



# Arizona Geological Society Newsletter

SEPTEMBER 2016

## Dr. M. Lee Allison Passed Away on August 16, 2016

Dr. M. Lee Allison, State Geologist and Director of the Arizona Geological Survey, passed away at noon on Tuesday, August 16th, after suffering a severe head injury from a fall at his home on Saturday.

Lee held BA (University of California, Riverside), MS (San Diego State University) and Ph.D. (University of Massachusetts, Amherst) degrees in geology. Having extensive experience in petroleum and geothermal exploration throughout the United States, he was active in science and public policy, especially as it related to natural resources, geologic hazards and public engagement.

Lee served as the Utah State Geologist (1989-1999), Kansas State Geologist (1999-2004), Policy Advisor for Science and Energy to Governor Kathleen Sebelius of Kansas (2004-2005) and chaired the Kansas Energy Council (2002-2005) before becoming the State Geologist and Director for the Arizona Geological Survey in December 2005.

He developed and successfully implemented a business model that enabled the Arizona Geological Survey to become one of the nation's most innovative, entrepreneurial and high-regarded geological surveys. Its transition from a state-funded to mostly grant-funded agency enabled the AZGS to provide core services to the citizens of Arizona and participate in other important state, national and international projects that have made scientific data accessible to all via the internet. Internationally recognized as leaders in cyber-infrastructure and data management, cyber developments at the AZGS have been adopted by the U. S. Department of Energy, the White House, U. S. GEO (Group on Earth Observation) Committee, Power Africa and ISPRA (Geological Survey of Italy).

Lee also served as President of the Arizona Geological Society in 2008 and held a councilor position on its executive committee during 2007 and 2010-2011. He was the guest speaker at two of our monthly dinner meetings, the most recent occurring on August 2, 2016, when he spoke on "The Future of State Geological Surveys: the Arizona Case Study."

We offer our sincere condolences to Lee's family, friends and colleagues. He was an incredibly dynamic leader, a mentor to many, and highly respected by all who knew him. He will be missed by all, but his contributions to geology, cyber-infrastructure and data management will endure. May he rest in peace.



## September 6, 2016 DINNER MEETING

**Who:** Keith Long will present “No Bonanza from Cheap Oil”

**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 *PIMA 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 on-line reservation (\$10 without).

**RESERVATIONS ARE REQUIRED:** Reserve on the AGS website ([www.arizonageologicalsoc.org](http://www.arizonageologicalsoc.org)) by 11 a.m. Friday, September 2nd. Please indicate Regular (Grilled Salmon with Caper Cream Sauce), Vegetarian, or Cobb Salad meal preference. Please cancel by Friday, September 2nd at 11 a.m. if you are unable to attend - no shows and late cancellations will be invoiced.

### Our 2016 Dinner Meetings Sponsors



**The AGS is grateful for our Sponsors, who help us offset the increasing costs of our dinner meetings and other activities of the society.**

## No Bonanza from Cheap Oil

by Keith Long, U. S. Geological Survey

During the second half of 2014, oil prices fell by half after hovering around \$105 per barrel for four years. Historically, an oil price decline of 30 percent or more would add 0.5 percent to world economic growth in the medium-term, with greater growth in oil-importing countries. It may be too soon to tell if history will repeat itself globally, but the United States cannot expect much benefit. We are no longer an oil-importing nation. The estimated \$70 billion drop in oil industry investment since the oil price collapse has largely offset the estimated \$120 billion in savings to consumers and corporations. Cost savings for corporations are apparently insufficient to overcome larger macroeconomic and policy trends that have suppressed investment to the point that overall labor productivity is decreasing. Consumers seem not to believe that low oil prices will last and remain skittish post-recession. Hence, they are more likely to reduce debt or increase savings than spend. Lower oil prices would normally reduce inflationary pressures, allowing the Federal Reserve to reduce interest

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rates and further boost economic growth. This is not possible with interest rates at near zero levels. Increased global economic growth coupled with lower input costs (oil as energy and as a feedstock) ought to increase exports for a number of domestic industries, such as petrochemicals. Global economic growth, however, is weakening and a 10 percent rise in the value of the dollar, due largely to the oil price collapse, offsets cost reductions from cheaper oil. Low oil prices are likely to persist. U.S. shale oil production has proven remarkably robust as operators find economies that were ignored during the recent boom. Application of similar oil production technologies to old world-class fields in the Permian Basin and elsewhere is adding to domestic production. Eventually, consumers and corporations should realize this and modest increases in growth may ensue. However, in an economy with declining labor productivity, record-low labor participation rates, double-digit increases in health care and education costs, regulatory uncertainty, and a host of other macroeconomic problems, a consumer and corporate-investment led economic boom is unlikely.

## About the September Dinner Speaker



Keith Long studied geology at the University of California Santa Cruz and the University of Michigan before earning a Doctorate in Mineral Economics from the University of Arizona. He joined the Mineral Resource Program of the U.S. Geological Survey in 1988 to conduct mineral resource investigations in South America, principally in Bolivia. He turned to domestic duties in 1995, developing mineral deposit and mining cost models, and investigated the history of mining and milling operations in the Coeur d'Alene mining region, for which Keith received the John M. Townsley Award from the Mining History Association in 2002. In 2009, he published a re-estimation of Taylor's Rule relating mineral reserves to mine capacity in *Natural Resources Research*, a journal he edited from 2010 to 2012. In 2010, he was lead author of *Principal Deposits of Rare Earth Elements in the United States*. His current research areas are critical minerals issues, life cycle assessment methodology, and integrated resource assessments.

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## Up-coming Arizona Geological Society Dinner Meetings

Date	Speaker	Title of Presentation
10/4/2016	Hamish Martin	The Resolution Copper Deposit, Superior, Arizona: Progress in Understanding the Geology, Ore Genesis and Mine Development
11/1/2016	Alexander Schauss	Minerals, Trace Elements and Human Health
12/6/2016	Jonathan Overpeck	Big Overview Talk on Climate Change; esp Anthropogenic global Warming

## M. Lee Allison Scholarship

Four years ago, the Arizona Geological Society began offering a new scholarship intended to target a broader number of students than the Courtright Scholarship. The newer award, dubbed the AGS Scholarship, is aimed at goal-oriented undergraduate, graduate, and post-graduate students in geosciences who are enrolled at one of the three Arizona universities. It seeks to reward students who excel in academics and research, and who can demonstrate outstanding leadership qualities through their involvement in diverse community activities. The committee that designed the criteria for the AGS scholarship might well have been using the career of Dr. M. Lee Allison as a template.

In less than ten years, under Lee Allison's innovative leadership, the Arizona Geological Survey grew from a state-endowed department to a largely self-funded and world-renown institution. During that time, Lee served on many community, state, and national organizations and committees, often as a board member or executive. The lists of successful projects initiated by him, his tireless outreach activities, together with his many other achievements, are absolutely eye-popping. He was and remains an inspiration to all of us. For this reason, the Arizona Geological Society feels it is highly appropriate to honor him and his service to so many people and organizations by changing the name of the AGS Scholarship to the M. Lee Allison Scholarship. We hope that Lee will continue to inspire students of all ages to strive for the levels of excellence in both science and community that he made seem so easy to achieve.

## Geology in the News

[Eight Beautiful Places that have Revealed the Earth's Secrets](#) - by Meghan Bartels, Business Insider, August 21, 2016.

[ASU Researchers Develop Better Understanding Seismic Hazards](#) - by ADI News Services, Arizona Daily Independent, August 23, 2016.

[Small Quake Felt in Arizona, New Mexico; Aftershock to 2014 Duncan Earthquake?](#) - by Lee Allison, Arizona Geology Blog, July 24, 2016.

[Did the Earliest Americans Pass through Ice or Cross Over Water? New Study Fuels Debate](#) - by Amina Khan, Los Angeles Times, August 10, 2016.

[Arizona Strip May Soon See Uranium Mine](#) - by David Louis, Today's News-Herald, August 20, 2016.

[Research Uncovers 340 Million Year-Old Oceanic Crust in the Mediterranean Sea using Magnetic Data](#) - by American Associates, Science Daily, August 15, 2016.

[The Great American Eclipse is a Year from Today](#) - by Doyle Rice, USA Today, August 21, 2016.

['World-Class' Minerals Deposits Evoke Both Optimism, Concern](#) - by Kendal Blust, Nogales International, July 29, 2016.

[Cataclysm at Meteor Crater: Crystal Sheds Light on Earth, Moon, Mars](#) - by David Tenenbaum, University of Wisconsin-Madison, American Association for the Advancement of Science, July 26, 2016.

[Boyce Thompson Arboretum: Garden on the Edge of an Ancient Volcano](#) - by Richard Leveille and Greg McKelvey, Payson Roundup, August 2, 2016.



## 2017 Slate of Nominees - AGS Officers and Councilors

Don't miss the September 6th dinner meeting, when we will vote on the following Slate of Officers for 2017. If you are unable to attend the meeting you may vote online. All AGS members with a known email address will be sent an email with a link to the online ballot asking the membership to approve.

Additional nominations for Officers and Advisory Councilors will be accepted from the floor from the voting membership as defined in Article IX, Section 2 at the September meeting of members.

If you wish to vote online, you must do so before 5 PM on Monday, September 5th. If you vote online, you will not be permitted to vote again at the meeting. One vote per member.

President: David F. Briggs, Independent

VP Programs: Robert J. Kamilli, Retired, U. S. Geological Survey

VP Field Trips: Wolf Schuh, Freeport-McMoRan, Inc.

VP Marketing: Ann D. Pattison, Independent

Treasurer: Rachel C. Feuerbach, Independent

Vice Treasurer: Vacant

Secretary: Alison H. Jones, Clear Creek Associates

Vice Secretary: Jeff Cornoyer, Independent

Past President: Donald J. Applebee, ASARCO LLC

Councilor 1 (17-19): Dan Aiken, Retired, Freeport-McMoRan, Inc.

Councilor 1 (17-19): Leandra Marshall, Clear Creek Associates

Councilor 2 (16-18): Simone Runyon, Graduate Student, University of Arizona

Councilor 2 (16-18): Sarah E. Baxter, Independent

Councilor 3 (15-17): Carl Bowser, Emeritus Professor, University of Wisconsin

Councilor 3 (15-17): Marisa Lerew, ASARCO LLC

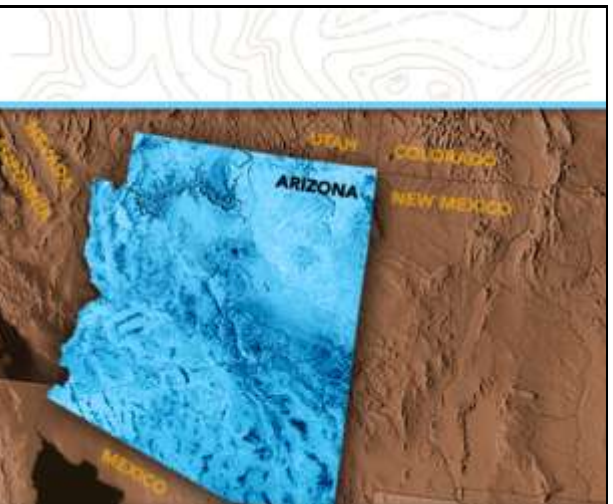


ARIZONA  
HYDROLOGICAL SOCIETY

### Thriving in a Tough Neighborhood

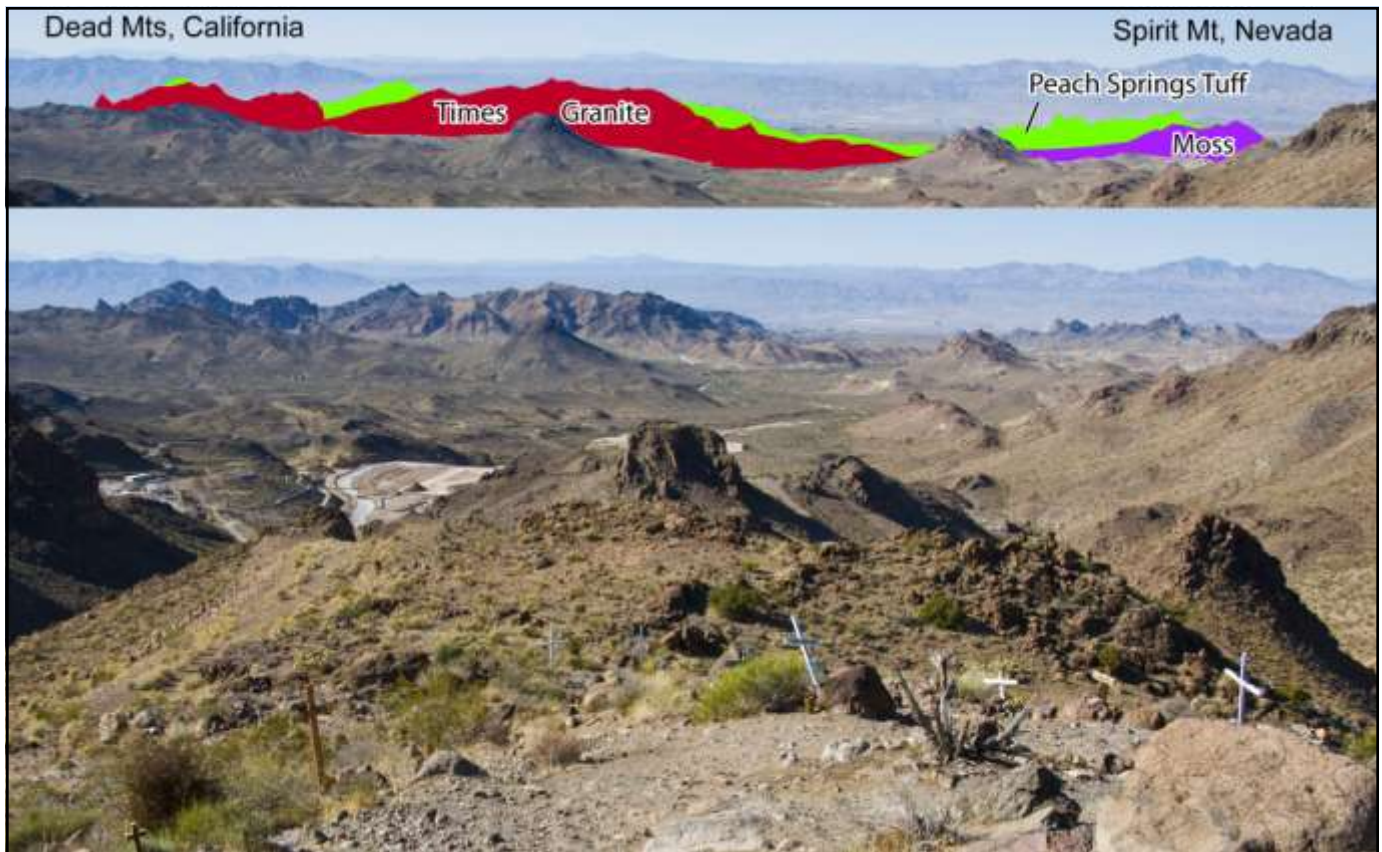
Fortune Favors the Prepared

29th Annual Symposium of the  
**Arizona Hydrological Society**  
Tucson, AZ | September 14-17, 2016



## Fall 2016 Field Trip Planned for October 22 & 23 $\pm$ 24, 2016

Leader: Charles Ferguson, Arizona Geological Survey



View to the west from Sitgreaves Pass on old Route 66 a few miles east of Oatman, Arizona of the Silver Creek Caldera. Gold Road Mine in the middle ground and main components of the caldera-fill depicted in solid colors in the upper view: intracaldera Peach Spring Tuff, Times Granite, and Moss Monzonite Porphyries.

This fall's AGS field trip is an overnight excursion to northwestern Arizona including a stay at one of the many motels (a list will be provided during registration including the quaint old and the posh new) in Kingman in Mohave County. The "formal" trip will start at noon on Saturday, October 22nd in Kingman and end at ~4pm on Sunday October 23rd in the Black Mountains a few miles west of Oatman. Lunch on Sunday will be provided and a menu of fine sandwiches will be available during registration. Overnight accommodations and all other meals, including dinner on Saturday night and breakfast on Sunday morning in Kingman will be the responsibility of each participant.

Bracketing the formal trip will be additional stops starting early (7am) on Saturday, October 22nd and ending on Monday afternoon, October 24th. This part of the trip will require 4WD vehicles, and for those who want to continue through Monday, a campsite in the Sacramento Mountains, California about 15 miles southwest of Needles will be used. Participants will be asked to provide their own camping equipment, or stay at a motel in Needles that will require them to make a 45-minute drive in the early morning in order to link up with the camping crew.

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## Fall Field Trip Continued from Page 6

The main focus of the field trip is tracking the Peach Spring Tuff's outflow sheet starting at its surrogate type locality in Kingman, through its source caldera near Oatman, Arizona, and across the Colorado River into a highly extended fragment of the caldera connected to well-known exposures of its outflow sheet in the Sacramento Mountains, California. The trip's route will, in effect, mimic the strongly south-southwesterly extension vector Ferguson et al. (2013), and Ferguson and Howard (2014) have documented across the Colorado River Extensional Corridor. This direction differs significantly from the west-northwesterly direction proposed and supported by many others (eg. McQuarrie and Wernicke, 2005). The low-sulfidation quartz-calcite-adularia epithermal Gold Road vein along old Route 66 near Oatman will be the only stop on the main field trip that will involve mineralization and economic geology.

The purpose of the morning phase of the trip on Saturday, October 22nd is to examine new and old aspects of the Laramide McConnico mineral district southwest of Kingman, and an important outcrop of Peach Spring Tuff that is part of a controversy regarding how the Peach Spring Tuff was erupted; a recent paper that has received a great deal of global attention (Roche et al., 2016) suggests that the pyroclastic flow was slow-moving and that it may have been possible to "outrun it on a fast bicycle". The presence of lithic blocks not from the caldera in the outcrop we will visit on Saturday morning challenges this interpretation.

Stops on Sunday night near the campsite in the Sacramento Mountains and on Monday will focus on the geometry of the extended caldera fragment and the nature (unconformity versus detachment) of at least two gently dipping contacts near Eagle Peak and Flattop Mountain that have long been interpreted as detachment faults. An additional contact that had been interpreted as a detachment and then re-interpreted as an unconformity (Simpson et al., 1991) will be discussed and looked at from Eagle Wash Sunday evening on the way to the campsite, but is too hazardous to visit.

More detailed information about this field trip will be available in the October news letter and on the [AGS web site](#) as it becomes available.

### References

- Ferguson C. A., McIntosh, W. C., and Miller, C. F., 2013, Silver Creek caldera - The tectonically dismembered source of the Peach Spring Tuff: *Geology*, v. 41, p. 3-6.
- Ferguson, C. A., and Howard, K. A., 2014, Early Miocene Silver Creek caldera as a strain marker in the Colorado River extensional corridor, USA: *Geological Society of America abstracts with programs*, v. 45, p. 608.
- McQuarrie, N., and Wernicke, B. P., 2005, An animated tectonic reconstruction of southwestern North America since 36 Ma: *Geosphere*, v. 1, p. 147-172, DOI: 10.1130/GES00016.1.
- Roche, O., Buesch, D. C., and Valentine, G. A., 2016, Slow-moving and dense pyroclastic flows during the Peach Spring super-eruption: *Nature Comm.*, DOI: 10.1038/ncomms10890.
- Simpson, C., Schweitzer, J., and Howard, K. A., 1991, A reinterpretation of the timing, position, and significance of part of the Sacramento Mountains detachment fault, southeastern California: *GSA Bulletin*, v. 103, p. 751-761.

## Arizona Geological Society Membership Stats (8/22/2016)

Total Membership	Professional Members	Student Members	Organizational Members
448	376	65	7



## AZ Geological Society Members' Contributions to Geology

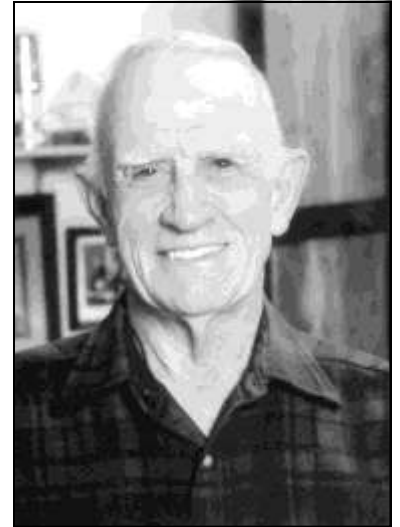
Since the Arizona Geological Society was founded in 1948, many of its members have made notable contributions to the science of geology and related fields. This month's newsletter recognizes the contributions of J. David Lowell and William R. Dickenson.

### J. David Lowell

J. David Lowell was raised on a ranch near Nogales, Arizona to become one of the world's most successful exploration geologists. He received a B.S. degree in Mining Engineering from the University of Arizona in 1949 and a M.S. degree in Geology from Stanford in 1957. He served as President of the Arizona Geological Society in 1965-66

Dave has personally discovered more copper than anyone in history, contributing to the discoveries of the Kalamazoo, Vekol Hills and Casa Grande West deposits in Arizona, the JA Deposit in British Columbia, the Dizon and Far Southeast deposits in the Philippines, and the La Escondida, Zaldivar-Escondida Norte and Leonore deposits in Chile. He is also personally responsible for the discovery of the San Cristobal Au-Ag mine in Chile and the 8-million ounce Pierina gold deposit in Peru.

David Lowell has published more than 50 articles, including one of which he co-authored with John Guilbert in 1970 that defines the Lowell-Guilbert porphyry copper model. This work remains a standard reference for exploration geologists, today.



### William R. Dickinson (1931-2015)

William Dickinson was born in Nashville, Tennessee in 1931 and moved to Santa Barbara, California as teenager. He earned a bachelor's degree in petroleum engineering in from Stanford University in 1952. After serving in the U. S. Air Force from 1952 until 1954, he returned Stanford, where he earned Masters and Ph.D. degrees in Geology in 1956 and 1958, respectively. He became a faculty member at Stanford University in 1958, where he rose through the ranks of full professor. He joined the University of Arizona faculty in 1979 and became the head of the its Department of Geosciences in 1986. Although formally retired in 1991, he continued his research, publishing more than half of his 298 professional publications after his retirement.

Bill was a true pioneer in the field of plate tectonics and its implications for geology in the western United States. As a longtime member of the Arizona Geological Society, he co-organized the 1981 AGS symposium on "Relations of Tectonics to Ore Deposits in the Southern Cordillera" the proceedings of which were published as AGS Digest 14. He also co-edited AGS Digest 18, "Mesozoic Rocks of Southern Arizona and Adjacent Areas." AGS Digest 22, "Ores and Orogenesis: Circum-Pacific Tectonics, Geologic Evolution, and Ore Deposits" was dedicated in his honor in 2008.





## Arizona Geological Survey News Brief

### AZGS Update – Tragedy strikes the Arizona Geological Survey

At about noon on Tuesday, 16 August 2016, Lee Allison, State Geologist and Director of the Arizona Geological Survey, passed away. Lee suffered a critical head injury from a fall at his home on Saturday. Lee's passing is a tragic loss for his wife, family, and the staff of the Arizona Geological Survey, the geologic and geoinformatics communities, and Lee's broad circle of friends, colleagues, and acquaintances around the world. He was a dynamic leader and a visionary, who worked tirelessly for the public good.

Those of us at the Survey will miss him greatly.

We are working with Lee's colleagues from several professional societies to host a fall event to memorialize Lee. Rest assured, we will keep you all informed. Later this week, we'll publish a longer note about Lee in the pages of the Arizona Geology e-Newsletter.

**Interim Director.** Long-time AZGS Geologist Phil Pearthree has stepped up to assume the role of Interim Director until such arrangements can be made by the Arizona Board of Regents for the selection of a new State Geologist and AZGS Director.

**Museum News!** On 6 August, the Arizona Historical Society transferred the Mining and Mineral Museum, a mineral collection numbering 21,000+, a mineral curator, and several hundred thousand dollars in funding to AZGS. We are tasked by state statute to open and operate the Arizona Mining, Mineral and Natural Resources Education Museum. We are in discussion with University of Arizona Administration on the best, most fruitful approach.

Interested to learn more? Contact AZGS' MMNRE coordinating team – [fmconway@email.arizona.edu](mailto:fmconway@email.arizona.edu).

### Publications

**New release:** Holm, R. F., 2016, [The North Verde Volcanic Field, Verde Valley, Arizona](#). Arizona Geological Survey Contributed Report, CR-16-E, 31 p. and 6 appendices. (NOTE: Our first publication since rejoining University of Arizona on 1 July 2016)

#### Released online:

Spencer, J. E. and Reynolds, S. J. (eds.), 1989, [Geology and Mineral Resources of the Buckskin and Rawhide Mountains, West Central Arizona](#). Arizona Geological Survey Bulletin 198, 272 p.

Bezy, J. V., and Trevena, A. S., 2003, [A Guide to the Geology of the White Mountains and the Springville Volcanic Field, Arizona](#). Arizona Geological Survey Down-to-Earth Series DTE-16, 56 p.

Bezy, J. V., 2003, [A Guide to the Geology of the Flagstaff Area](#). Arizona Geological Survey Down-to-Earth Series DTE-14, 56 p.

Hanson, S. L., 2003, [Roadside Geology: Wupatki and Sunset Crater Volcano National Monuments](#). Arizona Geological Survey Down to Earth, DTE #15, 36 p.

For fresh e-mail addresses and phone numbers of AZGS staff : <http://www.azgs.az.gov/staff.shtml>. For general information, or to reach out to our staff, please call 520.621.2470, from 8am – 5pm Monday through Friday.

# Announcements

## Welcome New AGS Members

Perseo Anaya

Shelby Cave

Hanna Brooks

Jacqueline Seguin

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



# FREEPORT-McMoRAN

**Freeport-McMoRan sponsors student dinners for the 2016 AGS monthly meetings.**

### 2016 AGS MEMBERSHIP APPLICATION OR RENEWAL FORM

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

Dues (check box)  1 year: \$20;  2 years, \$35;  3 years: \$50;  full-time student (membership is free)

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

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

Company: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Street: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

Work Phone: \_\_\_\_\_ Home Phone: \_\_\_\_\_

Fax Number: \_\_\_\_\_ Cellular Phone: \_\_\_\_\_

E-mail: \_\_\_\_\_ Check this box if you do not have an email address

*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 Scholarship Funds.