



Vol. 24, No. 1
Spring 1994

Arizona Geology

A publication of the Arizona Geological Survey

INFORMATION AND SERVICE SINCE 1889

- geologic information
- geologic library and databases
- mapping and framework
- hazards and limitations
- mineral resources
- well cuttings and core repository
- oil, gas, geothermal and helium regulation (administered by the Oil and Gas Conservation Commission)

ARS 27-152

INSIDE

General-Interest
Publications
--Page 2

Map Mesa Next
--Page 2

Hazards Guide
--Page 2

Just Released
--Page 3

Uranium and Radon
--Page 3

Oil Show in Geothermal Test

Larry D. Fellows
Director and State Geologist

In 1993 a geothermal test hole, the 1 Alpine-Federal, was drilled 6 miles north of the town of Alpine in southern Apache County. An oil show was present and valuable subsurface information was obtained. The purpose of the project, which was funded by the Arizona Department of Commerce and the U.S. Department of Energy, was to assess the hot-dry-rock geothermal potential of the area by measuring the temperature of granite. The contractor estimated granite to be approximately 4,200 feet below

the surface. Granite had not been reached at 4,505 feet and drilling was stopped. The temperature at that depth was not as high as had been anticipated. A detailed report is being prepared by the contractor and will be released by the Arizona Geological Survey (AZGS) after it has been

submitted and approved.

Two-inch-diameter core was taken from 502 feet below the surface to the bottom of the hole. Steven L. Rauzi, Oil and Gas Program Administrator, reported that limestone units in the Supai Group (Permian age) from 4,000-4,400 feet, including all of the Fort Apache Limestone, had a slight petroliferous odor which became strong when acid was applied. Oil was bleeding from vertical fractures in a 4-foot zone at the top of this interval. Heavy oil, oil staining, and dead oil were previously described from the upper Supai in several

wells to the north and west.

The hole penetrated the top 604 feet of the Supai Group, the total thickness of which is estimated to be almost 1,500 feet. Rauzi estimated that the hole would have to be deepened 1,500-2,100 feet to reach granite, assuming there are no complications due to faulting or intrusive igneous rocks.

Dark-colored igneous rocks, believed to be dikes, were present at three places within the Supai Group. Oil is produced from similar igneous rocks that intruded strata in the Hermosa Group

see **OIL SHOW**, page 4

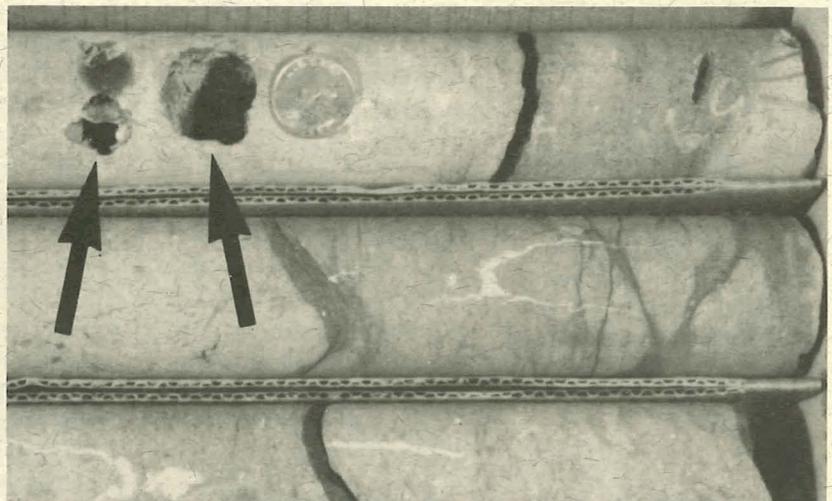


Figure 1. Core from the Ft. Apache Limestone. Note cavities in top row (arrows). Quarter for scale.

Map Mesa Next

General-Interest Publications

Many maps and reports completed by Arizona Geological Survey (AZGS) geologists are intended for use by practicing professionals. Maps and reports of interest to the general public are also available for purchase. They depict and describe roadside geology, earthquakes and epicenters in Arizona, the 1887 Sonoran earthquake, young faults and volcanic rocks, land subsidence and earth fissures, radon, metallic mineral districts and production, nonmetallic mineral resources, and energy resources.

These publications can be used by earth science teachers and students, land owners, and other interested citizens who have not had formal education in the geological sciences or whose knowledge of these subjects is limited.

A list of general-interest publications has been compiled and may be obtained (no charge) from the AZGS Publication Sales Manager. Use the order form on this list and receive a 20 percent discount on the items listed. This sale ends May 15, 1994.

Arizona Geological Survey (AZGS) geologists will finish mapping the Phoenix 1° x 2° Quadrangle (1:250,000 scale) this field season. Where should they map next? The Geological Mapping Advisory Committee was established to help answer this question. Committee members overwhelmingly responded that the Mesa 1° x 2° Quadrangle has the greatest mapping needs. In accordance with this assessment, the AZGS submitted a request to the U.S. Geological Survey for matching funds from the STATE-MAP component of the National Geologic Mapping Program to supplement mapping

activities. Mapping will begin in the west half of the Mesa Quadrangle in October 1994.

Committee members considered the following criteria in determining the need for geologic mapping: extent of mapping completed or in progress, potential for population growth, known and potential geologic hazards and limitations to land and resource management, known and potential mineral and energy resources, and level of geologic complexity and understanding.

Representatives from industry, governmental land- and resource-management agencies, and academia served on the committee. Eleven

geologists and consultants represented the private sector in areas of urban and engineering geology, hydrogeology, and mineral and oil exploration. Four State government members (Environmental Quality, Land, and Water Resources Departments and the Oil and Gas Conservation Commission) and four Federal agency members (Bureau of Land Management, Bureau of Reclamation, Forest Service, and National Park Service) participated. Three members represented Arizona universities (Arizona State and Northern Arizona Universities and the University of Arizona).

Hazards Guide

The Citizens' Guide to Geologic Hazards was published by the American Institute of Professional Geologists. The authors of this 134-page book described geologic hazards that occur worldwide, kill more than 100,000 persons each year, and cause billions of dollars in damage. The book is subdivided into two sections: (1) hazards posed by geologic materials (reactive minerals, asbestos, and radon) and (2) hazards that result from geologic processes (earthquakes,

volcanoes, landslides, avalanches, and others). Lists of available videotapes and slide sets are included.

The Guide was written for architects, attorneys, engineers, environmental scientists, geologists, home owners, insurance agents, legislators, mortgage bankers, planners, realtors, teachers, and zoning commissioners. It may be purchased from the Arizona Geological Survey for \$21.35, plus \$5.75 for shipping and handling. Request publication NP-6.

Tell Us, Please

This is the third issue of the "new" *Arizona Geology*. If you do not like the format and prefer not to receive future issues, please tell us. If you want to stay on the mailing list but are planning to move, please tell us, so we can mail future issues to your correct address.

Just Released

The Arizona Geological Survey released seven new publications, described below, since November 1993. Please mail publication orders to AZGS Publications, 845 North Park Ave., #100, Tucson, AZ 85719-4816. Orders are shipped by UPS, which requires a street address for delivery. All orders must be prepaid by check or money order payable in U.S. dollars to the Arizona Geological Survey. 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- 5.00, add 2.00
5.01- 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.

Earth fissures and related subsidence features adjacent to the Tucson aqueduct, Central Arizona Project, Pinal and Pima Counties, Arizona: S. Slaff, Open-File Report 93-11, 18 p., 6 sheets. \$15.00

The author identified features on air photos that might be related to subsidence and fissures, investigated them in the field, and summarized the results in this report.

Index to geologic maps in the Mesa 1° x 2° Quadrangle, Arizona: S.J. Skotnicki, Open-File Report 93-19, 18 p., 3 sheets, scale 1:250,000. \$7.50

Published maps, unpublished thesis and dissertation maps, and unpublished maps on file at the AZGS are indexed and citations to them are listed. A partial list of citations to geologic studies done that do not include maps is also included.

Implications of live oil shows in eastern Arizona geothermal test: S.L. Rauzi, Open-File Report 94-1, 17 p., 12 sheets, scale 1:500,000. \$11.75

The author discusses Paleozoic paleogeography, post-Paleozoic uplift and erosion, structural geology, and oil and gas potential beneath volcanic rocks in east-central Arizona.

Basic geologic and hydrologic information, Bradshaw Mountains, Yavapai County, Arizona: P.S. Scott, Open-File Report 94-2, 65 p., 12 sheets, scale 1:100,000. \$23.00

The report includes a bibliography of publications covering the area, an index of geologic maps, a compilation geologic map, mine locations, mineral-production and water-well data, and other information.

Well location map, Colorado Plateau province, Arizona: Apache, Coconino, Navajo, and portions of adjacent counties: S.L. Rauzi, 1994, Oil and Gas Publication 11, 48 p. plus 3-page addendum, scale 1:500,000. \$6.00

The map shows locations of more than 1,000 oil, gas, and geothermal wells; selected deep water wells; and mineral-exploration test holes. The accompanying booklet includes location, surface elevation, total depth, rock unit at total depth, and other information, including a list of oil seeps and other surface indications of oil. This report updates one that was done in 1975.

Geologic map of the Black Mountains accommodation zone, Mohave County, Arizona: J.E. Faulds, Contributed Map 93-F, 4 sheets, scale 1:12,000. \$12.00

These geologic maps (2 sheets) and cross sections (2 sheets) cover an area of approximately 70 square miles in the northern Black Mountains in west-central Mohave County. The focus of the study is an east-trending zone of complex faulting that separates areas to the north that are tilted eastward by numerous west-dipping normal faults from areas to the south that are tilted westward by numerous

Uranium and Radon

The U.S. Environmental Protection Agency (EPA), through the State Indoor Radon Grant (SIRG) Program, funded the Arizona Radiation Regulatory Agency to collect and disseminate information about radon in Arizona. Some of these funds were provided to the Arizona Geological Survey (AZGS) to study the distribution of uranium in rocks and soils in Arizona. This information can be used to identify areas with potential for indoor radon. Results of all uranium studies completed by AZGS geologists from 1990 to 1993 were published in AZGS Bulletin 199, which also includes reports of several investigations that were not funded by SIRG.

During the current, 4th year of SIRG funding, AZGS geologist Ray Harris will study parts of western and southern Arizona in which rocks contain unusually high concentrations of uranium and, therefore, may have potential for elevated radon levels in buildings constructed on those rocks. Uranium and radon investigations are planned and coordinated by J.E. Spencer.

OIL SHOW, from page 1

(Pennsylvanian age) in the Dineh-bi-Keyah field in northeasternmost Apache County.

Rauzi described the 1 Alpine-Federal well in an article in the *Oil and Gas Journal* (January 3, 1994, p. 52-54). He subsequently completed a more detailed report, **AZGS Open-File Report (OFR) 94-1**, in which he discussed the potential for petroleum beneath rocks of the White Mountain volcanic field in east-central Arizona. Information about how to obtain this report is given on page 3 of this issue. Rauzi also

updated **Oil and Gas Publication 11** to incorporate information obtained from the 1 Alpine-Federal and other wells drilled since 1975.

The upper part of the core (502-3,255 feet), which includes the Datil and Baca formations of Tertiary age, is on loan to the New Mexico Bureau of Mines and Mineral Resources (New Mexico's state geological survey) in Socorro, to facilitate regional studies of Tertiary geology.

The Arizona Oil and Gas Conservation Commission regulates the drilling and production of oil, gas, helium, and geothermal resources.

AZGS staff carry out Commission policies and regulations and maintain well files and a repository of cores and cuttings obtained during drilling. Cuttings from 4,300 wells, mostly water wells, and cores from more than 300 holes are in the repository. An index of the well cores is available as **OFR 93-2**. Cores and cuttings may be examined by the public. A **complete list of oil and gas publications** may be obtained at no charge from the AZGS.

For more information about the Alpine well or oil and gas in Arizona, in general, please contact Steve Rauzi at the AZGS.

JUST RELEASED, from page 3

east-dipping normal faults. The northern part of the Virginia mineral district, which includes the Van Deemen mine, and the southern part of the El Dorado Pass mineral

district, which includes the Pope mine, are within the map area.

Geology and production history of the uranium ore deposits in the Cameron area, Coconino County, Arizona: W.L.

Chenoweth, Contributed Report 93-B, 30 p., 1 sheet, scale 1:62,500. \$7.00

The geologic setting, mining activities, and uranium production from 100 properties from 1951-63 are described in the report.

Arizona Geology

is the official newsletter of the Arizona Geological Survey.
Published quarterly.
Vol. 24, No. 1

Fife Symington
Governor

Larry D. Fellows
Director & State Geologist

Rose Ellen McDonnell
Admin. Services Officer

Peter F. Corrao
Design and Production

Copyright © 1994
by the Arizona Geological Survey
 printed on recycled paper

Fossils

Proceedings of the First Annual *Fossils of Arizona* Symposium may be purchased from the Arizona Geological Survey for \$18.00, plus \$4.50 for shipping and handling. Request publication NP-7. The book contains the nine papers that were presented in November 1993.



Arizona Geological Survey
845 N. Park Ave., Suite 100
Tucson, AZ 85719-4816
Tel: (602) 882-4795

Address Correction Requested

NON PROFIT ORG.

U.S. POSTAGE

PAID

TUCSON, ARIZONA

PERMIT NO. 3088