



Arizona Geological Society Newsletter

FEBRUARY 2016

February 2, 2016 DINNER MEETING

Who: Karen Wenrich will present “The Ga-Ge-Rich Apex Mine, Utah - A Tsumeb, Namibia Analogue”

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 \$27, Guests \$30, Students Members free with on-line reservation (\$10 without).

RESERVATIONS ARE REQUIRED: Reserve on the AGS website (www.arizonageologicalsoc.org) by **11 a.m. Friday, January 29th**. Please indicate Regular (Marinated Chicken Breast with a Sundried Tomato Cream Sauce), Vegetarian, or Cobb Salad meal preference. Please cancel by **Friday, January 29th at 11 a.m.** if you are unable to attend - no shows and late cancellations will be invoiced.



The AGS Thanks Our 2015 Sponsors for their Support

The Ga-Ge-Rich Apex Mine, Utah - A Tsumeb, Namibia Analogue by Dr. Karen J. Wenrich, Consulting Geologist

The Apex Mine is located on the east flank of the Beaver Dam Mountains, in SW Utah. It was mined intermittently between 1884 and 1962 for Cu, Pb, Ag, and minor Zn. In addition, Ga and Ge were recovered during 1985-1986.

Abstract Continued on Page 2

Abstract Continued from Page 1

The ore consisted of limonitic breccia derived from silty and sandy carbonate rocks of the Pennsylvanian Callville Limestone and overlying Pookon Dolomite. This breccia collapsed into the Mississippian Redwall Limestone, a part of the thick Paleozoic carbonate sequence in the area. The breccia was previously interpreted as the result of faulting. This study shows that it is a nontectonic, polymictic breccia that formed by collapse of overlying rock, as high up in the section as the Permian Queantoweap Sandstone, into solution caverns. Both brecciation and mineralization predate all faulting in the area. Similarities in mineralogy, geochemistry, and structure demonstrate that this deposit is an analogue of the Tsumeb Cu-Ge-Ga Mine. The Tsumeb ore deposit contains both oxidized and primary ore, whereas the Apex orebody is the oxidized remnants of a primary uranium-rich, polymetallic (base metal) orebody, typical of northern Arizona. The occurrence of multiple solution-collapse breccia pipes in the Beaver Dam Mountains indicates an extensive karst system favorable for ore deposition far westward beyond the Colorado Plateau Province, into the Transition Zone and Basin and Range Province.

Mineralization at the Apex Mine likely occurred during at least two separate events: (1) 200-260 Ma when the initial uranium and base metals mineralized the breccia (similar to thousands of breccia pipes in the SW corner of the Colorado Plateau formed with Pangean time events, and mid-continent MVT ores), and (2) 4-6 Ma when the primary ore was oxidized during Basin and Range extension. The oxidation removed the uranium and likely enriched the Fe, Ge, and Ga in the orebody.

The analogy between the Tsumeb and Apex mines extends further in that they both lie in a similar underlying extensive karst network. Tsumeb is also part of a large mining district of base metal (Zn-Cu-Pb) sulfide mines, in the Otavi Mountainland, Namibia, which formed in collapse breccias and solution cavities related to a karstic network associated with the post-Gondwanaland surfaces in carbonate rocks of the Neoproterozoic Otavi Group. The base metal sulfide ores have been oxidized to late stage ores, 24-33 Ma, rich in Ga-Ge-V, similar to the Apex Mine. Complete oxidation of the sulfide replacement ore at the Apex created a reduction in volume of the limestone host rock. This created caves within the orebody rich in jarosite and goethite, and containing graded bedding of cave dissolution residue.

Previously published metallurgical studies had suggested that the Ga and Ge resided in jarosite and goethite, respectively. However, geochemical results from this study indicate that this is not the case, and that originally both Ga and Ge likely occurred in sulfide minerals within the primary ore, and probably currently reside in oxidized minerals richer in Co and Ni than in Fe-rich minerals. If this mineralogical scenario is true, it would explain why the company had metallurgical problems and could not recover the necessary amount of Ga and Ge from the ore, which resulted in the 1986 mine closure.

A full paper version of this abstract can be found in Wenrich, K.J. and Verbeek, E.R., 2014, The Apex Mine, Utah—A Colorado Plateau-type solution-collapse breccia pipe and a Tsumeb, Namibia analogue, in: MacLean, J.S., Biek, R.F., and Huntoon, J.E., eds, *Geology of Utah's Far South*: Utah Geological Association Publication 43, pp. 651-688.

About the February Dinner Speaker

Dr. Karen Wenrich graduated from 3 years of high school in Wiesbaden, Germany, after spending her childhood being dragged around the U.S. by a father who was a colonel in the Air Force (a hump pilot during WWII and later a lawyer in the JAG for the Air Force). She lived in Colorado Springs and Reno until she was 6 years old; her dad then piled her, her 3-month-old sister, and her mother with all their possessions into a 48'

Bio continued on Page 3

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Studebaker and drove up the all-dirt Alcan Highway to Fairbanks, Alaska, where she attended first and second grade in a Quonset hut. Climbing on rocks as a child in the west was a way of life, which undoubtedly stimulated an interest in geology. When she was a child, her uncle would ask her what she wanted to be, and when she would reply “a geologist”, he would say, “You’ll outgrow it”.

Tired of being uprooted, she set roots down at Penn State where she received a scholarship, assistantship, and then a fellowship; in 9 years, she left Penn State with a B.S., M.S., and Ph.D. in geology/volcanology to return to Colorado for a job with the USGS.

Karen’s Ph.D. was on “Trace and major element chemistry and the petrogenesis of lavas from the upper portion of Humphrey’s Peak, San Francisco Mountain, Flagstaff, Arizona.” Karen was quickly converted to an economic geologist by the USGS, where she worked for 25 years (at least 15 years doing field work in Arizona) until 1997, followed by her present career, consulting for the mining industry.

She has published over 175 papers, and received several USGS outstanding performance awards and AAPG best paper presentation awards. She is an AIPG certified professional geologist. Karen has a worldwide reputation as an expert in the geology and mineralogy of uranium deposits. From 2002-2005, Karen worked with diplomatic status for the International Atomic Energy Agency in Vienna, Austria, as their senior uranium geologist in charge of studying worldwide uranium resources. As an IAEA staff member, she shared in their receipt of the 2005 Nobel Peace Prize: “For their efforts to prevent nuclear energy from being used for military purposes and to ensure that nuclear energy for peaceful purposes is used in the safest possible way.” She has done extensive studies on the breccia-pipe uranium deposits of northern Arizona and elsewhere. In 2008, 2010, and 2011, Karen testified before the U.S. House Natural Resources Committee about the proposed bill to permanently bar the filing of mining claims on 1.1 million acres of federal lands north and south of the Grand Canyon. These efforts to prevent the bill from passing in congress were successful. However, President Obama subsequently withdrew the land as an executive order.

Last March, Karen married a Penn State geology classmate, Linton (Lenny) Wildrick (a hydrogeologist), who she has known for 50 years.

DAVID M. SPATZ (1947-2015)

A Celebration of Life honoring former AGS President Dave Spatz will be held on Sunday, February 7th at the home of Joy Rutan, 3544 W. Eastham Lane, Tucson starting at 3:00 PM. Please RSVP to Joy at 520-744-1204 or cell 520-444-6335. A big pot of chili, appetizers, and drinks will be available; you are welcome to bring other food or refreshments. Be aware that there will be animals at the house if you have allergies. We want to remember all of the wonderful times Dave shared with us so please bring your favorite stories, photos, or memorabilia to share or organize into a scrap book.

Arizona Geological Society Membership Stats (1/22/2016)

Total Membership	Professional Members	Student Members	Organizational Members
500	401	92	7

Consolidation of the Arizona Geological Survey with the University of Arizona Threatens its Ability to Serve the Citizens of Arizona

by David F. Briggs

On Friday, January 15, 2016, Arizona Governor Ducey released his [Proposed Executive Budget for Fiscal Year 2017](#), where he recommended consolidating the Arizona Geological Survey with the University of Arizona. His logic in merging the two groups is they are both engaged in rigorous research, which presents potential for greater opportunities to successfully leverage research grants from outside sources.

However, many in Arizona's geological community are skeptical of this proposed consolidation. The types of research conducted by the two organizations differ considerably.

The University of Arizona's research programs are focused on highly academic topics that are only understood by a few individuals with specialized knowledge. On the other hand, the applied science performed at the Arizona Geological Survey is designed to help the layperson, industry and local governments solve everyday problems. While both types of research are important to society, their application and administration requires different skill sets that are not necessarily compatible.

The mission statements for the University of Arizona and the Arizona Geological Survey also differ. Although the University of Arizona relies on its research programs to help fund many of its academic programs, its primary mission is the education of the next generation of citizens. This contrasts with the Arizona Geological Survey's primary mission, which is service related. This agency is a source for geological information and informs, advises and assists on public issues involving geological processes, materials, landscapes and prudent use of lands and mineral resources. The Arizona Geological Survey also provides technical expertise and assistance to industry and other State and local government agencies on matters related to earth sciences.

The organizational character of the University of Arizona and the Arizona Geological Survey are also significantly different. The University of Arizona is a huge bureaucracy (15,600 employees - 2014-2015) with many competing interests that require considerable administrative costs to function. One reason why the Arizona Geological Survey has done as well as it has since becoming an independent agency in July 1988 is its small size (38 employees—2015), which has enabled it to minimize its administrative costs while maximizing the amount of revenues it actually uses to fund its core mission. The Arizona Geological Survey has also been very successful at getting funding from outside grants and other sources, returning an average of \$7.79 for every state dollar spent (average based fiscal years, 2011-2015), compared to an average of \$2.49 generated by the University of Arizona. The Arizona Geological Survey gives the citizens of Arizona more bang for their tax dollar!

The consolidation of the Arizona Geological Survey with the University of Arizona will do little to solve the challenges the university faces in funding its research programs. However, the lack of autonomy, ruthless competition for budget and research dollars, and significant increase in administrative costs that would ultimately result from this proposed consolidation will severely limit the Arizona Geological Survey's ability to perform its core mission of serving the citizens of Arizona.

I encourage the AGS membership to let Governor Ducey and your state representatives know Arizona's needs will be best met by retaining the Arizona Geological Survey as an independent state agency.

Up-coming Arizona Geological Society Dinner Meetings

Date	Speaker	Title of Presentation
3/1/2016	Peter Johnson	Tectonics and Ore Deposits of the Arabian-Nubian Shield
4/5/2016	Jordon Bright	Looking for an Ocean in the Desert - the Enigmatic Bouse Formation of Southeastern Arizona and Southeastern California
5/3/2016	Peter Modreski	No title yet, but will speak on Pegmatites

Association of Environmental and Engineering Geologists - Arizona Section

Dinner Meeting: 6:30 PM, Wednesday, February 3, 2016

At: SunUp Brewing Company

322 East Camelback Road, Phoenix, Arizona

Gary S. Rasmussen will present: Surface Ground Rupture from the 1992 Mw 7.3 Landers Earthquake as Observed from the Air and Ground

RSVP by Tuesday at 5:00 pm, February 2, 2016 by email to aeg.arizona@gmail.com

2016 SME ANNUAL CONFERENCE & EXPO

THE FUTURE FOR MINING IN A

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FEBRUARY 21-24, 2016 | PHOENIX, ARIZONA



Geology in the News — with Emphasis on Southwestern United States

John Duhamel, [Governor Proposes Transferring Arizona Geological Survey to University of Arizona — Bad Idea](#): Arizona Daily Independent, January 21, 2016.

Lee Allison, [Bill would Eliminate Licensing of Assayers in Arizona](#): Arizona Geology, January 21, 2016.

Firk Els, [The One Copper Price vs China Chart You want to see Today](#): Mining.com, January 12, 2016.

Lee Allison, [Moderate Quake south of Arizona-Utah Border](#): Arizona Geology, January 22, 2016.

Urvija Banerji, [Boarding Down the Slopes of an Active Volcano in Nicaragua](#): Atlas Obscura, January 21, 2016.

Lee Allison, [Wulfenite Proposed as Arizona State Mineral](#): Arizona Geology, January 16, 2016.

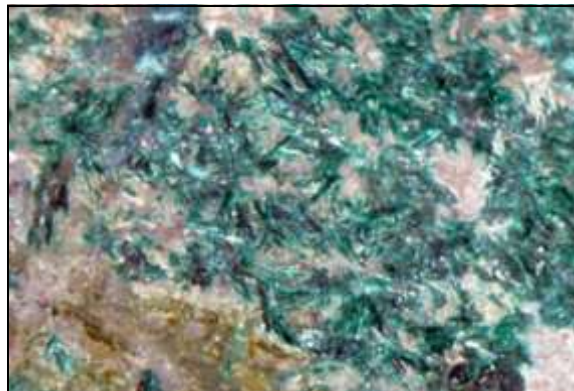
William Ascarza, [Mining near Mammoth Dates to late 1800s](#): Arizona Daily Star, January 10, 2016.

Anonymous, [Capstone Extends Pinto Valley Mine Life to 2039](#): Capstone Mining Corporation, January 18, 2016

62nd Annual Tucson Gem and Mineral Show®

by David F. Briggs

Over the next several weeks, mineral enthusiasts from around the world will be in Tucson, Arizona for the Tucson Gem, Mineral and Fossil Showcase. This event actually consists of more than 40 separate shows that take place annually between late January and the middle February at numerous locations around Tucson. Some of these shows are open to the public, while others are only for retail dealers. This event reaches its climax with the Tucson Gem and Mineral Society's show, which will be held at the Tucson Convention Center between February 11-14, 2016.



The Tucson Gem and Mineral Society held its first mineral show at the Helen Keeling Elementary School in 1955. Its initial success prompted organizers to make it an annual event, which was held at the Pima County Fair and Rodeo Grounds on South Sixth Avenue until 1972. The show was moved to its present location at the Tucson Convention Center in 1973, where it continues to be sponsored by the Tucson Gem and Mineral Society.

The Tucson Gem and Mineral Society was founded in 1946 by a small group of mineral collectors and lapidary enthusiasts. The stated mission of this organization is to promote the interest and study in geology, mineralogy, lapidary and related earth sciences.

Over the years, the interest generated by the Tucson Gem and Mineral Society's mineral show has resulted in a number of smaller satellite shows being held in Tucson at the same time, making the Tucson Gem, Mineral and Fossil Showcase one of the largest and most popular events of its kind in the world.

Each year the organizers of the Tucson Gem and Mineral Show® pick a mineral or a group of minerals it will showcase. This year's theme is "Shades of Blue: Minerals of the World." It will feature many spectacular exhibits from museums and private collections around the world. Approximately 250 of the best mineral, jewelry, gemstone, lapidary and fossil retail dealers are scheduled to be present at this year's event.

Whether you are interested in mineral specimens, fossils, gemstones, jewelry, beads, publications, lapidary equipment and supplies, or arts and crafts, I'm sure you will be able to find an event to attend. Although most of these events are free, the main Tucson Gem and Mineral Show® charges a small admission fee.

A complete list of events, dates, places and types of things displayed at each of these events can be found at [Visit Tucson](#).

Located in southeastern Arizona, Tucson is situated at the center of an area that has a rich mining history. While attending this year's Tucson Gem, Mineral and Fossil Showcase, please take an opportunity to visit Bisbee, Tombstone and ASARCO's Mineral Discovery Center.



Underwriting Arizona Mining Review

The Arizona Mining Review, the premier e-Video Magazine addressing mining in the Southwestern U.S., is seeking underwriters for 2016 to help offset production and broadcasting costs.

Please contact Mike Conway (Michael.conway@azgs.az.gov | 520.209.4146) for additional information and to discuss the benefits of underwriting.

Arizona Geological Survey News Brief



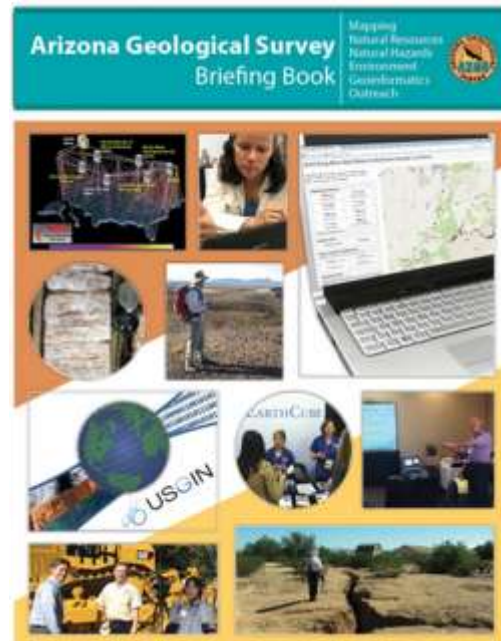
[Arizona Mining Review](#) (AMR) e-Video Magazine's next episode will be filmed live at the SME Annual Conference in Phoenix from Feb 21-24, 2016, and released later that month.

AZGS News

Governor's Ducey's 2017 budget has real impact for AZGS; "For FY2017, the Executive recommends consolidating the Arizona Geological Survey with the Department of Geosciences within UA's School of Earth and Environmental Sciences. The State Geologist would continue to be a gubernatorial appointee." The 2017 budget zeros out AZGS funding, which was previously \$941,000 annually.

Lee Allison in his blog post of 22 Jan. 2016, wrote, "Since 2011, the Arizona Geological Survey has successfully raised more than \$35,800,000 in external research grants from federal, state, local, non-profit, and private sources. Over that same period our total cumulative state appropriation was \$5,364,100, for a Return on Investment of \$6.68 of income for every \$1 of state funds. This compares favorably with top tier research centers across the country.

We are moving forward in meetings with Univ. of Arizona administrators and staff from Governor Ducey's office on how to make this transition work. For a rundown on AZGS accomplishments in FY-2015 see our 54 page, [Annual Report of the Arizona Geological Survey FY2015](#). Survey staff have prepared a briefing book to better inform UA administrators of AZGS accomplishments, intellectual capability, and our ongoing efforts to serve our state stakeholders.



Stay tuned to Lee Allison's [Arizona Geology blog](#) or our [AZGS Facebook](#) page for updates on AZGS going forward in 2016.

Steve Rauzi, long-time administrator of the Arizona Oil and Gas Conservation Commission (AZOGCC) retired in mid-December 2015. Nyal Niemuth, chief of AZGS's Economic Geology section, is assuming the responsibilities of the administrator of the AZOGCC.

New Publications & Publications Newly Released Online

Niemuth, N., 2015, [Arizona Major Mines Map - 2015](#). Arizona Geological Survey Map 40.

Richard, S.M. (ed.), 2002, [Database for Mineral Districts in the State of Arizona](#) - Based on Metallic Mineral Districts of Arizona. Digital Information DI-23. Newly released online.

Rupke, A. and Boden, T., 2015, [Potash Bed Mapping in the Paradox Basin, Northern San Juan County Utah](#). Proceedings of the 48th Annual Forum on the Geology of Industrial Minerals, Phoenix, Arizona, April 30 - May 4, 2012. Arizona Geological Survey Special Paper #9, Chapter 8, 23 p.

Wilson, E.D., 1927, [Geology and ore deposits of the Courtland-Gleeson Region, Arizona](#). Arizona Bureau of Mines Bulletin B-123, 79 p., 3 plates. Newly released online.

ANNOUNCEMENTS

Welcome New AGS Members

Amanda Barkley

Jocoba Montgomery

Leo Sheehan

Don Jenkins

Rich Ralko

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 Arizona Geological Society Scholarship Funds.