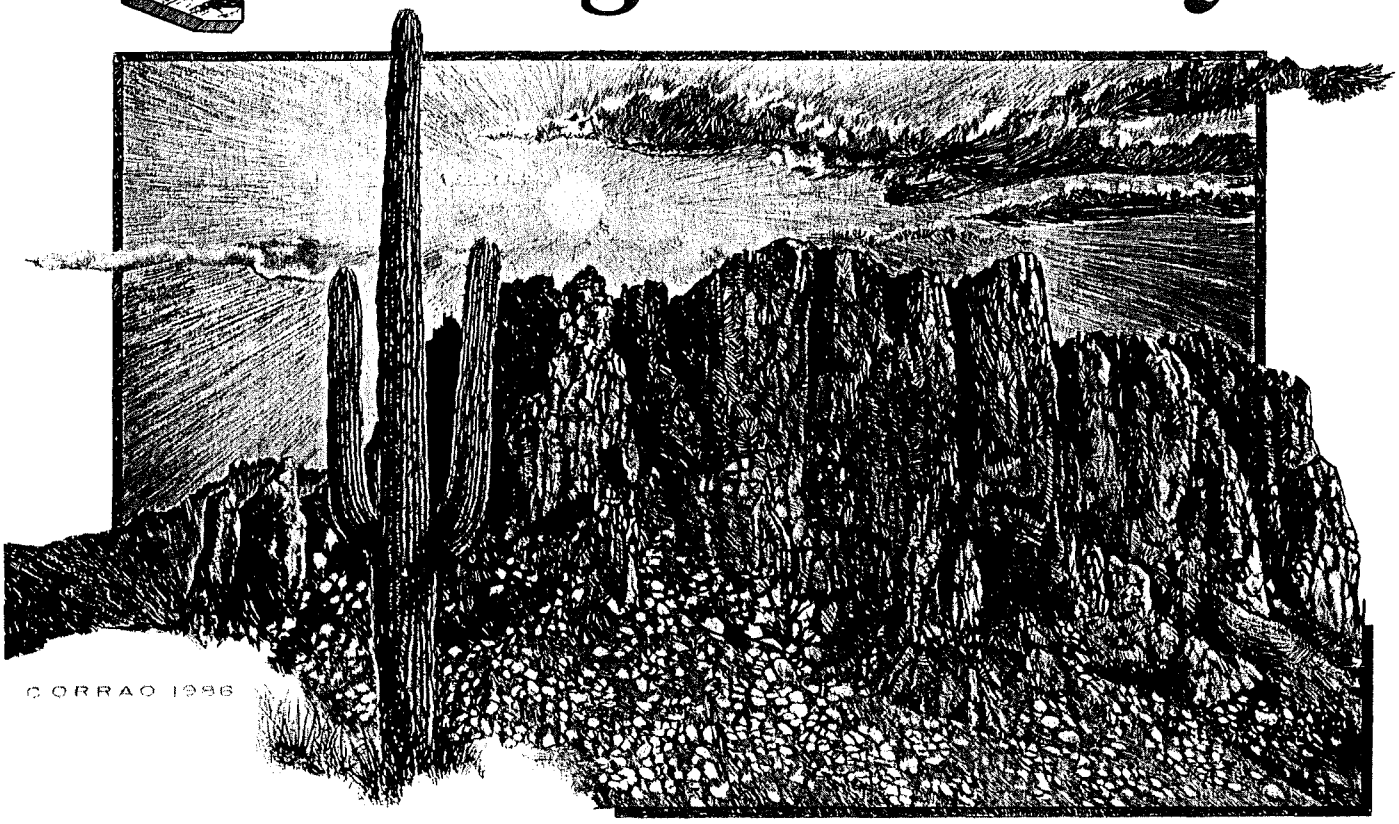
Arizona Geological Survey



Annual Report

Fiscal Year 1985–1986

July 1, 1985 to June 30, 1986

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ARIZONA GEOLOGICAL SURVEY
OPEN-FILE REPORT
86-16

Geologic Framework
Mineral and Energy Resources
Urban and Applied Geology
Geologic Information

This report is preliminary and has not been edited or reviewed for conformity with Arizona Geological Survey standards

The University of Arizona, Tucson

SUMMARY OF ACTIVITIES

FY1985-86

The Arizona Geological Survey has statutory responsibility for investigating, describing, interpreting, and providing information about Arizona's geologic framework, mineral and energy resources, and geologic hazards and land-use limitations. Statutory duties, program, accomplishments, personnel, and budget are described on following pages. Accomplishments in FY1985-86 are summarized below.

Investigations. Results of geologic investigations and data collection were published as Bulletin 196, Mine index for metallic mineral districts in Arizona; Circular 24, Bibliography of metallic mineral districts in Cochise, Graham, and Greenlee Counties, Arizona; Map 20, Map of Mid-Tertiary (40-15 m.y.) volcanic, plutonic, and sedimentary rock outcrops in Arizona; and Map 22, Map of Pliocene-Quaternary faults and volcanic rocks in Arizona. Four 12-page issues of Fieldnotes, a research and information periodical, were published. Eighteen maps and reports were released in the Open-File series. Eleven papers were included in outside professional publications. Geologists presented or coauthored 16 talks to professional groups and led 5 field trips.

The Arizona Geologic Information System, a computerized geologic data base, was expanded by addition of theses and dissertations on Arizona geology, radiometric age determinations, and conodont-color-alteration indices.

The second year of geologic mapping was completed as part of the U.S. Geological Survey's Cooperative Geologic Mapping Program, a 50-50 matched-funding project. Mapping was done in the Hieroglyphic Mountains.

Information and education. Information and assistance were provided to more than 1200 persons who visited the office to purchase publications, use the library, and consult with geologists. In addition, three to five times that many telephoned or wrote for assistance. Sale of publications and open-file reports totalled $19,374, up $4,249 from FY1984-85. Thirty-four talks were given to elementary and secondary schools, civic organizations, and other groups.

Personnel and budget. Projects and activities completed during FY1985-86 were done by 9.114 full-time equivalent (FTE) professional and classified staff, one half-time graduate research assistant, and a number of part-time and hourly students. Local funds were used to employ 0.886 FTE classified employee. State funds expended totalled $337,989.

A total of $52,883 was spent from 5 federally funded projects, from which 9 part-time and temporary employees were paid.

Larry D. Fellows

Larry D. Fellows
State Geologist
July 7, 1986

GOVERNOR

BOARD OF REGENTS

PRESIDENT

SENIOR VICE PRESIDENT FOR ACADEMIC AFFAIRS

ARIZONA BUREAU OF GEOLOGY AND MINERAL TECHNOLOGY

ADMINISTRATION

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GEOLOGICAL SURVEY BRANCH
(Arizona Geological Survey)

Larry D. Fellows
State Geologist and
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845 N. Park Ave.
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J. Brent Hiskey
Assistant Director
Geology and Mines Building
University of Arizona
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The Arizona Bureau of Geology and Mineral Technology
is a Division of the University of Arizona.

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All art work and illustrations were done by Pete Corrao.

Statutes

DUTIES

Investigate, describe, and interpret the geological setting of this state, including its natural hazards and limitations, its natural attributes and its mineral resources.

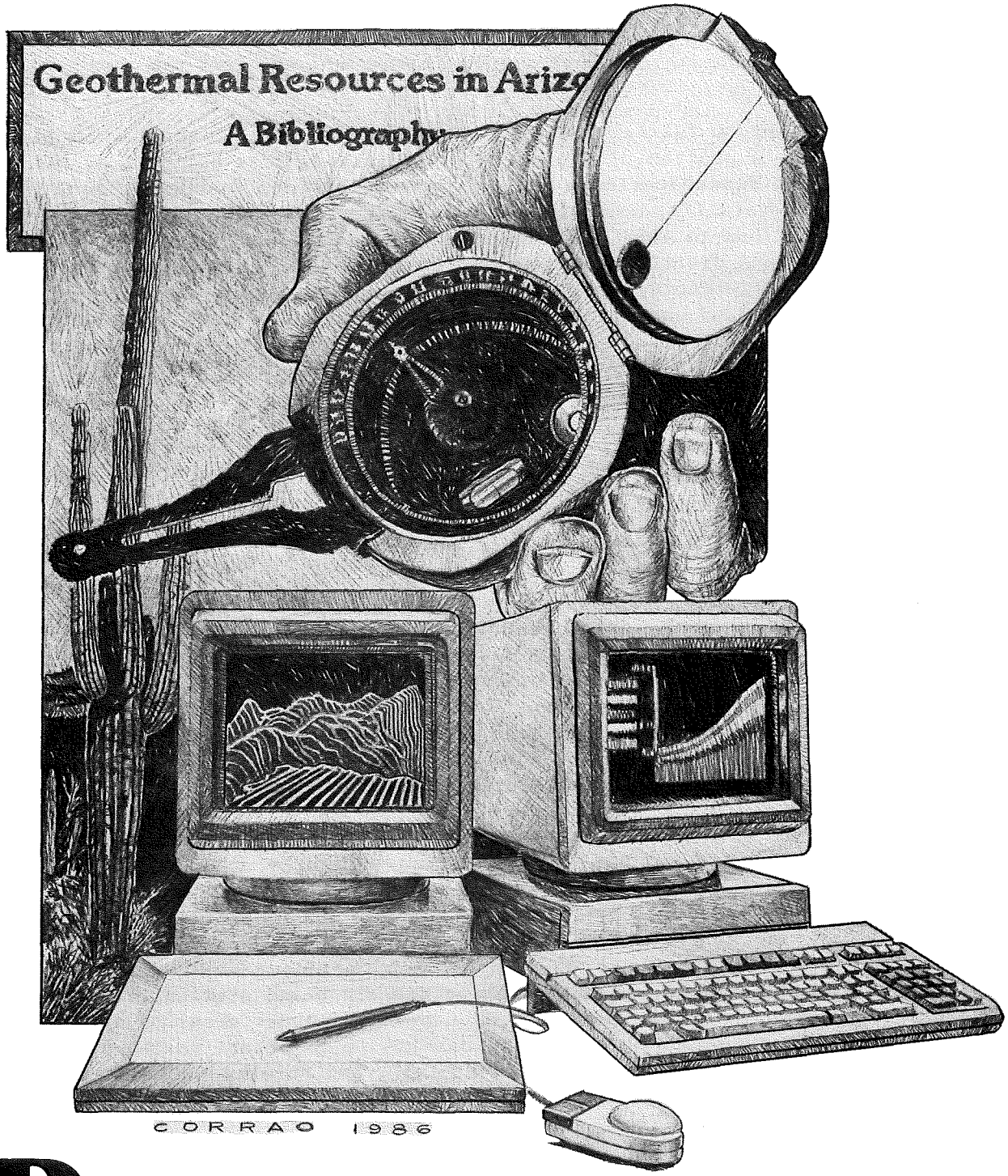
Publish in the form of bulletins, circulars, maps and other related series or otherwise make available to state agencies, government officials, industry, and the public **the results of all geological ... and related research and investigation undertaken** by the Bureau.

Provide lectures, talks, displays, and exhibits for the general education of the public toward a better understanding of this state and the wise use of this state's land and its mineral resources.

Operate and maintain a central repository for reports, books, maps, and other publications regarding the geology, mineral resources, and associated technologies present or practiced in this state. Such repository shall be available for the use of the public.

Operate and maintain a central repository for rock cores, well cuttings, and related subsurface samples and all associated supplemental data consistent with the laws of this state requiring the deposit of such material and information. Such repository shall be available for the use of the public.

(Section 27-152.01, Arizona Revised Statues)



Program

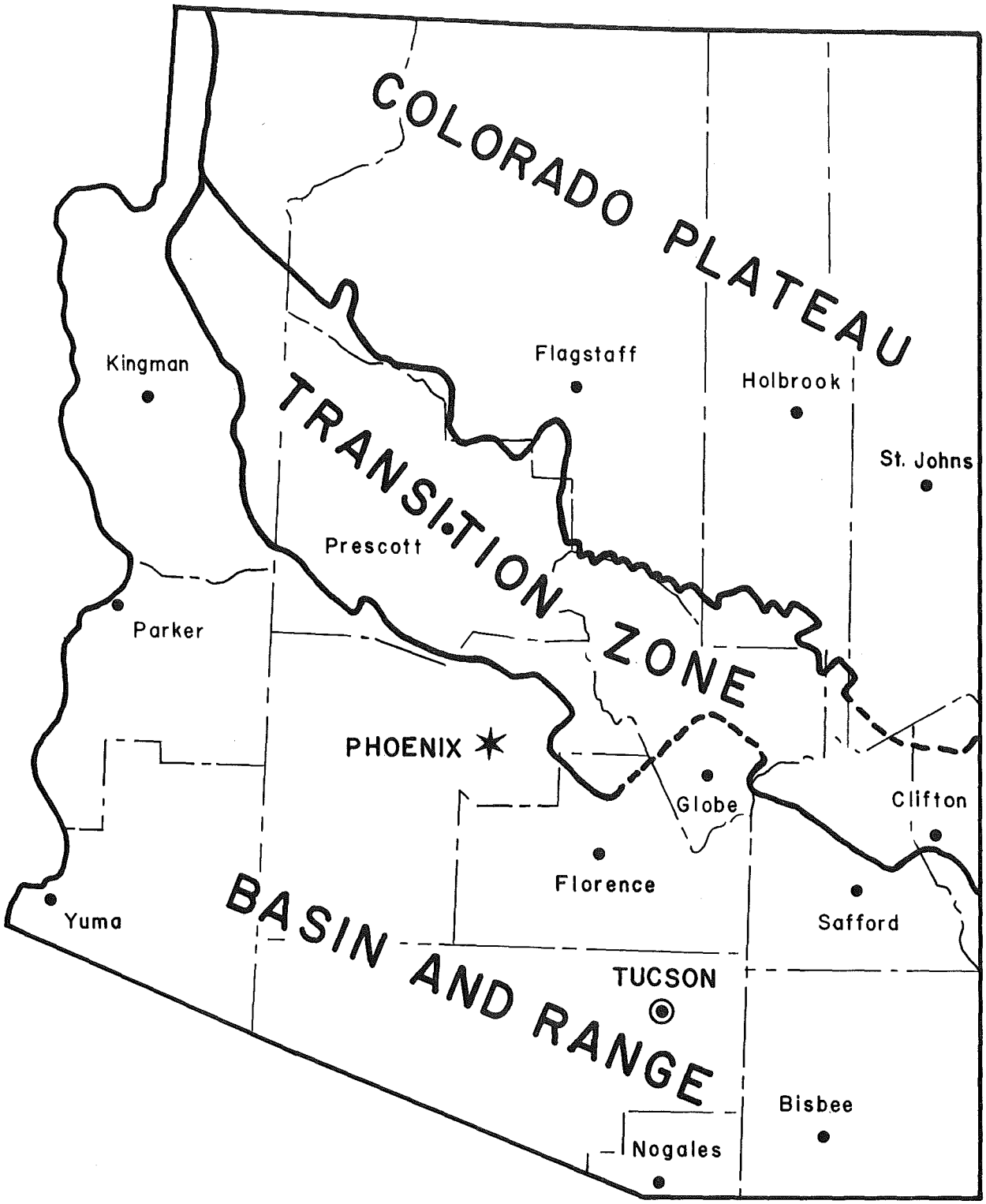


Figure I. MAJOR PHYSIOGRAPHIC PROVINCES IN ARIZONA

Urban and applied geology. What types of geologic materials are present at the surface and in the subsurface? What geologic processes (weathering, flooding, faulting, subsidence, collapse, etc.) are active? Answers to these questions are obtained by doing field and laboratory investigations. This information is used by those who evaluate suitabilily of areas or specific sites for construction of roads, canals, waste disposal facilities, buildings, dams, etc. Information users include state, federal, and local land planners and managers, highway departments, municipal waste management units, geotechnical consultants, and many others.

The Arizona Geological Survey has no lead professional position with expertise in this category, but has hired staff with federal and state funds, when available, and has worked cooperatively with scientists employed by other agencies and the private sector. Effort has been made to publicize the work of others through articles in Fieldnotes or other publications. The Arizona Geological Survey, for example, drafted and published a series of maps, prepared by Dr. Troy L. Péwé and students at Arizona State University, that depict geologic aspects of land planning and management near Scottsdale.

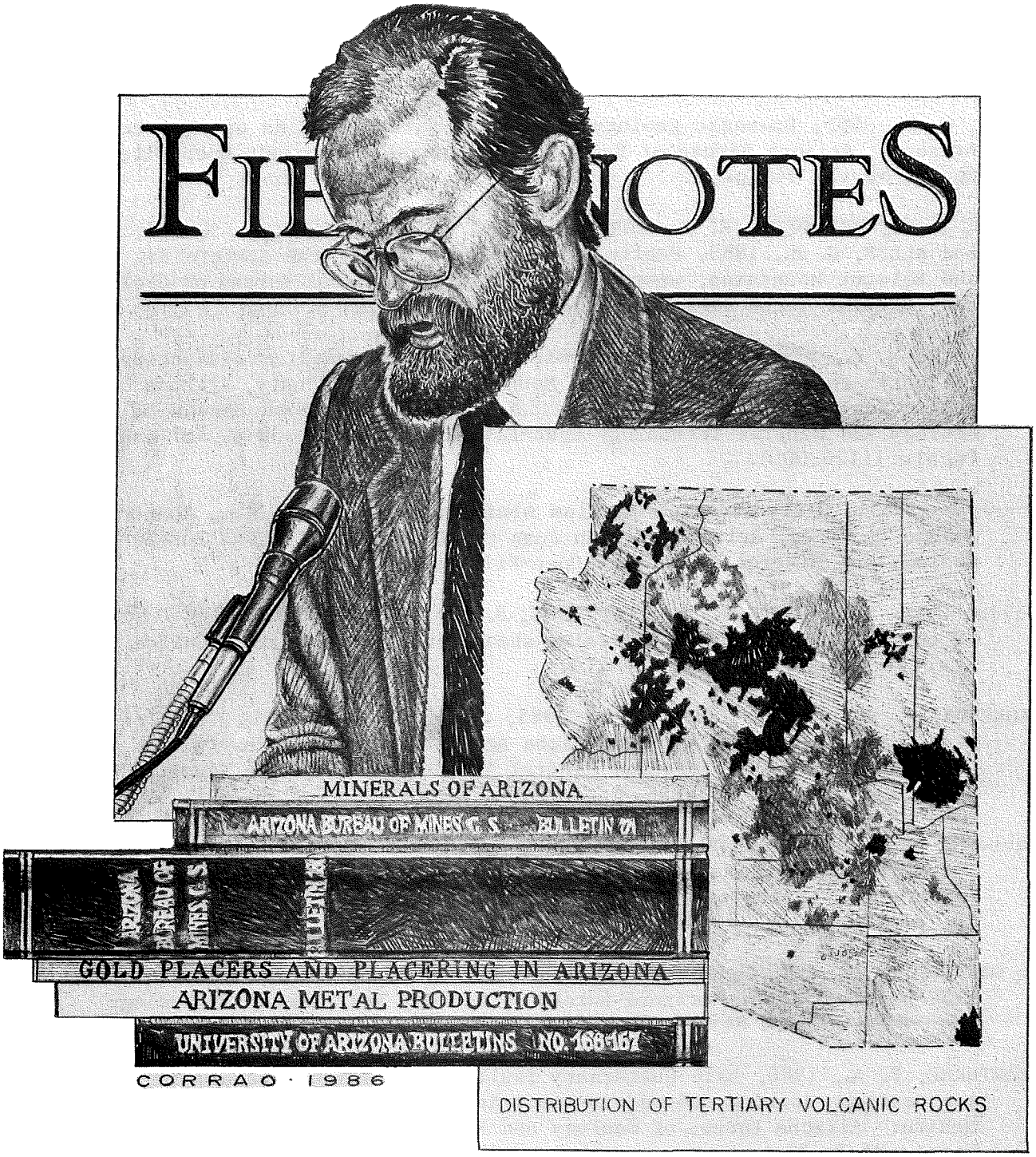
Plans are being made to do urban-area studies in order to provide the basic geologic information needed by land planners and managers, government agencies, geotechnical firms, engineers, and others. Emphasis will also be given to studies that identify the geologic parameters involved in siting waste disposal and other facilities in order to provide maximum protection to ground water. Such work will be done in close cooperation with the Department of Water Resources and the newly created Department of Environmental Quality.

ARIZONA GEOLOGIC INFORMATION SYSTEM

The Arizona Geological Survey has begun work on a comprehensive computerized information system for storing, manipulating, and retrieving information on Arizona geology. The system, which presently consists of a small network of microcomputers, already includes a number of data bases. Plans call for acquisition of a larger computer system capable of access via telephone lines by users across the State. When fully operational, the Arizona Geologic Information System will serve as a central computerized clearinghouse of geological information on Arizona.

Library. Library holdings include publications of the geological surveys of states adjacent to Arizona; dissertations and theses on Arizona geology; publications and open-file reports of the U.S. Geological Survey, U.S. Bureau of Mines, and U.S Department of Energy; several professional journals; and selected books on various aspects of geology. In addition, many unpublished maps, reports, and other data are on file. All items in the library are available to the public. Although it is not a lending library, copy service is available and ample work space is available for visitors.

Rock cuttings and core repository. Cuttings and cores saved during drilling are invaluable sources of information about geological formations present in the subsurface. State law requires that drillers of oil tests submit samples of the drill cuttings. Cuttings from water wells, largely from the Tucson basin, are provided by the U.S. Geological Survey. Many cores are donated by mineral exploration companies after the cores have been described, sampled, and analyzed. Work space and a microscope are available for those who want to examine the cuttings or cores.



Accomplishments

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PEIRCE, H. W., Shafiqullah, M., and Breed, W. J., 1986, Geochronology of some exotic cobbles, Chinle Formation, Arizona (abstract), in Abstracts of the symposium on Southwestern geology and paleontology: Museum of Northern Arizona, Flagstaff, p. 7.

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REYNOLDS, S. J., FLORENCE, F. P., RODDY, M. S., and TRAPP, R. A., 1986, Preliminary map of K-Ar age determinations in Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report 86-3 (scale 1:500,000).

REYNOLDS, S. J., FLORENCE, F. P., CURRIER, D. A., ANDERSON, A. V., TRAPP, R. A., and Keith, S. B., 1985, Compilation of K-Ar age determinations in Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report 85-8, 320 p.

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REYNOLDS, S. J., RODDY, M. S., and WELTY, J. W., 1986, Map of Paleozoic rocks and conodont color alteration indices in Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report 86-1 (scale 1:1,000,000).

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---------, 1986b, Geologic map of the Lincoln Ranch basin, eastern Buckskin Mountains, western Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report 86-2 (scale 1:24,000), with text (6 p.).

---------, 1986c, Relationship of the Transition Zone to Mesozooic and Cenozoic tectonism in the Basin and Range Province, Arizona (abstract): Geological Society of America Abstracts with Programs, v. 18, p. 416.

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---------, 1986b, Patterns in economic geology - implications for metallic mineral exploration in Arizona: Williams College, Williamstown, MA.

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FIELD TRIPS LED

PEIRCE, H. W., and Nations, J. D., 1986, The tectonic and paleogeographic significance of Tertiary strata of the southern Colorado Plateau and the Transition Zone basins: Geological Society of America, Rocky Mountain Section, Flagstaff

REYNOLDS, S. J., 1986, South Mountains: Arizona-Nevada Academy of Science meeting, Glendale.

---------, 1986, South Mountains: University of Nevada, Las Vegas

REYNOLDS, S. J., and SPENCER, J. E., 1986, Granite Wash, Harquahala, and Buckskin Mountains: Arizona Geological Society Symposium on Frontiers in Geology and Ore Deposits of Arizona and the Southwest

SPENCER, J. E., and REYNOLDS, S. J., 1986, Buckskin and South Mountains: Seismologists and structural geologists from Harvard, Oxford, University of California - Santa Barbara, Bucknell College, and U.S. Geological Survey.

INVESTIGATIONS IN ADVANCED STAGES OF COMPLETION
(Scheduled for completion in FY86-87)

CAPPS, R. C., REYNOLDS, S. J., KORTEMEIER, C. P., and Scott, E. A., Geologic map of the northeastern Hieroglyphic Mountains, central Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report.

Jenney, J. P., and REYNOLDS, S. J., editors, Geologic evolution of Arizona: Arizona Geological Society.

Johnson, W. D., Jr., SCARBOROUGH, R. B., WELTY, J. W., REYNOLDS, S. J., and TRAPP, R. A., Map of granitic rock outcrops and ages in Arizona: Arizona Bureau of Geology and Mineral Technology.

PEIRCE, H. W., Proceedings volume for 21st Forum on Geology of Industrial Minerals: Arizona Bureau of Geology and Mineral Technology.

---------, Map of Arizona Industrial Minerals and Rocks: Arizona Bureau of Geology and Mineral Technology.

---------, Paleozoic overview: Arizona Geological Society Digest.

Péwé, T. L., Geologic hazards in Arizona: Arizona Bureau of Geology and Mineral Technology Special Paper.

Raymond, R. H., and others, Water level declines, subsidence, and earth fissures in southern Arizona: Arizona Bureau of Geology and Mineral Technology.

REYNOLDS, S. J., and Lister, G. S., Ductile-to-brittle evolution of the South Mountains shear zone, central Arizona.

REYNOLDS, S. J., and others, Preliminary geologic map of the Granite Wash Mountains, west-central Arizona: Arizona Bureau of Geology and Mineral Technology.

REYNOLDS, S. J., and SPENCER, J. E., Geologic setting of Mesozoic and Cenozoic metamorphism in Arizona, in Rubey Volume on metamorphism and crustal evolution of the conterminous western U. S.: Prentice-Hall.

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Fieldnotes

Fall 1985 - Volume 15, Number 3, 12 p.

Arizona's backbone: the Transition Zone: H. W. Peirce

Geological Survey Branch hosts 21st Forum on Geology of Industrial Minerals: H. W. Peirce
Landscapes of Arizona
Orlo Childs retires from MMRRI
New Bureau publications

Winter 1985 - Volume 15, Number 4, 12 p.

Gold and Silver extraction: The application of heap-leaching cyanidation: J. Brent Hiskey (Mineral Technology Branch)

Arizona State Trust Lands: mineral-resource revenues and activities: Robert A. Larkin (Arizona State Land Department)
Cooperative geologic mapping
The Arizona Bureau of Geology and Mineral Technology: a brief history
Geologic place names: Ajo
Recent publications on the geology of Arizona
New Bureau publications

Spring 1986 - Volume 16, Number 1, 12 p.

Geology of side canyons of the Colorado, Grand Canyon National Park: André R. Potochnik and Stephen J. Reynolds

An oil rig at the Grand Canyon?
Bureau receives new rock-and-mineral collection
Theses and dissertations, 1985: Evelyn M. VandenDolder
New Bureau publications

Summer 1986 - Volume 16, Number 2, 12 p.

Volcanic history of Arizona: Stephen J. Reynolds, John W. Welty, and Jon E. Spencer

The nonfuel mineral industry: 1985 summary: Evelyn M. VandenDolder
Early Proterozoic geology of Arizona: Clay M. Conway (U.S. Geological Survey) and Karl E. Karlstrom (Northern Arizona University)
Gould-Simpson Building honors two distinquished scientists: by Orlo E. Childs and George H. Davis
New Bureau publications

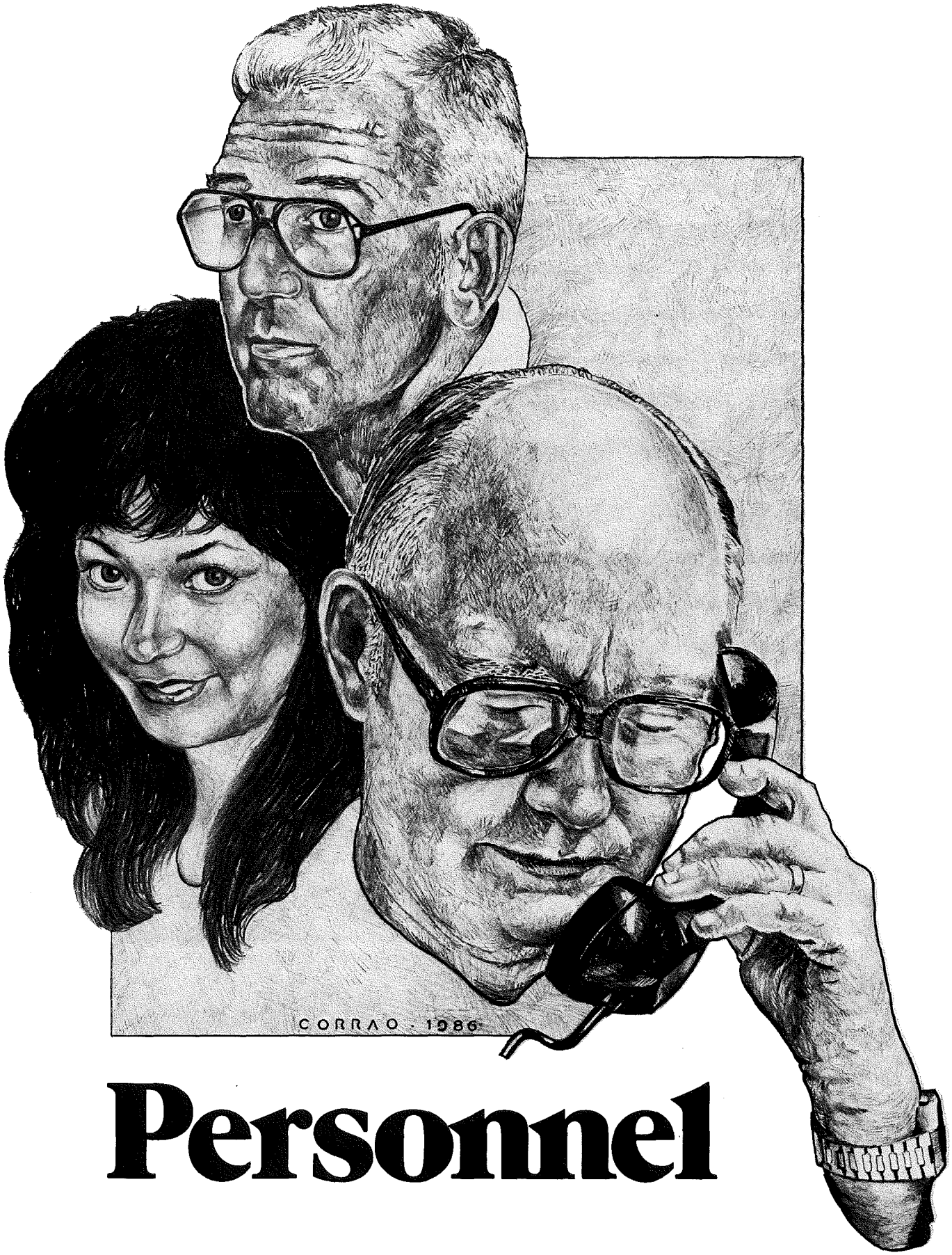
Workshops and field trips:

Corbett School 6th grade (Tucson): Camp Cooper
Donaldson Elementary School 6th grade (Tucson) "Environmental Days": Catalina State Park
Kellond Elementary School 6th grade (Tucson): Peppersauce Campground
Pimeria Alta Historical Society: Calabasas School, Nogales, and Tubac
Tanque Verde Elementary School 6th grade (Tucson): Triangle Y Camp
Tucson Public Library "Great Escapes" Summer Program for Children: Tucson
University of Arizona Engineering Workshop for Disadvantaged, Women, and other Minorities: Tucson (4 talks)

Displays:

Arizona Geological Society, Symposium on Frontiers in Geology and Ore Deposits of Arizona and the Southwest: Tucson

Arizona Science Teachers Association Annual Meeting: Mesa



Personnel

GEOLOGISTS AND SPECIALTY AREAS

LARRY D. FELLOWS, State Geologist and Assistant Director; B.S., Iowa State University; M.A., University of Michigan; Ph.D. University of Wisconsin.

- geology of Arizona
- geologic hazards and limitations

H. WESLEY PEIRCE, Principal Geologist; B.S., University of Montana; M.S., Indiana University; Ph.D., University of Arizona.

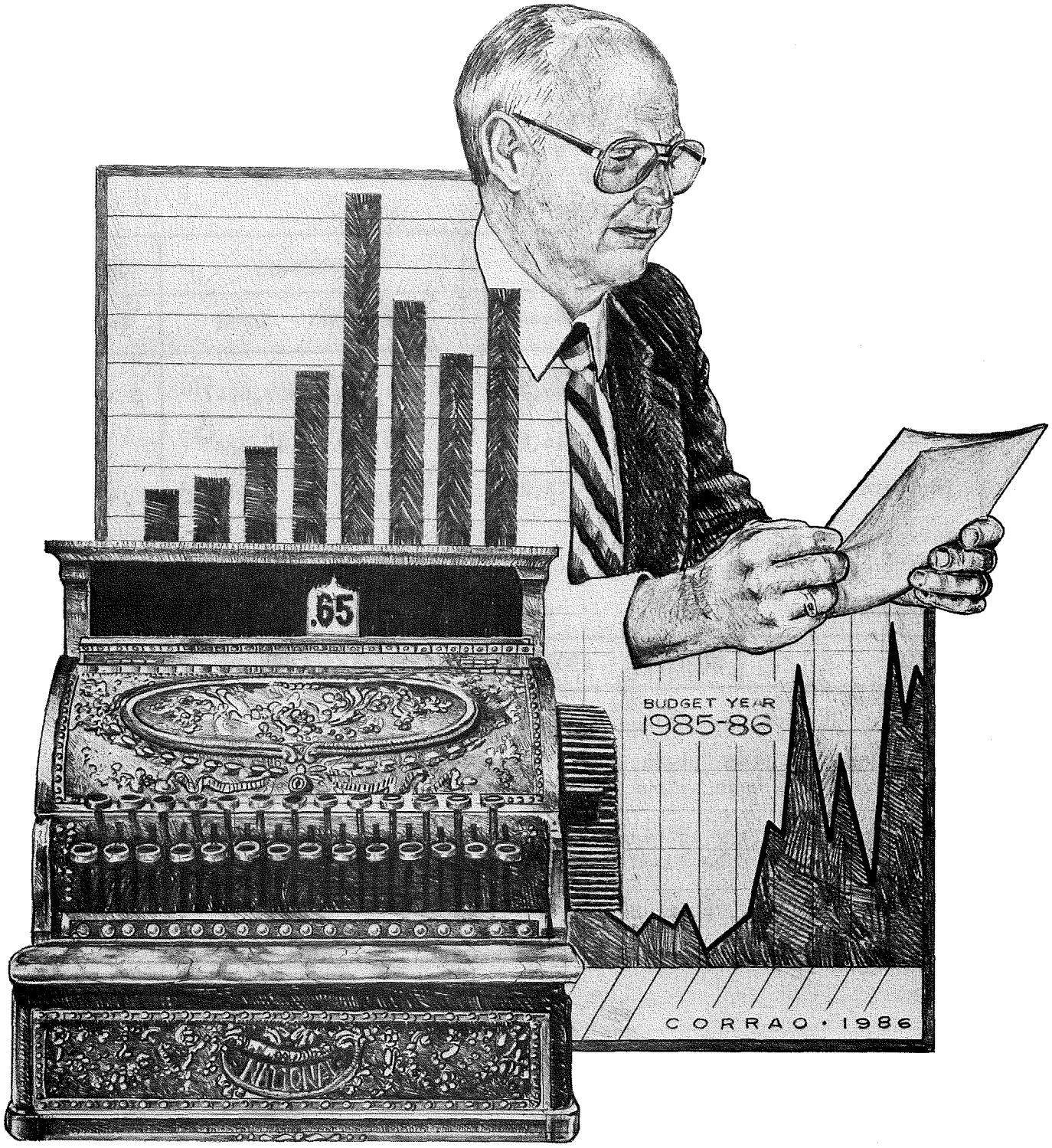
- geology of Arizona
- impact of "things geologic"
- industrial minerals: salt, gypsum, limestone, etc.
- energy materials: petroleum and coal
- subsurface geology: Plateau and Cenozoic basins
- physiography: development, subdivision; Mogollon Escarpment
- Pennsylvanian-Permian stratigraphy: Plateau and Transition Zone
- earth science education

STEPHEN J. REYNOLDS, Assistant Research Geologist; B.S., University of Texas at El Paso; M.S., University of Arizona; Ph.D., University of Arizona.

- geology of Arizona
- state geologic mapping project
- structural geology; analysis of rock fabric and fault movement
- Basin and Range province
- computer applications
- base metals (copper, molybdenum, lead, zinc, etc.)
- geochemistry of granites

JON E. SPENCER, Assistant Research Geologist; B.S., University of California, Santa Cruz; Ph.D., Massachusetts Institute of Technology.

- geology of Arizona
- genesis of metallic mineral deposits
- Basin and Range province
- structural geology
- geologic mapping
- precious metals (gold, silver)
- geochronology
- geophysics
- Tertiary rocks, structures, and mineral deposits



Budget

CONTRACTED PROJECTS

GEOLOGIC MAPPING

Description: Geologic mapping in Phoenix Quadrangle (1° x 2°), a 50-50 matched-funding project with U. S. Geological Survey. U. S. Bureau of Land Management provided color aerial photographs. Mapping was done in Big Horn and Belmont Mountains.

Principal investigators: Stephen J. Reynolds and Larry D. Fellows

Amount of contract: $45,685 (dollars from U. S. Geological Survey)
18,941 (in-kind work by U. S. Geologicl Survey)
64,626 (in-kind work by Arizona Geological Survey)

Duration of contract: October 1, 1984 to December 31, 1985. Completed.

Amount spent in FY85-86: $11,585.

Persons employed in FY85-86: George B. Allen, Richard C. Capps, and John W. Welty

Reports and maps completed in FY85-86: ALLEN, G. B., 1985, Economic geology of the Big Horn Mountains of west-central Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report 85-17, 140 p. (Partially funded from this contract).

CAPPS, R. C., REYNOLDS, S. J., KORTEMEIER, C. P., STIMAC, J. A., Scott, E. A., and ALLEN, G. B., 1985, Preliminary geologic map of the eastern Big Horn and Belmont Mountains, west-central Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report 85-14, 25 p.

GEOLOGIC MAPPING

Description: Geologic mapping in Phoenix Quadrangle (1° x 2°). A 50-50 matched-funding project with U. S. Geological Survey. U. S. Bureau of Land Management provided color aerial photographs. Mapping was done in Hieroglyphic Mountains.

Principal investigators: Stephen J. Reynolds and Larry D. Fellows

Amount of contract: $63,204 (dollars from U. S. Geological Survey)
18,948 (in-kind work by U. S. Geological Survey)
82,152 (in-kind work by Arizona Geological Survey)

Duration of contract: January 1, 1986 to December 31, 1986.

Amount spent in FY85-86: $36,453.

Persons employed in FY85-86: Richard C. Capps, Curtis P. Kortemeier, David E. Wahl, Jr., and John W. Welty

QUATERNARY FAULTS

Description: Reconnaissance analysis of area adjacent to Gila River from Coolidge Dam to Florence to identify possible Quaternary faults. Examined air photos and field checked anomalous areas. Project funded by U. S. Bureau of Reclamation.

Principal investigators: Larry D. Fellows and Robert B. Scarborough

Amount of contract: $4700.

Duration of contract: January 1, 1985 to June 30, 1986. Completed.

Amount spent in FY85-86: $1050

Persons employed in FY85-86: Philip A. Pearthree

Reports and maps completed: PEARTHREE, P. A., and SCARBOROUGH, R. B., Reconnaissance assessment of Quaternary faulting in the Gila River region from San Carlos Reservoir to Coolidge, AZ: Submitted to U. S. Bureau of Reclamation.

LANDSLIDES

Description: Statewide compilation of historic landslide and rockfall events. Funded by U. S. Geological Survey. Arizona Department of Transportation provided information about slope failure and rockfall along highways.

Principal investigator: Larry D. Fellows

Amount of contract: $4628

Duration of contract: February 1, 1985 to September 30, 1985. Completed.

Amount spent in FY85-86: $1784.

Persons employed in FY85-86: Vincent J. Realmuto

Reports and maps completed in FY85-86: REALMUTO, V. J., 1985, Preliminary map of selected mass-movement events in Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report 85-16, 9 p. text and 2 maps (scale 1:500,000).