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Arizona Geology
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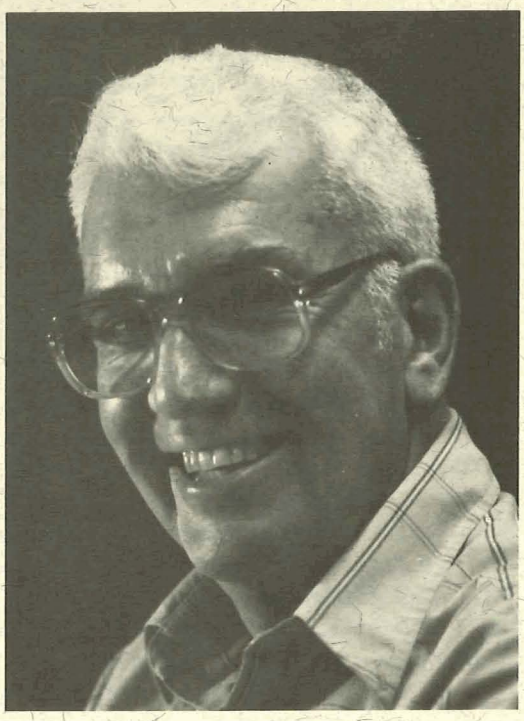
ARS 27-152

INSIDE

H. Wesley Peirce

Civilization exists by geological consent, subject to change without notice. Had philosopher Will Durant not penned those words, Dr. H. Wesley "Wes" Peirce probably would have written something very similar. Wes devoted his career to studying the geology of Arizona and informing others about the impact of "things geologic" on their lives and communities. Peirce coined the expression "things geologic," which he commonly used in place of the more formal word "geology," because, he said, "it permits a selective development of ideas, principles, and concepts that treat interrelationships among non-living things, processes, and life. Life -- all life -- is fundamentally dependent upon and influenced by the non-living components of the environment -- things geologic."

Wes Peirce died at his home in Tucson November 7, at age 70. A consummate field geologist and meticulous writer, he published more that 80 reports, maps, abstracts, and nontechnical articles on Arizona geology and was working on several others until he became debilitated by cancer. Peirce had a passion for teaching and was committed to the concept, "Give a man a fish and feed him for a day; teach a man to fish and feed him for life." He eagerly gave of his time and talent to teach teachers, students, and interested citizens about "things geologic."



Wes, who grew up in San Diego, earned degrees in geology from the University of Montana (B.S.), University of Indiana (M.S.), and University of Arizona (Ph.D.). He began working at the Arizona Bureau of Mines (renamed the Bureau of Geology and Mineral Technology) in July 1956, and retired July 1, 1987 as Principal Geologist Emeritus of the Geological Survey Branch, which is now the Arizona Geological Survey.

Dr. Peirce is survived by his wife, Maxine, five children, his father, one sister, one brother, and nine grandchildren. His family has established a scholarship fund to assist students studying Arizona geology at the University of Arizona. Please send donations to the H. Wesley Peirce Scholarship Fund, 1302 S. Avenida Sirio, Tucson, AZ 85710.

More Wells Planned

Defiance Positive Area

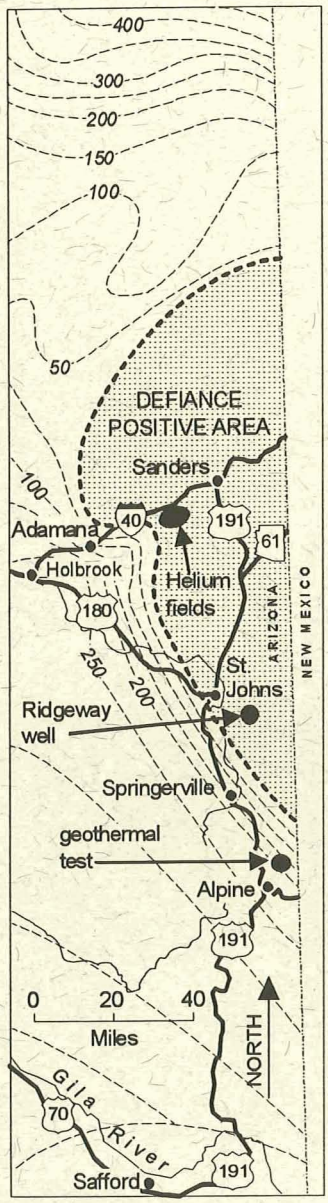


Figure 1. Defiance positive area (stippled) and thickness (in meters) of Pennsylvanian rocks in east-central Arizona. Modified from map by H. W. Peirce, 1979, The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States -- Arizona: U.S.Geological Survey Professional Paper 1110-Z, p. Z7.

Larry D. Fellows
Director and State Geologist

High concentrations of carbon dioxide and above-average amounts of helium were encountered in a well drilled by Ridgeway Petroleum Company near St. Johns (Figure 1), in east-central Arizona, last August. We described that well in the Fall 1994 issue of *Arizona Geology*. An oil show in a geothermal test hole drilled near Alpine in 1993 enticed Ridgeway to examine the geology of the area, assess the potential for oil and gas, secure leases, and drill the well. Ridgeway plans to drill additional wells to determine whether carbon dioxide and (or) helium are present in quantities that can be produced economically.

East-central Arizona is an exciting place for resource exploration. The Defiance positive area (Figure 1) was once present, although evidence of its existence is now hidden by younger rocks. The area was positive during much of the Paleozoic era. Paleozoic rock units pinched out against the flanks of the uplift until Permian marine deposits finally covered it. Supai Group rocks are unconformable on Precambrian granite, which is exposed in the core of the positive area.

A poorly defined structural feature crosses the southern part of the county. Extensive areas south of St. Johns were flooded with young lavas and related deposits of the White Mountain volcanic field. Because of limited drilling, the subsurface framework is not well known.

Helium was produced from three shallow fields about 45 miles northwest of St. Johns in the 1960s and 70s. An oil seep has been reported along the Little Colorado River south of St. Johns and oil shows have been reported in some wells. Halite and sylvite are present in the subsurface beneath portions of Apache and Navajo Counties. Liquified petroleum gas is being stored in caverns created in halite near Adamana (Figure 1). Low-temperature geothermal waters are present beneath portions of southern Apache County.

Most of the land in the Holbrook-Sanders-Springerville area is State Trust land, administered by the Arizona State Land Department, or is privately owned. These lands are available for exploration, once valid leases and permits have been obtained.

The amount of State Trust and Public (Federal) land leased for oil and gas increased during 1994, partly because of activity related to the St. Johns well. Active leases, unrelated to this well, have also been issued in other parts of the State, including near the Utah border in northwestern Arizona, in Greenlee County east of Safford, northeastern Cochise County, and southern Yuma County.

In November, 99,959 acres of State Trust land were under lease, up from 38,715 acres in January. Federal land under lease totalled 153,363 acres, compared to 120,366 acres at the beginning of 1994. Leases on privately owned land are recorded at the county courthouse. We are unaware of the total currently under lease. To date, 253,322 acres of State Trust and Federal land are currently under lease for oil and gas. That might sound like a lot, but it's only about 400 square miles, equivalent to a rectangle 20 miles on a side.

Leases of State Trust land are granted for a 10-year period, at an annual rental of $1.00 per acre for the first 5 years and $2.00 per acre for the second 5 years. Money from leases goes to the State Trust and is distributed to designated beneficiaries. Leases of Federal land cost $1.50 per acre annually for a 10-year term. Half the money generated from those leases is returned to the State General Fund.

New Publications

The Arizona Geological Survey (AZGS) released nine new publications, described below, since September 1994.

Geologic map of the Salome 30' x 60' Quadrangle, west-central Arizona: S.M. Richard, J.E. Spencer, and S.J. Reynolds, 1994, Open-File Report 94-17 (Pub. number OFR 94-17), 33 p., 1 sheet, scale 1:100,000. $8.00

This map includes the southern half of the Harcuvar Mountains, the northwestern Big Horn Mountains, and all of the Granite Wash, Harquahala, and Little Harquahala Mountains. The map was compiled from 1:24,000-scale geologic maps.

Surficial geology of the Wittmann and Hieroglyphic Mountains Southwest 7.5' quadrangles, northern Maricopa County, Arizona: Gary Huckleberry, 1994, Open-File Report 94-21 (Pub. number OFR 94-21), 20 p., 2 sheets, scale 1:24,000. Each sheet $1.50; text $3.25; text and sheets $6.25

Urban development adds incentive to understand the surficial geology and geologic hazards in the map area, which is primarily covered with surficial deposits. Old, dissected alluvial-fan deposits with clay-rich soils and (or) caliche accumulations predominate near the mountains. Younger deposition has been concentrated farther downslope in areas with minimal topographic relief. The latter areas may experience widespread inundation during large floods.

Surficial geology, soils, and vegetation patterns of the Table Top Mountain area, Pinal and Maricopa Counties, Arizona: Elise Pendall, 1994, Open-File Report 94-22 (Pub. number OFR 94-22), 37 p., 1 sheet, scale 1:24,000. $11.00

Piedmonts around Table Top Mountain contain an unusually complete suite of alluvial deposits ranging in age from modern to late Pliocene. Increases in pedogenic clay and (or) calcium carbonate with deposit age cause change in the distribution of soil moisture, which, in turn, leads to variations in vegetation patterns.

Surficial geology of the southern Verde Valley, Yavapai County, Arizona (Middle Verde, Camp Verde, and Horner Mountain Quadrangles): P.K. House, 1994, Open-File Report 94-23 (Pub. number OFR 94-23), 20 p., 3 sheets, scale 1:24,000. $7.50

Quaternary climatic fluctuations affected the Verde River and its tributaries. The maps contain information about the distribution of flood hazards, potential soil problems, potential for economic aggregate deposits, and Quaternary movement on the Verde fault zone.

Surficial geologic map of the Mesa 30' x 60' Quadrangle, Maricopa and Pinal Counties, Arizona: P.A. Pearthree and Gary Huckleberry, 1994, Open-File Report 94-24 (Pub. number OFR 94-24), 1 sheet, scale 1:100,000. $3.50

Geomorphology and surficial geology in this area are variable and complex. Surficial geologic units were differentiated by age (modern to Tertiary) and by their position in the regional landscape (intramontane and piedmont, basin-floor, and major-river deposits). Potential flood hazards and groundwater recharge are also considered.

Comprehensive bibliography of uranium and radon in Arizona: R.C. Harris and R.A. Trapp, 1994, Open-File Report 94-25 (Pub. number OFR 94-25), 51 p. $8.00

Studies of uranium and radon can be useful in estimating the probability of elevated uranium levels in geologic materials. Such information can help homebuilders and others anticipate or avoid

see NEW PUBLICATIONS, page 4

How to Order Them

You may purchase publications by mail or in person from the AZGS office. Please send mail 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 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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If you purchase items at the AZGS office, please keep in mind that we need up to two days for photocopying and (or) reproducing reports and maps in the Open-File Report, Contributed Map, and Contributed Report Series.

NEW PUBLICATIONS, from page 3

potential indoor-radon problems. This bibliography will also be useful to those engaged in uranium exploration.

Geology and production history of the Fern No. 1 uranium mine, Navajo County, Arizona: W.L. Chenoweth, 1994, Contributed Report 94-H (Pub. number CR 94-H), 11 p. $2.00

Uranium production was from a channel deposit in the basal Chinle Formation. Uraninite was the principal mineral, but chalcocite, bornite, and chalcopyrite were also present. This mine produced more high-grade uranium ore than any other mine in Monument Valley.

Reconnaissance environmental geology of northern Scottsdale, Maricopa County, Arizona: T.L. Péwé, Jim Bales, and Melissa Montz, 1983, Contributed Map 94-E (Pub. number CM 94-E), 3 sheets, scale 1:24,000. Plate 1, geology; Plate 2, geologic hazards; and Plate 3, waste disposal. Each sheet $3.50. All 3 sheets $10.50.

Precambrian granite and metamorphic rocks crop out in the northern McDowell Mountains. A pediment developed on granite extends northward from the southwest side of the Carefree basin. Numerous dikes of Tertiary basalt and rhyolite cut the pediment.

The distribution of bedrock and surficial deposits was mapped. Potential for rockfall, landslides, earthquakes, flooding, and earth fissures is outlined. Potential for waste disposal is evaluated on the basis of depth to bedrock and groundwater, flooding, slope, availability of cover, and caliche.

Reconnaissance environmental geology of the Tonto foothills, Scottsdale, Maricopa County, Arizona: T.L. Péwé, Ray Kenny, and Jim Bales, 1985, Contributed Map 94-F (Pub. number CM 94-F), 4 sheets, scale 1:24,000. Plate 1, geology; Plate 2, geologic hazards; Plate 3, waste disposal; and Plate 4, flooding. Each sheet $3.50. All 4 sheets $14.00.

Precambrian granite surrounds the east end of the Carefree basin, which is filled with Tertiary alluvial deposits. Tertiary basalt, rhyolite dikes, and flow remnants crop out. Older Precambrian metamorphic rocks are present at the northern end of the area.

The distribution of bedrock and surficial deposits is mapped. Potential for rockfall, landslides, and earthquakes is outlined. Potential for underground waste disposal is evaluated on the basis of depth to ground water, depth to bedrock, flooding, slope, availability of cover, and caliche. Potential for river, creek, and sheet flooding is outlined on the basis of mapping of floodplains, low terraces, flood frequency, and amount of stream runoff. Frequency and amount of stream runoff are plotted.

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