



Vol. 25, No. 3  
Fall 1995

# Arizona Geology

Published Quarterly by the Arizona Geological Survey

**ARIZONA  
GEOLOGICAL SURVEY**  
INFORMATION TO  
ARIZONANS SINCE 1889

## 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

- Information about Arizona geology
- Geologic publications
- Databases and data files
- Geology library
- Rock cuttings and core repository
- Geologic maps and character of map units
- Geologic hazards investigations
- Mineral and energy resources investigations
- Staff support for Oil and Gas Conservation Commission

A.R.S. § 27-152

## Grand Canyon - More Rain and Rockslides

Larry D. Fellows  
*Arizona Geological Survey*

Heavy rain at the South Rim of the Grand Canyon August 20 forced closure of the Bright Angel Trail for an estimated three weeks. In a 40-minute period, 0.64 inches of rain fell. A second storm dropped 1.1 inches of rain August 21.

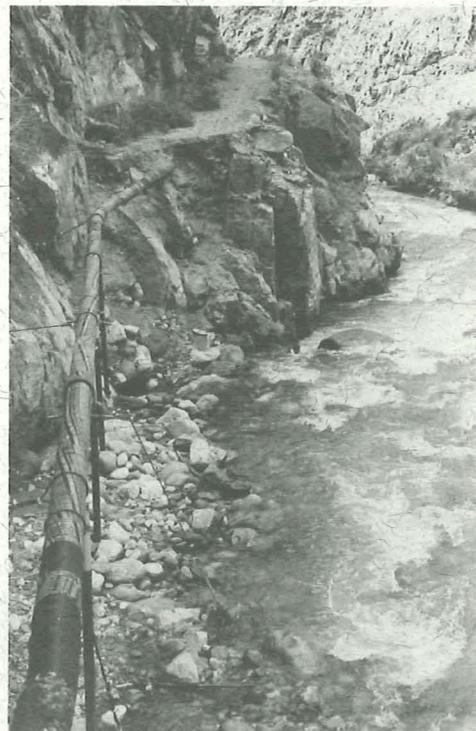
The trail was impassable in 20-25 places above Indian Garden, which is 4.5 miles and 3,200 feet below the Rim. Flash floods washed away portions of the trail. Rockslides left some boulders as large as small cars on the trail. About 1,000 feet of rock wall will have to be rebuilt.

No hikers were injured. As many as 2,000 people hike the trail daily during the summer. Grand Canyon National Park remained open and all visitor facilities and other activities were available as scheduled. The North Kaibab Trail remains closed because of damage by heavy rain in March. For information about trail conditions, call the National Park Service at (520) 638-7888.

The Bright Angel Trail was closed for nearly three weeks after 2.3 inches of rain fell in a 48-hour period March 4-6. The average total rainfall for March at the South Rim is only 1.4 inches. Water-supply pipelines from the Canyon's north slope to the South and North Rims were severed. The entire Bright Angel and North Kaibab Trails were closed by multiple rock slides. The South Kaibab was closed below Mormon Flats, a two-mile walk from the South Rim.

A debris flow from Prospect Creek March 6 constricted the Colorado River at Lava Falls Rapid by about 50 percent. The debris fan extended 100-150 feet into the river over a distance of 600

feet. Several members of a research group, camped a short distance upstream, heard a roaring sound during the night. When they awoke, they saw the new debris fan, produced by the largest debris flow that has occurred at Lava Falls Rapid since 1955 and the first since 1963.



Damage to the North Kaibab Trail and water pipeline caused by flooding in March 1995. Grand Canyon National Park photograph.

# Oil and Gas

## ARIZONA GEOLOGICAL SURVEY

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### New Commissioner.

Dr. Donald W. Clay, Yuma, was appointed by Governor Symington to serve a five-year term as a member of the Oil and Gas Conservation Commission (OGCC). Dr. Clay is a retired geology professor from Arizona Western College.

**New law.** H 2013, passed during the 1995 Legislative session and signed by Governor Symington, clarifies the responsibility of an operator relative to plugging abandoned wells.

**Sunset review.** The OGCC is undergoing a review by the Arizona Legislature to determine whether its functions

should be continued. A public hearing will be held, probably in October. Such reviews are required by statute for all State agencies.

**Drilling update.** The Townsend Co. 26-1 State well, 18 miles west of Winslow in Coconino County, was drilled to a total depth of 2,960 feet and abandoned in June. No shows of oil or gas were reported.

During July and August the Arzon Corporation 1 State was drilled to a depth of 8,974 feet.

Pipe was set at 4,064 feet and the well, 3 miles west of San Simon in Cochise County, was temporarily abandoned.

The Ridgeway Arizona Oil Co. 22-1 State, 5 miles southeast of St. Johns in Apache County, was drilled and abandoned in August because of lost circulation in the San Andres Limestone (Permian). Total depth was 218 feet. The 22-1X was permitted as a replacement well. The Ridgeway 3-1 State well was recently drilled 7 miles southeast of St. Johns. The Ridgeway wells are being drilled to test the quantities and areal extent of carbon dioxide and helium that were encountered in Supai (Permian) rocks in the Ridgeway 1 Plateau Cattle well, drilled in August 1994. 

## We Moved

Everything is new -- address, zip code, telephone number, and FAX number: Arizona Geological Survey, 416 West Congress Street, Suite 100, Tucson, AZ 85701; telephone (520) 770-3500; FAX (520) 770-3505.

We moved to the State Office Complex in downtown Tucson in June. Exit I-10 at Congress Street, go about a block east, turn left (north) at the 400 West Congress sign, and you're there! Please refer to map. Free parking is avail-

able for office visitors. We encourage you to come to our new office.

Many other State agencies have offices in the Complex. Some of them are: Agriculture, Attorney General, Commerce, Education, Environmental Quality,

Governor, Health Services, House and Senate, Mine Inspector, Real Estate, Registrar of Contractors, and Water Resources.

For information about these offices, and others that are not listed here, please call (520) 628-6300.



State of Arizona Regional Complex in downtown Tucson. The Arizona Geological Survey occupies the first floor of Building 416.

## 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.

Design and Layout:  
Peter F. Corrao

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# New Publications

The Arizona Geological Survey released eight reports and maps since May 1995.

## **AZGEOBIB, Version 2.0: A list of references on the geology of Arizona:**

R.A. Trapp, N. Schmidt, S.J. Reynolds, and K.C. Horstman, 1995, Open-File Report 95-4 (Pub. number OFR 95-4), 326 p. \$30.00

This is an alphabetical list, by author, of the 11,170 citations currently in the bibliographic database on Arizona geology. The list is not indexed. Please refer to the description of AZGEOBIB PROGRESS on page 4 of this issue.

## **Surficial geology of the lower Agua Fria River, Lake Pleasant to Sun City, Maricopa County, Arizona:**

G. Huckleberry, 1995, Open-File Report 95-5 (Pub. number OFR 95-5), 36 p., 2 sheets, scale 1:24,000. \$10.00

Seven alluvial terraces are present above the modern Agua Fria channel. The author mapped them and described the character of soil developed on them.

## **A reconnaissance of earth fissures near Stanfield, Maricopa, and Casa Grande,**

**western Pinal County, Arizona:** R.C. Harris, 1995, Open-File Report 95-6 (Pub. number OFR 95-6), 6 p., one plate, scale 1:24,000. \$5.00

The author reviewed

air photos, field-checked all anomalous features, identified earth fissures, and plotted their locations on topographic maps.

## **Bibliography of subsidence and earth fissures within Arizona:**

R. Frisch-Gleason, S. Slaff, and R.A. Trapp, 1995, Open-File Report 95-8 (Pub. number OFR 95-8), 24 p. \$4.50

This list of 354 references was compiled by the AZGS in cooperation with the Arizona Department of Water Resources.

## **Bibliography on subsidence and earth fissures in the metropolitan Phoenix area:**

R.A. Trapp and R. Frisch-Gleason, 1995, Open-File Report 95-11 (Pub. number OFR 95-11), 6 p. \$2.00

Because of population growth and urban development, information is needed about the location and extent of subsidence and fissures. The list contains 75 references, which are also included in OFR 95-8, described above.

## **Geologic map of the southeastern Kofa Mountains and western Tank Mountains, southwestern Arizona:**

M.J. Grubensky, G.B. Haxel, and K.A. Demsey, 1995, U.S. Geological Survey Miscellaneous Investigations Series Map I-2454 (Pub. number NP-11), 1 plate, scale 1:62,500. \$ 6.00

Faulted and tilted lower Miocene volcanic rocks crop out extensively. Jurassic plutonic rocks and metamorphosed Jurassic sedimentary and volcanic rocks are also exposed. Orocopia Schist is exposed at Neversweat Ridge. Quaternary deposits are divided into several units. The study area, which covers what is now the Kofa Wilderness Area, includes the historic King of Arizona gold mine.

The study was done cooperatively by the USGS and the AZGS.

## **Geology and production history of the Golden Crown (George Harrison No. 1) uranium mine, Navajo County, Arizona:**

W. L. Chenoweth, 1995, Contributed Report 95-F (Pub. number CR 95-F), 6 p. \$2.00

Uranium ore from this mine, 17 miles north of Kayenta in the Monument Valley area, was obtained from the Shinarump member of the Chinle Formation (Triassic).

## **The geology, leasing, and production history of the Oak Springs uranium-vanadium mines, Apache County, Arizona:**

W.L. Chenoweth, Contributed Report 95-G (Pub. number CR 95-G), 15 p. \$2.25

Ore bodies are on Gravel Top Mesa in the eastern Carrizo Mountains. Uranium and vanadium were produced from the Salt Wash member of the Morrison Formation (Jurassic).



## How to Order Them

You may purchase publications from the AZGS office or by mail. Please send 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 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:

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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.

**AZGEOBIB PROGRESS**

This is the Arizona Geological Survey (AZGS) computerized bibliographic database on Arizona geology. It currently contains 11,170 citations, each of which has been key-worded by subject and location. About 300 subject, 2,000 stratigraphic names, and 550 location key words are used. Bibliographic subsets can be constructed using combinations of subject and location key words. The 550 geographic areas are identified on a map that the AZGS released as **Open-File Report 95-2**. A complete list of citations in the database has been released as **Open-File Report 95-4**, described on page 3 of this issue. New citations are regularly added to the database.

Please contact Richard A. Trapp for additional information.

**INTERLIBRARY LOAN**

Copies of the AZGS' *formal* publications (bulletins, circulars, professional papers, maps, and down-to-earth series) are housed at the Arizona Department of Library, Archives, and Public Records (the State Library) at the State Capitol, 1700 West Washington, Phoenix 85007. These publications are also available in 14 depository libraries, established in cooperation with the State Library, throughout the state. If your local library is not one of the designated repositories, you may be able to obtain copies of these AZGS publications on interlibrary loan through the State Library. Please contact your local library for information.

AZGS publications in the open-file report, contributed map, and contributed report series are *not* available by interlibrary loan.

**PORPHYRY COPPER VOLUME**

*Porphyry Copper Deposits of the American Cordillera*, published by the Arizona Geological Society as Digest 20, includes most of the papers that were presented at the October 1994 symposium, *Bootprints along the Cordillera -- Porphyry Copper Deposits from Alaska to Chile*. This 656-page, hardbound digest contains 43 articles on porphyry copper deposits, including 12 overview articles and 31 topical studies of deposits in North and South America. Symposium registrants who have not received a copy of Digest 20 should contact the AGS (P.O. Box 40952, Tucson, AZ 85717).

Digest 20 may be purchased from the Arizona Geological Survey for \$75.00, plus \$10.25 for shipping and handling if you would like to have the book mailed.

**REGISTRATION OF GEOLOGISTS**

During the past Legislative session, changes were made to the statutes administered by the Arizona Board of Technical Registration. One bill, S 1077, authorizes the Board to vote whether to allow an applicant for registration (including geologists and engineers) to take the exam even if he or she has not worked under the direct supervision of a registered professional.

For details about the above change, as well as others that were made, contact the Board at 1951 West Camelback, Suite 250, Phoenix, AZ 85015. Telephone: (602) 255-4053.

Eighteen states require registration of geologists, 16 with an exam and two without. Three states have certification and three have definition laws. Laws are being considered in five other states.



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