



# Arizona Geological Society Newsletter

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MAY 2018

## MAY 1, 2018 DINNER MEETING

**Who:** **William B. White** is the featured speaker. See abstract below.

**Where:** Sheraton Tucson Hotel and Suites, 5151 East Grant Road, (at the intersection of Grant and Rosemont on the North side of Grant in the **SABINO BALLROOM** (enter at northwest corner of the building) and go upstairs to the meeting room.

**When:** Cash Bar at 6 p.m.—Dinner at 7 p.m.—Talk at 8 p.m.

**Cost:** Members \$30, Guests \$33, Students Members free with online reservation (\$10 without).

**RESERVATIONS ARE REQUIRED:** Reserve on the AGS website (<http://www.arizonageologicalsoc.org/events>) by **11 am on Friday, April 27th**. Please indicate Regular (Sauteed Chicken Breast Topped with Bacon Bits, Garlic, Mushroom, & Parmesan Cream Sauce), Vegetarian (Polenta), or Salad (Greek Salad with Chicken) meal preference. Please cancel by **Friday, April 27th at 11 am** if you are unable to attend - no shows and late cancellations will be invoiced.

**The May dinner meeting is sponsored by**

**Available**

If you are interested in sponsoring the dinner meeting, please email:  
[vpmarketing@arizonageologicalsoc.org](mailto:vpmarketing@arizonageologicalsoc.org)

## ABSTRACT

**The Science of Caves and Cave Contributions to Science**  
**By William B. White, Dept of Geosciences, Penn State University**

Caves have been of interest to humans for millennia, but scientific interest in caves began only in the early 20th Century in the United States and a bit earlier in Europe. Much of the earlier research focused on the caves themselves, how they form, and the processes that take place inside them. Research of the past few decades has reversed the focus with the interest being in information caves can provide to other parts of the Earth sciences. The talk will provide a broad brush overview of cave sciences in the 21st Century.

Caves form by two distinct mechanisms. Best known is the top-down dissolution of limestone by circulating ground water made slightly acidic by carbon dioxide. Both equilibrium and kinetics of the reactions are well-known and some elegant models have been made of cave development. A more recent finding is that many

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caves have formed by deep-seated solutions welling up to the water table with the active agent being sulfuric acid rather than carbonic acid.

Many caves display spectacular speleothems but the bulk mineralogy tends to be boring: calcite, gypsum, and aragonite. Although less obvious, more than 300 other minerals have been formed by secondary deposition in caves.

What brought cave studies into the mainstream of the Earth sciences is the importance of karst aquifers as water supplies. Karst aquifers are a major source of domestic water supply. The conduit permeability means that karst aquifers respond rapidly to flood flows with changes in flow paths and water levels. Contaminant transport in karst aquifers is rapid, often to unknown destinations, and strongly dependent of the physical properties of the contaminant.

Caves have been recognized as useful sources of geomorphic information. Caves are strongly linked to landscape evolution. Clastic sediments in caves can be dated by cosmogenic isotopes providing useful markers for incision rates of surface streams and landscape evolution.

Calcite stalagmites grow slowly from the bottom up. A precise chronology of the layers can be obtained by U/Th isotope dating methods. Isotopic signatures (O,C,H) and trace element concentrations can be mapped along the growth axis. These maps reveal climatic variations of the surface above the cave over the time span represented by the speleothem.

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## **MEMBER NOTICE: TECHNICAL DIFFICULTIES WITH WEBSITE**

Over the last week the Arizona Geological Society web site has been experiencing technical difficulties, making payments online through PayPal impossible. We are currently working with PayPal to restore service and hope to have this problem resolved in the near future.

If you have been trying to make on-line reservations for our May dinner meeting, you can pay by cash or check at the door on the night of the meeting. Other payments can be made by check and sent to our Post Office box at:

**Arizona Geological Society**  
**PO Box 40952**  
**Tucson, AZ 85717**

## ABOUT THE SPEAKER



**William B. White** is professor emeritus of geochemistry in the Department of Geosciences at the Pennsylvania State University. Prior to retirement he held joint appointments in Geosciences and in the Materials Research Institute. He also taught in the Department of Materials Science and Engineering and supervised graduate students in the interdisciplinary program in Environmental Pollution Control. He holds a B.S. degree in chemistry from Juniata College (Huntingdon, PA) (1954). From 1954 to 1958 he was on the staff of the Department of Research in Chemical Physics at the Mellon Institute in Pittsburgh while pursuing graduate study in physics at the University of Pittsburgh. In 1958 he transferred to

Penn State, received his Ph.D. in geochemistry in 1962, and after a year and a half in a post-doctoral position, joined the faculty in 1963, reaching the rank of full professor in 1972.

Dr. White received the Matthew J. and Anne C. Wilson Award for outstanding teaching from the College of Earth and Mineral Sciences in 1974, the Outstanding Service Award (Honorary Life fellow) from the National Speleological Society in 1975, and the Lifetime Achievement Award in the Science of Speleology from the NSS in 1994. In 2001 he received the Karst Waters Institute Award and in 2004 the Distinguished Career Award from the Quaternary Geology and Geomorphology Division of the Geological Society of America. He is a Fellow of the American Association for the Advancement of Science, The Mineralogical Society of America, The American Ceramic Society, and the National Speleological Society. Dr. White's research activities have been divided between materials science and geological science. The former includes investigations of crystal chemistry, glass science, optical and phosphor materials, and infrared, Raman, and luminescence spectroscopy. The geological sciences include mineral physics and the hydrogeology and geomorphology of caves and karst. Overall, the research has been reported in 440 technical papers and 15 books. Recent books include "The Encyclopedia of Caves" (Elsevier, 2012), "The Caves of Burnsville Cove, Virginia" (Springer, 2015), and "Caves and Karst of the Greenbrier Valley in West Virginia" (Springer, 2015). His textbook on Geomorphology and Hydrology of Karst Terrains (Oxford Univ Press 1988) has been widely used.

Field investigations for cave and karst studies include the Appalachians (Pennsylvania to Alabama), the Mammoth Cave area, Kentucky, Puerto Rico, and other locations. Dr. White has traveled widely to karst areas of the world including much of the United States, parts of western Europe, the Adrian Coast and China.

~ ~ Welcome New Members ~ ~

**Kevin Hubbard   Luth Samana   Daabid Schellenberg   Alberto Silva Ariano**

**James Davis   David Reid   Chris Wanless   Russ Franklin**

**Joan Barry   Wayne Edgin   Seymour Sears   Matthew Wetzel**

## Arizona Geological Society Membership Stats (4/24/2018)

Total Membership	Professional Members	Student Members	Organizational Members
435	342	86	7

### AGS Executive Committee Members Needed!

Are you interested in the future of the **Arizona Geological Society (AGS)**? Would you like to make a meaningful contribution to the geology profession in Arizona? If so, the AGS needs you! The **Arizona Geological Society Executive Committee** is currently looking for volunteers – professional geologists and students – to serve in these four open committee positions:

- **Vice Treasurer**
- **Vice Secretary**
- **Councilor**

The Executive Committee meets **once a month from 6 pm to 7:30 pm**. Your small commitment of time each month can make a huge difference for the AGS. If you are interested in one of these volunteer positions and would like more information, please contact the Arizona Geological Society by email at:

**[info@arizonageologicalsociety.org](mailto:info@arizonageologicalsociety.org)**

## 2018 AGS Spring Field Trip to Jerome



**Overview of the United Verde Open Pit**

On Saturday, April 21, 2018, the weather was excellent as approximately 60 members and guests of the Arizona Geological Society visited Freeport-McMoRan's United Verde volcanogenic massive sulfide deposit, located in Jerome, Arizona. Participants included a number of professionals; both active and retired, as well as university faculty and students.

Following a brief orientation by our hosts, David Briggs gave a brief presentation on the history of the Verde mining district from an elevated area near the General Office, where attendees could view many of the important historical landmarks in and around the United Verde pit. For those who wish to learn more about Jerome, a comprehensive article on the history of the Verde Mining District, can be downloaded from the Arizona Geological Survey's web site.

Participants hiked from the General Office to an overlook at the United Verde open pit, where Paul Lindberg discussed the volcanogenic massive sulfide model that describes how the United Verde ore deposit formed. He also employed a block model to describe the structural evolution of the Verde mining district and its impact on the development of supergene enriched zones at the United Verde and United Verde Extension deposits.



**Paul Lindberg Presentation at United Verde Pit Overlook**

At the conclusion of Paul's presentation, the Arizona Geological Society awarded Paul with a Honorary Life Membership in recognition of his exceptional contributions to Arizona Geology over nearly five decades.

The field trip participants enjoyed lunch at the overlook of the open pit, where many examined the altered Cleopatra Rhyolite in the footwall of the massive sulfide ore body and collected representative samples.

After lunch, participants hiked back to the General Office, where Jerry Waegli and Barbara Neilsen made their presentations. Jerry Waegli discussed various aspects of the United Verde massive sulfide ore body and various exploration programs that



**Participants Enjoy Lunch at United Verde Pit Overlook**

have occurred since the mine's closure in 1953, while an interesting presentation on Freeport-McMoRan's reclamation

activities in the district was made by Barbara Neilsen. The formal field trip ended

around 1:30 PM, giving those participants who wished learn more about the area an opportunity to visit the museum at the Jerome State Historic Park and the Jerome community.

### 2018 Spring Field Trip Acknowledgements

The success of our 2018 Spring Field trip to Jerome on Saturday, April 21, 2018, would not have been possible without the volunteers, resources and assistance provided by Freeport-McMoRan, Inc. The Arizona Geological Society is grateful for their generous support.

Any successful event of this type, requires a lot of hard work and planning by many individuals. The Arizona Geological Society applauds Ralph Stegen, Jerry Waegli, Barbara Neilsen, Paul Lindberg and David Briggs for their excellent job of planning and leading this event as well as preparing an excellent field trip guidebook for its participants. The Arizona Geological Society thanks everyone, who helped make our 2018 Spring Field Trip a success.

Read more about the history of the Verde Mining District here:



**Jerry Waegli and Ralph Stegen Discuss Geology of the United Verde Ore**

[http://repository.azgs.az.gov/uri\\_gin/azgs/dlio/1877](http://repository.azgs.az.gov/uri_gin/azgs/dlio/1877)

## Paul Lindberg Receives a Honorary Life Membership in AGS



On Saturday, April 21, 2018, the Arizona Geological Society awarded Paul Lindberg a Honorary Life Membership for his exceptional contributions to Arizona Geology. Paul was presented with a certificate at the conclusion of his presentation on the United Verde deposit at the AGS 2018 Spring Field Trip to Jerome.

Born in 1931 in Iron Mountain Michigan, Paul Lindberg received a Bachelor of Geological Engineering degree from the University of Minnesota in 1956. As an undergraduate, he supported his schooling by running magnetometer surveys on the Bibwabik iron formation in Minnesota for the U. S. Steel Corporation. Upon graduation Paul was hired as a project mineral exploration geologist for the Anaconda Copper Company (1956-1976) and worked as a mineral exploration manager for McIntyre Mine Ltd. from 1976 until 1978. Since 1978, Paul has worked as a consulting geologist, spending much of his time on projects in the western United States, Alaska and western Canada.

Paul has spent much of career unraveling the complex geology of Arizona's Transition zone. He has authored and co-authored more than 30 professional articles, presentations and field trips dealing with various aspects of the geology and tectonic history of this region. Paul Lindberg has been a member of the Arizona Geological Society since 1974.

## AGS By-Laws Change Effective March 6th, 2018

Effective March 6, 2018, the AGS membership has voted to change Article IX, paragraph 2(d) of the AGS By-laws from:

(d) 50-Year Members – members in good standing who have **maintained continuous membership for a minimum of 50 years** shall have the privileges of a full member of the Society and will be excused from further payment of dues.

to:

(d) 50-Year Members – members in good standing who have **maintained membership for a minimum of 50 years** shall have the privileges of a full member of the Society and will be excused from further payment of dues.

**Please contact the AGS Secretary if your company is interested in advertising in this monthly newsletter.**

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**Arizona Geological Society is grateful to Freeport-McMoRan, Inc. for their generous support of our student members!**

**Freeport-McMoRan sponsored student dinners for the 2018 AGS monthly meetings.**



**AGS MEMBERSHIP APPLICATION OR RENEWAL FORM**

YOU CAN RENEW OR SIGN UP as a new member and pay online. Please go to our website, [arizonageologicalsoc.org](http://arizonageologicalsoc.org). Or use the form below if you are more comfortable with the old school approach.

Please mail check with membership form to: Arizona Geological Society, PO Box 40952, Tucson, AZ 85717

Dues (check box)  1 year: \$35;  full-time student (membership is free)

NEW MEMBER or RENEWAL? (circle one) Date of submittal \_\_\_\_\_

Name: \_\_\_\_\_ Position: \_\_\_\_\_

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*All newsletters will be sent by email. If you do not have an email address, we will mail a hard copy to you, but we cannot guarantee timeliness.*

If registered geologist/engineer, indicate registration number and State: \_\_\_\_\_

Enclosed is a \_\_\_\_\_ tax-deductible contribution to the  J. Harold Courtright or the  M. Lee Allison