Lee, M. P., and Lipin, B. R., 1984, International strategic minerals inventory summary report – chromium, 41 p.

930-C Krauss, U. H., Saam, H. G., and Schmidt, H. W., 1984, International strategic minerals inventory summary report – phosphate, 41 p.

931 Peterson, J. A., 1984, Arizona mineral resource data – information available through the U.S. Geological Survey Mineral Resource Data System, 31 p.

942 Schmoker, J. W., Michalski, T. C., and Worl, P. B., 1984, Nonprofit sample and core repositories open to the public in the United States, 102 p.

Maps

I-1505 Peterson, J. A., 1984, Metallogenetic maps of the ophiolite belts of the western United States, 16 p., scale 1:2,500,000.

I-1523 Luedke, R. G., and Smith, R. L., 1984, Map showing distribution, composition, and age of late Cenozoic volcanic centers in the western conterminous United States, scale 1:2,500,000.

MF-1412-C Moss, C. K., and Abrams, G. A., 1985, Geophysical maps of the North End Roadless Area, Chiricahua Mountains, Cochise County, Arizona, scale 1:50,000, 2 sheets.

MF-1521-F Kreidler, T. J., 1984, Mine and prospect map of the Dragoon Mountains Roadless Area, Cochise County, Arizona, scale 1:50,000.

MF-1567-B Gerstel, W. J., 1985, Geochemical map of the Rattlesnake Roadless Area, Coconino and Yavapai Counties, Arizona, scale 1:24,000.

MF-1568-A Weir, G. W., Beard, L. S., and Ellis, C. E., 1983, Mineral resource potential map of the Fossil Springs Roadless Area, Yavapai, Gila, and Coconino Counties, Arizona, 12 p., scale 1:24,000.

MF-1568-B Davis, W. E., and Weir, G. W., 1984, Aeromagnetic map of the Fossil Springs Roadless Area, Yavapai, Gila, and Coconino Counties, Arizona, scale 1:24,000.

MF-1573-A Wrucke, C. T., and others, 1983, Mineral resource potential map of the Mazatzal Wilderness and contiguous roadless area, Gila, Maricopa, and Yavapai Counties, Arizona, 15 p., scale 1:48,000.

MF-1577-A Wolfe, E. W., Wallace, A. R., McColly, R. A., and Korzeb, S. L., 1983, Mineral resource potential map of the Arnold Mesa Roadless Area, Yavapai County, Arizona, 10 p., scale 1:24,000.

MF-1614-A Wrucke, C. T., and others, 1983, Mineral resource potential map of the Whetstone Roadless Area, Cochise and Pima Counties, Arizona, 10 p., scale 1:48,000.

MF-1614-B Wrucke, C. T., and Armstrong, A. K., 1984, Geologic map of the Whetstone Roadless Area and vicinity, Cochise and Pima Counties, Arizona, scale 1:48,000.

Open-File Reports

83-819 Wardlaw, B. R., Harris, A. G., and Schindler, K. S., 1985, Thermal maturation values (conodont color alteration indices) for Paleozoic rocks in Arizona, 14 p.

84-276 Hopkins, R. T., Campbell, W. L., Fox, J. P., and Antweiler, J. C., 1984, Analytical results and sample locality map of stream-sediment, panned-concentrate, rock, and water samples from the Narrows, Lime Hills, and Sand Cove Wilderness Study Areas, Mohave County, Arizona, 23 p., scale 1:50,000.

84-288 Hopkins, R. T., Fox, J. P., Campbell, W. L., and Antweiler, J. C., 1985, Analytical results and sample locality map of stream-sediment, panned-concentrate, rock, and water samples from the Andrus Canyon, Grassy Mountain, Last Chance Canyon, Mustang Point, Nevershine Mesa, Pigeon Canyon, and Snap Point Wilderness Study Areas, Mohave County, Arizona, 34 p., scale 1:50,000.

84-410 Erickson, M. S., Arbogast, B. F., Marsh, S. P., and McDougal, C. M., 1984, Analytical results and sample locality map of rock samples from the Mazatzal Wilderness and contiguous roadless areas, Gila, Maricopa, and Yavapai Counties, Arizona, 45 p., scale 1:48,000.

84-629 (A-M) Richter, D. H., and Sharp, W. N., 1984, Mineral resource potential of the Silver City 1° x 2° quadrangle, New Mexico-Arizona, scale 1:250,000.

Map A Geologic map.
Map B Copper resource potential.
Map C Molybdenum resource potential.
Map D Zinc and lead resource potential.
Map E Gold and silver resource potential.
Map F Tin resource potential.
Map G Iron, nickel, and cobalt resource potential.
Map H Manganese and manganese-iron resource potential.

Map I Tungsten and beryllium resource potential.
Map J Uranium resource potential.
Map K Fluorite resource potential.
Map L Zeolites and diatomite resource potential.
Map M Area in which resource potentials are designated; area in which no resource potential is designated.

84-662 Smith, D. B., Tosdal, R. M., Adrian, B. M., and Vaughn, R. B., 1984, Assessment of mineral resources in the Muggins Mountains Bureau of Land Management Wilderness Study Area (AZ-050-53A), Yuma County, Arizona, 34 p.

84-787 Goudarzi, G. H., comp., 1984, Guide to preparation of mineral survey reports on public lands, 51 p.

85-46 Adam, D. P., Hevly, R. H., and Diggs, R. E., 1985, Pollen data from a 2.93-meter Holocene lacustrine section from Walker Lake, Coconino County, Arizona, 13 p.

Professional Papers

437-I Ireland, R. L., Poland, J. F., and Riley, F. S., 1984, Land subsidence in the San Joaquin Valley, California, as of 1980, 93 p., 1 plate.

1259 Bohannon, R. G., 1984, Nonmarine sedimentary rocks of Tertiary age in the Lake Mead region, southeastern Nevada and northwestern Arizona, 72 p., scale 1:750,000.

1303 Creasey, S. C., 1984, The Schultze Granite, the Tea Cup Granodiorite, and the Granite Basin Porphyry—a geochemical comparison of mineralized and unmineralized stocks in southern Arizona, 41 p.

Special Report

White, N. D., and Fields, R. L., 1984, Bibliography of water-resources reports for Arizona through 1982, 152 p.

Water-Supply Papers

2223 Aldridge, B. N., and Eychaner, J. H., 1984, Floods of October 1977 in southern Arizona and March 1978 in central Arizona, 143 p., 6 plates.

2228 Peters, N. E., 1984, Evaluation of environmental factors affecting yields of major dissolved ions of streams in the United States, 39 p.

Other Publishers

Museum of Northern Arizona

Morales, Michael, ed., 1984, Abstracts of the symposium on southwestern geology and paleontology, 18 p.

University of Arizona

Ely, L. L., and Baker, V. R., comp., 1985, Geomorphic surfaces in the Tucson basin, Arizona—a field guidebook, 149 p.

REGISTRATION OF GEOLOGISTS

Are geologists required by law to be registered to practice in the State of Arizona? Because we are commonly asked this question, we have included the following information. The code of the State Board of Technical Registration, based on the Arizona Revised Statutes, specifies that a person desiring to practice the professions of architecture, assaying, engineering, geology, landscape architecture, or land surveying must first secure a certificate of registration and comply with prescribed conditions.

"Geological practice" is defined as "any professional service or work requiring geological education, training, and experience, and the application of special knowledge of the earth sciences to such professional services as consultation; evaluation of mining properties, petroleum properties, and groundwater resources; professional supervision of exploration for mineral natural resources including metallic and nonmetallic ores, petroleum, and groundwater; and the geological phases of engineering investigations."

A geologist is a person who, "by reason of his special knowledge of the earth sciences and the principles and methods of search for and appraisal of mineral or other natural resources acquired by professional education and practical experience, is qualified to practice geology as attested by his registration as a professional geologist. A person employed on a full-time basis as a geologist by an employer engaged in the business of developing, mining, or treating ores and other minerals shall not be deemed to be engaged in geological practice for the purposes of this chapter if he engages in geological practice exclusively for and as an employee of such employer and does not hold himself out and is not held out as available to perform any geological services for persons other than his employer."

A "geologist-in-training" is "a candidate for registration as a professional geologist who is a graduate of a school approved by the board or who has had four years or more of education or experience, or both, in geological work which meets standards specified by the board in its rules. In addition, the candidate shall have passed the geologist-in-training examination."

The Board of Technical Registration publishes and sells a list of active registrants. This roster includes both an alphabetical list of registrants and a numerical list by registration number. All disciplines registered by the board are included in each list. A separate list of registered geologists (or of any of the other disciplines) may be purchased from the board for a special fee.

As part of the Sunset Review process, the Auditor General recently conducted a performance audit of the Board of Technical Registration. Findings of the audit will be discussed by the legislature to determine whether to continue the board as is or modify it. The audit team concluded that registration of geologists, assayers, and landscape architects is unnecessary and recommended that the legislature take appropriate action to delete those disciplines from the purview of the Board of Technical Registration.

As of January 1985, there were 239 geologists registered in Arizona, 130 of whom reside in the State.

For information about registration requirements, please write the office of the Board of Technical Registration, 1645 W. Jefferson, Suite 140, Phoenix, AZ 85007, or telephone (602) 255-4053.

OPEN-FILE REPORTS published by the Arizona Bureau of Geology and Mineral Technology in 1984 are listed below. They can be examined in the Bureau library during regular working hours or purchased for the amounts indicated.

84-1 Morrison, R. B., 1984, Late Pliocene and Quaternary geology, Ajo quadrangle, scale 1:250,000 ($3.00, plus $1.75 shipping and handling charge).

84-2 Morrison, R. B., 1984, Late Pliocene and Quaternary geology, El Centro quadrangle, scale 1:250,000 ($3.00, plus $1.75 shipping and handling charge).

84-3 Morrison, R. B., 1984, Late Pliocene and Quaternary geology, Lukeville and Sonoyta, scale 1:250,000 ($3.00, plus $1.75 shipping and handling charge).

84-4 Reynolds, S. J., and Spencer, J. E., 1984, Preliminary geologic map of the Aguila Ridge-Bullard Peak area, west-central Arizona, scale 1:24,000 ($2.00, plus $1.75 shipping and handling charge).

84-5 Scarborough, R. B., and McGarvin, T. G., 1984, Update of published geologic maps of Arizona, November 1982–June 1984, scale 1:1,000,000 ($2.00, plus $1.75 for shipping and handling charge).

Computerizing Arizona Geology

by Stephen J. Reynolds

The Arizona Bureau of Geology and Mineral Technology has a legislated responsibility to conduct geologic research and communicate the results to the legislature, governmental agencies, industry, and the general public. The Bureau is also a repository of geologic information, including maps, publications, well cuttings, and theses. In the past decade, information on the geology and mineral resources of Arizona has been published at an accelerated pace, which has made it increasingly difficult for an individual or organization to keep abreast of the latest research developments. To help manage this information explosion, the Bureau has purchased four microcomputers capable of word processing, database management, and scientific computing.

PRESENT USES

Word Processing

The Bureau uses its microcomputers extensively for word processing. Texts are entered or even composed at the keyboard by typists, editors, and geologists. Once the text is entered, it can be easily edited and rewritten without retyping the entire document. Final versions of letters, grant proposals, and manuscripts for Bureau and non-Bureau publications are printed on one of three printers. Manuscripts can be printed in camera-ready form, thus saving costs and eliminating delays and typographic errors that arise during typesetting. Bulletin 195, now in press, was prepared in this manner. *Fieldnotes* is typeset directly from a floppy disk that the Bureau provides to the typesetter.

Database Management

The Bureau microcomputers are used for management of both geologic and administrative data. The *Fieldnotes* mailing list has been transferred from the main University of Arizona computer to the Bureau microcomputers. This has given the Bureau greater control over additions, deletions, and revisions. The *Fieldnotes* readership can be easily assessed by printing lists using a variety of parameters such as city or zip code. Printing mailing labels by sorted zip code has permitted savings on postage.

Geologic databases are being entered into the computer to make the information more readily accessible to Bureau staff and the general public. One of the first databases to be computerized is a compilation of radiometric age determinations for rock units in Arizona. More than 1,500 age determinations, representing most of the published ages, have been added to the database and are being edited for accuracy. Each age determination is accompanied by information about the location, rock type, dated material, and geologic setting of the rock unit. The database can be used to print lists of age determinations by latitude and longitude, by age, or by rock type. The compilation will be published along with a series of 1:1,000,000-scale computer-generated maps and extensive cross-references. The availability of this publication will be announced in a future issue of *Fieldnotes*.

The Bureau is in the initial stages of computerizing a geologic bibliography for Arizona. Each citation includes codes that identify subject matter and study area (e.g., county, mountain range, or mining district). This system will enable users to search the database for all information on a specific area or subject. The system is flexible enough to narrow a search by using several codes at once (e.g., all studies on middle Tertiary gold mineralization in the Black Mountains). By using the program's ability to sort by subject, one can compile a comprehensive index within minutes, rather than the weeks required by manual compilation. The Bureau plans to distribute the bibliography in a conventional book format and on floppy disks that users can access with their own microcomputer systems.

A fourth database contains geochemical analyses of igneous rocks in Arizona. The graphic capabilities of the Bureau computer, including high-resolution color graphics, will be used to evaluate the spatial variations of igneous-rock geochemistry and the relationship of igneous systems to mineralization.

The last database presently being compiled is a catalog of the Bureau's repository of drill-hole cuttings and cores. The database will enable users to determine quickly where cuttings for a specific drill hole are stored.

Scientific Computations

The Bureau's present use of microcomputers for scientific computing includes calculating normative mineralogy of igneous rocks from geochemical analyses. Plotting and statistical routines have been developed to evaluate the crystallization history and mineral potential of igneous rocks in the State.

FUTURE USES

The Bureau microcomputers will be increasingly used for word processing, especially in producing camera-ready copy for Bureau publications. Thousands of dollars could be saved by reducing the amount of typeset material. The major anticipated use of Bureau computers, however, will be in further database management. Databases are being planned for the following subjects: (1) specialized bibliographies, such as a thesis bibliography; (2) geology of mineral districts in the State; and (3) index to geologic mapping in the State. When available, these databases will enable exploration companies, land-use planners, and others to obtain up-to-date information about the geology, mineralization, and potential geologic constraints of any area in Arizona.

Use of Bureau computers for scientific analyses will also grow. Numerical programs, such as finite-element modeling, will be used to model the subsurface configuration of rock units and to understand more fully geologic processes such as faulting and mineralization. The computers will also be used for stereographic plotting of structural data, such as the orientation of faults, folds, and mineralized veins. Additional graphic applications, such as computer-produced 35-mm slides, are among the Bureau's long-term goals for its computer system.

Although the Bureau's microcomputers are now managing various types of geologic data, the Bureau still plans to produce original geologic maps the old-fashioned way: by wearing out boot leather, field hats, and colored pencils.

THESES AND DISSERTATIONS ON THE GEOLOGY OF ARIZONA, 1980-84

The following list includes theses and dissertations on the geology of Arizona that were awarded from 1980 through 1984 by Arizona State University, Northern Arizona University, and the University of Arizona. This list, however, is not a complete compilation of theses on geologic topics. Theses on the geology of other States or on general geologic topics are not listed here. Theses awarded by out-of-State universities are also not listed.

Most of the theses included here are not available in the Bureau library. Each thesis, however, may be examined at the main library of the university that awarded it. More detailed information may also be obtained from the respective geology departments:

Department of Geology, Arizona State University, Tempe, AZ 85287; (602) 965-5081

Department of Geology, Northern Arizona University, Box 6030, Flagstaff, AZ 86011; (602) 523-4561

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