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Arizona Geology

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ARIZONA
GEOLOGICAL SURVEY
INFORMATION TO
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OUR MISSION

To provide unbiased earth-science information to the public, businesses, and governmental agencies to facilitate development of relevant policies and courses of action for prudently managing and using Arizona's land, water, mineral, and energy resources.

OUR FUNCTIONS

- Geologic publications
- Computerized databases
- Library and data files
- Well cuttings and core repository
- Geologic mapping and characterization
- Investigations of geologic hazards and limitations
- Mineral and energy resource investigations
- Regulation of oil, gas, helium and geothermal resources (by the Oil and Gas Conservation Commission)

A.R.S. § 27-152

Land-Subsidence and Earth-Fissure Information

Larry D. Fellows
Arizona Geological Survey

The Arizona Department of Water Resources (ADWR) and the Arizona Geological Survey (AZGS) have established the Center for Land-Subsidence and Earth-Fissure Information (CLASEFI). The purpose of CLASEFI is to assemble information about subsidence and earth fissures and provide information and assistance to the public.

Ground water has been pumped faster from some basins in southern Arizona than natural recharge has occurred. This caused ground-water levels to decline, the land to subside (more than 15 feet in two areas), and cracks (earth fissures) to develop along the margins of some basins. Subsidence and fissures may change natural drainage directions, cause highways to settle and crack, influence siting of waste treatment and disposal facilities, and affect other development activities. Earth fissures may serve as direct conduits for pollutants to enter ground-water reservoirs (Figure 1). Much

subsidence and fissuring has occurred in irrigated-agriculture areas. As population growth continues, development is expanding into some of those areas.

The ADWR, which by statute is responsible for ground-water availability, carefully monitors declining ground-water levels. The AZGS is responsible for assessing geologic hazards and limitations, including land subsidence and earth fissures. Responsibilities of both agencies are being addressed through this jointly funded activity.

Geologist Robin Frisch-Gleason will coordinate CLASEFI activities, compile data, conduct investigations, and interact with the public. Her first goal is to complete an updated bibliography of subsidence and earth fissures. Other projects will be undertaken at the recommendation of a steering committee, which has been established to provide oversight.

The committee is composed of representatives from the Arizona Departments of

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continued on page 2



Figure 1. In some parts of Arizona earth fissures have been improperly used as disposal sites for various types of waste.

Sugarloaf Fault

ARIZONA GEOLOGICAL SURVEY

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Arizona Geology

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.

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The Arizona Department of Transportation (ADOT) will construct several new bridges during widening of State Route 87 to four lanes northeast of Phoenix in Maricopa County. The Sugarloaf fault crosses the highway about 10 miles north of Saguaro Lake. ADOT contracted with the Arizona Geological Survey (AZGS) to assess the probability that the fault might generate an earthquake that would damage the bridges.

By interpreting trenches dug across the fault (Figure 1), AZGS geologists concluded that a magnitude 6.2 to 6.7 earthquake occurred between about 2,000 and 15,000 years ago. Because earthquakes as large as this have occurred infrequently on the Sugarloaf fault, the hazard posed to the bridges is low. Dr. P.A. Pearthree, principal investigator, will prepare a final report, which will be made available to the public.



Figure 1. Geologists examine strata cut by the Sugarloaf fault.

INFORMATION CENTER, from page 1

Environmental Quality, Land, and Transportation; the U.S. Army Corps of Engineers, Bureau of Reclamation, Geological Survey, and Natural Resources Conservation Service; and the Central Arizona Water Conservation District, Flood Control District of Maricopa County, Maricopa County Department of Solid Waste Management, Pima County Department of Transportation and Flood Control District, and Pinal County Planning and Development Services. These agencies have direct involvement with subsidence and fissures.

Questions, comments, and suggestions about CLASEFI and its operation are encouraged. Please contact Robin Frisch-Gleason at the AZGS.

WSSPC

The Arizona Division of Emergency Management (Department of Emergency and Military Affairs) recently hosted a meeting of the Western States Seismic Policy Council (WSSPC, pronounced "wispic"). Directors of emergency-management agencies, directors of state geological surveys, and representatives of the Federal Emergency Management Agency and U.S. Geological Survey attended. The purpose of the meeting was to determine how to improve effectiveness of WSSPC.

Consensus was reached that state emergency-management agencies and

state geological surveys should strengthen working relationships.

The group voted to 1) revise the Board of Directors to consist of three emergency-management directors, three state geological survey directors, and one member who can be either, and 2) affiliate contractually with the Council of State Governments, a nonprofit organization that supports governmental groups in becoming better focused, organized, and productive.

WSSPC will hold its 1995 annual meeting in Flagstaff in September. More information about the meeting is given on page 4.



New Publications

The Arizona Geological Survey (AZGS) released five reports and maps since February 1995:

How geologists

tell time: Evelyn M. Vandendolder, 1995, Down-to-Earth 4 (Pub. number DTE-4), 33 p. \$5.00

The author describes the history of development of dating techniques, the geologic time scale, relative and numerical dating techniques, and the practical importance of knowing the ages of rocks and geologic events.

Relative dating techniques are used to show that a rock unit or geologic event is older or younger than another. These techniques are based on three fundamental geologic principles: uniformitarianism (present geologic processes are similar to those of the past), original horizontality, and superposition. Stratigraphic position, crosscutting relationships, unconformities, fossils, paleomagnetism, and soil development are used to determine relative ages.

Scientists developed numerical dating techniques to find the age, in years, of some minerals, rocks, or organisms. Methods based on the radioactive decay of atoms are described. These methods include potassium-argon,

argon-argon, uranium-lead, thorium-lead, rubidium-strontium, and several others.

Knowledge of the ages of rocks and geologic events is important for those who site and design structures in areas of faulting or flooding, explore for mineral deposits, determine rates of ground-water movement and replenishment, to name just a few.

This booklet was written for earth-science and geology teachers, students, and non-geologists.

Geologic map of the Little Horn Mountains 30' x 60' Quadrangle, southwestern Arizona:

J.E. Spencer, compiler, Open-File Report 95-1 (Pub. number OFR 95-1), 10 p., 1 sheet, scale 1:100,000. \$5.00

This compilation map covers the southwestern quarter of the Phoenix Quadrangle (1° x 2°). The following features are partially or entirely included: Gila Bend, Eagletail, Little Horn, Kofa, Tank, and Palomas Mountains; Saddle, Face, and Oatman Mountain; Cemetery Ridge; and the Clanton Hills.

Lower to middle Miocene volcanic rocks crop out extensively and are usually cut and tilted by northwest-striking normal faults. Tertiary, Mesozoic, and Proterozoic crystalline rocks are exposed in a few areas.

Uranium distribution in sediments of the upper San Pedro Basin, southeast Arizona, and implications for indoor radon:

R.C. Harris, Open-File Report 95-3 (Pub. number OFR 95-3), 9 p., 2 sheets, scale 1:62,500. \$6.00

Uranium in rock and soil decays to form radon, a colorless, odorless, radioactive gas that seeps into homes from underlying rock and soil. Uranium levels in the study area were measured with a portable gamma ray spectrometer.

Geology and production history of the Moonlight uranium-vanadium mine, Navajo County, Arizona:

W.L. Chenoweth, 1995, Contributed Report 95-D (Pub. number CR 95-D), 9 p. \$1.50

Ore bodies were formed in a channel in the basal Shinarump Member of the Chinle Formation. The channel was scoured into the underlying Moenkopi Formation.

The geology, exploration, and production history of the Capitan Benally No. 4A uranium-vanadium mine, Apache County, Arizona:

W.L. Chenoweth, 1995, Contributed Report 95-E (Pub. number CR 95-E), 6 p. \$1.25

How to Order Them

You may purchase publications from the AZGS office or by mail. Please send mail orders to AZGS Publications, 845 N. Park Ave., Ste. 100, Tucson, AZ 85719-4896. Orders are shipped by UPS, which requires a street address for delivery. All mail orders must be prepaid by check or money order payable in U.S. dollars to the Arizona Geological Survey. Do not send cash. Add these shipping and handling charges to your total order, please:

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 the cost of postage, insurance, mailing materials, and handling.

If you purchase items at the AZGS office, please allow up to two days for photocopying and (or) reproducing reports and maps in the Open-File Report, Contributed Map, and Contributed Report Series.

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The Arizona Geological Survey is moving to the State Office Center in downtown Tucson during late June. The move will limit our ability to effectively serve the public for several weeks. We request your patience during this time of transition.

Effective about July 1, our address will be 416 West Congress Street, Suite 100, Tucson, AZ 85701. The telephone number will be (520) 770-3500. The office is on the north side of Congress Street, less than one block east of Interstate Highway 10. Ample parking (free) is available.

Please visit our new office to use the library and data files, purchase geologic maps and reports, or confer with geologists.



NEED TOPOGRAPHIC MAPS?

Topographic maps of Arizona may be purchased from the Tucson Earth Science Information Center (ESIC). Maps are available in five scales: 1:24,000, 62,500, 100,000, 250,000, and 500,000.

ESIC staff also sell U.S. Geological Survey (USGS) geologic maps in the MF, GQ, HA, and I series, and USGS Bulletins, Professional Papers, and Water Supply Papers. Other products and services are also available.

The ESIC is a cooperative venture between the Arizona Geological Survey and the Geologic and National Mapping Divisions of the USGS.

For information about how to order maps contact Diane Murray at the ESIC office at 340 N. Sixth Ave., Tucson, AZ 85705-8325; tel: (520) 670-5584.



TWO DRILLING PERMITS ISSUED

The Arizona Oil and Gas Conservation Commission issued two drilling permits since January.

The first was issued to Ridgeway Arizona Oil Company to drill the 22-1 State, a 2,300-foot carbon dioxide test 5 miles southeast of St. Johns (sec. 22 T. 12 N., R. 29 E.) in Apache County.

The second was to The Townsend Company for the 26-1 State, a 2,700-foot oil test in Coconino County, 8 miles southwest of Winslow in sec. 26, T. 19 N., R. 13 E.

To date, no site-preparation or drilling activity has been reported at either location.

For additional information, please contact Steven L. Rauzi, Oil and Gas Program Administrator.



EARTHQUAKE MEETING IN FLAGSTAFF

The 17th Annual Conference of the Western States Seismic Policy Council will be hosted by the Arizona Division of Emergency Management in Flagstaff, September 18-21, 1995. The meeting, open to the public, will be of interest to the emergency-management community, engineering geologists, members of the insurance industry, and geoscience educators.

Presentations will be made by each member state and invited speakers from federal and state agencies. A field trip will be taken to observe geologic features.

For additional information, please contact Doug Bausch at P.O. Box 4099, Flagstaff, AZ 86011; tel: (800) 628-6754; fax: (520) 523-9220; or e-mail: wsspc@vishnu.glg.nau.edu.



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