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ARIZONA GEOLOGICAL SURVEY
INFORMATION TO ARIZONANS SINCE 1889

MISSION

To provide unbiased information to the public to enhance understanding of geologic processes, materials, and resources and support prudent management and use of Arizona's land, water, mineral, and energy resources.

FUNCTIONS

- *Provide information about Arizona geology*
- *Prepare and publish geologic maps and reports*
- *Maintain databases and files*
- *Maintain geology library*
- *Maintain rock cuttings and core repository*
- *Investigate geologic hazards and limitations*
- *Map and describe bedrock and surficial geology*
- *Map and characterize mineral and energy resources*
- *Provide administrative and staff support for Oil and Gas Conservation Commission*

A.R.S. § 27-152

Things Geologic

Larry D. Fellows
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Philosopher Will Durant wrote that civilization exists through geological consent, subject to change without notice. H. Wesley Peirce, geologist at the Arizona Geological Survey (AZGS) for 31 years, agreed and coined the term "things geologic" to help explain "geological consent." To Wes, "things geologic" included ideas and concepts that emphasize interrelationships between living things and the non-living earth.

Robin Frisch-Gleason worked with Wes prior to his death in 1994 to compile some of his writings. The AZGS published them in his memory as *Things Geologic* (Down-To-Earth Series 5). The words below are paraphrased or quoted verbatim from this book.

A major goal of Wes' in *Back to basics: mineral-vegetable-animal, no ground, no flea - no you, no me* was to change the commonly expressed word order "animal-vegetable-mineral." The Animal and Vegetable Kingdoms are dependent upon the Mineral Kingdom for existence. It makes sense, therefore, to place first things first: mineral, vegetable, animal.

Peirce wrote that civilization, as we know it, cannot be sustained without continued exploration, discovery, and development of the Mineral Kingdom. Furthermore, the world's people are engaged in an ongoing experiment; the path to the future is uncharted, with no guarantees about what lies ahead. One thing seems certain, however: for as long as there are consumers to consume, producers will try to produce.

Wes characterized *land* as a four-letter word so loaded with diverse, subtle meaning that when we are asked to select from its many values and potential uses, it is apt to become an explosive issue. Controversy arises when values conflict. The resolution of conflicts can indeed be a divisive political process. All such problems, however resolved, are necessarily tinged with arbitrariness.

Ecology, the science of relationships, is a com-

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Building destroyed by the October 1983 flood on the Rillito River in Tucson.

Things Geologic *(continued from page 1)*

monly misused and misunderstood word, the totality of which is not known or understood by anyone. Interrelationships form a complex total network that is difficult to conceptualize. One of the ecological imperatives that warrants emphasis is the profound dependence that modern industrial societies have on raw materials that are derived from land.

Communities, like trees, have roots that provide the daily means for survival and growth. These roots always lead back into the land. The farther the root is stretched, and the more complex the entire root network, the more vulnerable the organism. Imagine a strand of an energy root in your own gas tank, the other end, perhaps, being several thousand feet below the land surface of Saudi Arabia.

Many readers may be familiar with *Things geologic: no rocks, no ice cream.* This is an exercise in linkage, the essence of ecology. Wes referred to a booklet in which the author said, "The earth is made up of two main parts - soil and plants." Wes' response: "Nonsense! If we humans are to find a formula to sustain human existence on this planet, it is essential that we gain some common insights into what its real nature is. Most of us know little about our bodies and even less about the earth."

The term "geologic" is especially useful if it conveys the following: 1) the idea of great antiquity or age, especially relative to humankind, 2) the concept of nonrenewability, limitation, or finiteness, 3) the inequality in the distribution of things geologic (especially mineral and energy raw materials) within the earth, and 4) that most things geologic are beneath the earth's surface where they cannot be directly observed. These factors significantly influence human affairs on local, state, national, and worldly scales.

Wes described the misuse of "here" in *Conceptualizing earth history: the (mis)use of here.* The earth has been dynamic: not only have land masses moved relative to the poles, but also their crustal conditions have undergone change. Just because something is "here" today does not necessarily mean that it originated "here." The older the rock, the more likely it is to be out of place with respect to its beginnings.

These concepts and many more are discussed in Down To Earth 5. Ordering instructions are given on page 3.

New Publications

The Arizona Geological Survey released the following reports and maps since May 1996:

Things geologic: Robin Frisch-Gleason, compiler, 1996, Down To Earth 5 (Pub. number DTE 5), 39 p. $8.00

This is a collection of essays by H. Wesley Peirce on the impacts of geologic materials and processes on our lives. Additional information about content of the essays is provided on page 1 of this issue.

Database files describing mineralized sites in the State of Arizona (version 1.0): S. M. Richard, 1996, Digital Information Series 3 (Pub. number DI 3), 22 p., three 3.5" floppy disks, DOS formatted, files in dBase IV format. $10.00

Data from the USGS' Mineral Resource Data System were rearranged to form topical data tables and make access simpler. Some fields were removed and some data were consolidated. A text describes the data structure.

Bedrock geologic map of the Apache Junction and Buckhorn Quadrangles, Maricopa and Pinal Counties, Arizona: S. J. Skotnicki and C. A. Ferguson, 1996, Open-File Report 96-8 (Pub. number OFR 96-8), 17 p., 1 map, scale 1:24,000. $5.00

The map area includes the southern Usery Mountains, where Proterozoic granitic rocks are overlain by lower Miocene volcanics and some sedimentary

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is published quarterly by the Arizona Geological Survey (AZGS) to provide information about geologic materials and processes and their impacts on the development and use of Arizona's land, water, mineral and energy resources. We encourage your comments and suggestions.

Design and layout:
Peter F. Corrao

New Publications *(continued from page 2)*

rocks. Numerous mineral prospects are on fracture zones or faults that host fracture-filling hematite and chrysocolla in the eastern part of the area.

Bedrock geology of the Santan Mountains, Pinal and Maricopa Counties, Arizona: C. A. Ferguson and S. J. Skotnicki, 1996, Open-File Report 96-9 (Pub. number OFR 96-9), 22 p., 2 sheets, scale 1:24,000. $9.00

Proterozoic granitic rocks and schist, Laramide granitic rocks, and Miocene volcanic rocks crop out. Hematitic and silicic alteration are common in part of the study area.

Geologic map of the Sacaton Mountains, Pinal County, Arizona: S. J. Skotnicki and C. A. Ferguson, 1996, Open-File Report 96-10 (Pub. number OFR 96-10), 15 p., 2 sheets, scale 1:24,000. $7.00

Bedrock in the Sacaton Mountains consists primarily of Laramide granitic rocks with minor Proterozoic granitic rocks and schist. The Sacaton porphyry copper deposit, about a mile from the south edge of the range, may be related to the Laramide granitic rocks in the range.

Geologic map of portions of the Fort McDowell and McDowell Peak Quadrangles, Maricopa County, Arizona: S. J. Skotnicki, 1996, Open-File Report 96-11 (Pub. number OFR 96-11), 20 p., 1 map, scale 1:24,000. $6.00

This map depicts bedrock and surficial geology of the lower Verde River valley. The area is underlain by Quaternary and upper Tertiary alluvial fan, river, and lacustrine deposits. Bedrock along the valley flanks consists of Tertiary basalt and Proterozoic metamorphic and granitic rocks that have been extensively pedimented. The author discusses potential geologic hazards and limitations.

An assessment of the paleoflood hydrology methodology: Analysis of the 1993 flood on Tonto Creek, central Arizona: J. E. Fuller, P. K. House, and P. A. Pearthree, 1996, Open-File Report 96-12 (Pub. number OFR 96-12), 19 p. $6.00

The Tonto Creek flood of January 8, 1993, is the largest to have been preserved in the paleoflood record and was probably the largest to have occurred there in the last 300 years. These deposits provided an opportunity to test the basic assumptions of the paleoflood methodology, which has been applied to many streams throughout the world. This study confirmed that, except in the most ideal setting for slackwater sediment preservation, estimates of paleoflood discharge rates based on slackwater sediments alone may be about 30 percent low.

Historical geomorphology of the Verde River: P. A. Pearthree, 1996, Open-File Report 96-13 (Pub. number OFR 96-13), 26 p. $5.00

This report summarizes the geologic and geomorphic framework of the Verde River, the physical character of the river channel, and how channel morphology and position have changed in the past century. The study was undertaken to provide information needed to determine navigability of the Verde when Arizona became a state in 1912.

Historical geomorphology of the Gila River: Gary Huckleberry, 1996, Open-File Report 96-14 (Pub. number OFR 96-14), 31 p. $6.00

The study was done to review historical channel changes along the middle and lower Gila River. The character of the channel changed substantially during this century. The early 1900s was a time of major floods and channel widening. Channel widths subsequently decreased gradually, only to dramatically widen again in the past 15 years.

Historical channel changes on the San Pedro River, southeastern Arizona: Gary Huckleberry, 1996, Open-File Report 96-15 (Pub. number OFR 96-15), 34 p. $6.00

This report describes changes in the character of the San Pedro River during the past several centuries. It also describes the character of the river in 1912 and changes in channel position

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How to Order Them

You may purchase publications at the AZGS office or by mail. Address mail orders to AZGS Publications, 416 W. Congress St., Suite 100, Tucson, AZ 85701. Orders are shipped by UPS, which requires a street address for delivery. All mail orders must be prepaid by a check or money order payable in U.S. dollars to the Arizona Geological Survey or by Master Card or VISA. Do not send cash. Add 7% sales tax to the publication cost for orders purchased or mailed in Arizona. Order by publication number and add these shipping and handling charges to your total order:

Shipping & Handling CHARGES

In the United States:

Less than $1.01, add	$1.00
1.01- 10.00, add	3.00
10.01- 20.00, add	4.50
20.01- 30.00, add	5.75
30.01- 40.00, add	6.50
40.01- 50.00, add	8.00
50.01- 100.00, add	10.25
Over 100.00, add	12%

Other countries, request price quotation.

Shipping and handling charges include insurance. For rolled maps, add $1.00 for a mailing tube.

If you purchase Open-File Reports, Contributed Maps, or Contributed Reports at the AZGS office, allow up to two days for photocopying.

New Publications

(continued from page 3)

and character that have occurred since then.

Bibliography of geologic reports and maps for Apache County, Arizona, south of Interstate 40: R. A. Trapp, 1996, Open File Report 96-16 (Pub. number OFR 96-16), 27 p. $5.00

Because of the leasing and drilling for oil and gas that have taken place recently, the author compiled this bibliography to assist those who assess resource potential. This report supersedes OFR 94-20.

Reconnaissance survey of Upper Neogene strata in the Bouse Formation, Hualapai Limestone, and lower Gila River trough, western Arizona and directly adjacent southeastern California: J. E. Spencer, R. C. Harris, David Dettman, and P. J. Patchett, 1996, Open-File Report 96-17 (Pub. number OFR 96-17), 23 p. $4.00

Tertiary calcareous lake beds in Arizona commonly contain slightly elevated uranium concentrations. Homes built on these rocks may contain elevated radon levels. The purpose of this survey was to identify calcareous lacustrine sediments with elevated uranium contents. Well cuttings from the lower Gila River trough do not contain such deposits but do contain significant gypsum.

Compilation of unpublished Arizona K-Ar dates from the University of Arizona Laboratory of Isotope Geochemistry, 1971-1991: P. E. Damon, M. Shafiqullah, R. C. Harris, and J. E. Spencer, 1996, Open-File Report 96-18 (Pub. number OFR 96-18), 56 p. $10.00

This report includes 294 K-Ar analyses from Arizona and a few from southwestern New Mexico and the Pinacate volcanic field in northwestern Sonora. Most of these dates have not been previously published. All were recalculated using new decay and abundance constants. An 8-page list of age-date publications released from 1985-95 is also included.

Index of geologic maps of the San Carlos-Safford-Duncan Nonpoint-Source Management Zone: R. C. Harris, 1996, Open-File Report 96-19 (Pub. number OFR 96-19), 11 p., 2 plates, scale 1:1,000,000 $5.00

The study area is the Gila River drainage basin upstream from Winkelman. About 150 maps were indexed as part of a cooperative project with the Arizona Department of Environmental Quality.

Bibliography of the San Carlos-Safford-Duncan Nonpoint-Source Management Zone: R. A. Trapp and R. C. Harris, 1996, Open-File Report 96-20 (Pub. number OFR 96-20), 58 p. $10.00

About 1,200 geologic, hydrologic, and geophysical reports and maps that cover portions of the study area have been compiled and incorporated in the bibliographic database as part of a cooperative project with the Arizona Department of Environmental Quality.

Organic matter and thermal maturity analyses of the Upper Cretaceous sediments between 3,267 and 3,365 feet in the 1 Alpine Federal well, Apache County, Arizona: K. W. Schwab, 1996, Contributed Report 96-B (Pub. number CR 96-B), 90 p. $12.00

A geochemical analysis using Integrated Color Analysis via Spectral Power Distribution of transmitted light, a new technique developed by Geo-Strat, Inc., that electronically measures color of organic constituents (kerogen).

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