



Arizona Geological Society Newsletter

MARCH 2012

March 6, 2012 DINNER MEETING

Colin Williams will be our featured speaker. See abstract below.

- Where:** Sheraton Four Points Hotel, Wild Cat Room, 1900 E. Speedway Blvd. in Tucson
- When:** Cash Bar at 6 p.m.—Dinner at 7 p.m.—Talk at 8 p.m.
- Cost:** With reservation, members \$24, guests \$27, Students free with online reservation (\$10 without).
Without a reservation, a \$3 surcharge will be added (if the hotel is able to accommodate you).

RESERVATIONS: CALL 520.663.5295 by 5 p.m. on Friday, March 2 or reserve on the AGS website.

Please indicate low-salt, vegetarian, or vegan meal preferences. A coffee/salad/roll/dessert option is also available for \$18.

Please cancel if you are unable to attend. The hotel cannot guarantee that meals will be available without a timely reservation.

The Future of Geothermal Energy

Colin Williams, U.S. Geological Survey

The U.S. Geological Survey (USGS) recently assessed the electric power generation potential of conventional geothermal resources in the United States. These resources are concentrated in the States of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming, which contain all 241 identified moderate-temperature (90 to 150°C; 194 to 302°F) and high-temperature (>150°C) geothermal systems located on private or accessible public lands. Electric power potential was also determined for seven low-temperature (<90°C) systems in Alaska for which local conditions make electric power generation feasible. In addition, the assessment also includes a provisional estimate of the power generation potential from the application of unconventional, Enhanced Geothermal Systems (EGS) technology for creating geothermal reservoirs in regions characterized by high temperature, but low permeability, rock formations. The assessment indicates that the electric power generation potential from identified geothermal systems is approximately 9000 Megawatts-electric (MWe), distributed over these 13 states. The mean estimated power production potential from undiscovered geothermal resources is approximately 30,000 MWe. Another estimated 518,000 MWe could be generated through successful implementation of EGS technology in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

(Continued on Page 2)

About the Speaker

Colin Williams is Director of the USGS Geology, Minerals, Energy and Geophysics Science Center in the western region of the USA. Until recently, he was a Supervisory Research Geophysicist with the Earthquake Science Center at the U.S. Geological Survey (USGS) in Menlo Park, California. He currently serves as Chief of the Geothermal Resource Investigations Project with responsibility for assessing the geothermal energy resources of the United States and conducting research on improved methods for characterizing and evaluating geothermal resources. His primary research interest is in measuring and modeling the flow of heat and fluids through the Earth's crust and using those measurements to understand hydrothermal processes, earthquakes, and groundwater flow. He is the USGS representative on the Federal Interagency Geothermal Working Group and is a member of the USGS Energy Resources Program Council, the Science Advisory Board for the Department of Energy's (DOE) National Geothermal Data System, the expert panel for the DOE Innovative Exploration Technologies Road Map, and the Environmental Protection Agency's Technical Advisory Committee overseeing the City of Los Angeles Digested Sludge, Biosolids and Brine Injection Project. Colin joined the USGS in 1989 after earning degrees in Geophysics and Engineering from Columbia University, UC Berkeley, and Harvey Mudd College. He has written or co-authored more than 100 technical papers and abstracts and has received the Department of Interior's Meritorious Service Award.

Geothermal Energy—continued from page 1

The presence of significant undiscovered geothermal resources, as well as the large potential from breakthroughs in EGS technology relative to the currently installed geothermal production capacity of approximately 3000 MWe, highlights some critical needs for future exploration and development activities by both the government and private industry. One critical need is for new techniques to improve geothermal exploration and the acquisition of diverse types exploration data over a broader geographic area. A second is to develop improved occurrence models for quantifying the nature and extent of undiscovered resources. A third is to expand our understanding the geothermal resources in the conductive thermal settings of sedimentary basins, which are important components of the geothermal resources in the central and eastern United States. A fourth is to address the major issues surrounding the development and implementation of EGS. These include uncertainties in (1) the estimated geothermal recovery factor, which is the ratio of produced thermal energy to the thermal energy contained in the fractured EGS reservoir, (2) the likely spatial pattern of EGS development, and (3) the relative effects on productivity of declining fluid viscosity with increasing temperature, fracture closure at higher levels of effective stress, and the increased rates of mineral precipitation and dissolution at higher temperature. In support of ongoing efforts by the DOE Geothermal Technologies Program to advance geothermal energy utilization, the USGS is collaborating with the DOE to address this needs in future geothermal resource assessments, develop new geothermal resource classification standards and assist in the establishment of the National Geothermal Data System.

Arizona Centennial Fieldtrip #1 - Safford Operations

By Cori Hoag

Thanks go to the Freeport-McMoRan hydrometallurgy and mining staff for providing AGS and SME members with a great tour of the Safford Operations on February 18th. Forty participants came from Tucson, Willcox, and Phoenix and were provided with an interesting overview of the mining, leaching, and copper production activities. After the project presentations and a tasty lunch, we boarded the company vans to visit the Dos Pobres open pit and crushing facilities. We saw turquoise-colored electrolyte at the solvent extraction/electrowinning (SX/EW) plant ready to be plated. In the EW plant we watched as the 11,000



-pound overhead crane pulled banks of copper cathode out of the electrowinning cells and queued them up to have the high-purity copper stripped off the starter sheets. We also got a bird's eye view of the sulfur-burning acid plant from the top of a water cooling tower. This new plant produces sulfuric acid for dissolving chrysocolla and other copper oxide minerals from the crushed ore placed in 16-foot lifts on the lined heap leach facility. We can't say we're hydromet experts after a one-day visit, but we sure learned a lot and appreciate the opportunity to tour the facility. If you have ideas for a tour, please contact Cori Hoag at choag@srk.com.

L to R: AGS Members Jan Rasmussen, Mark Beunas, Mike Busby, Cori Hoag, and Pete Dunn pose by a stack of copper cathode.

SCENES from the TUCSON GEM and MINERAL SHOW



At left: The tent at 22nd St. and I-10 was a great source for fossils if you were in the market.

Below: dinosaur eggs.



Right: These petrified wood logs at the Inn Suites were spectacular—and expensive. Each one had a price tag of about \$6000. The American petrified wood is more colorful and expensive than the Indonesian variety.



Below: Jurassic shrimp—from Germany.



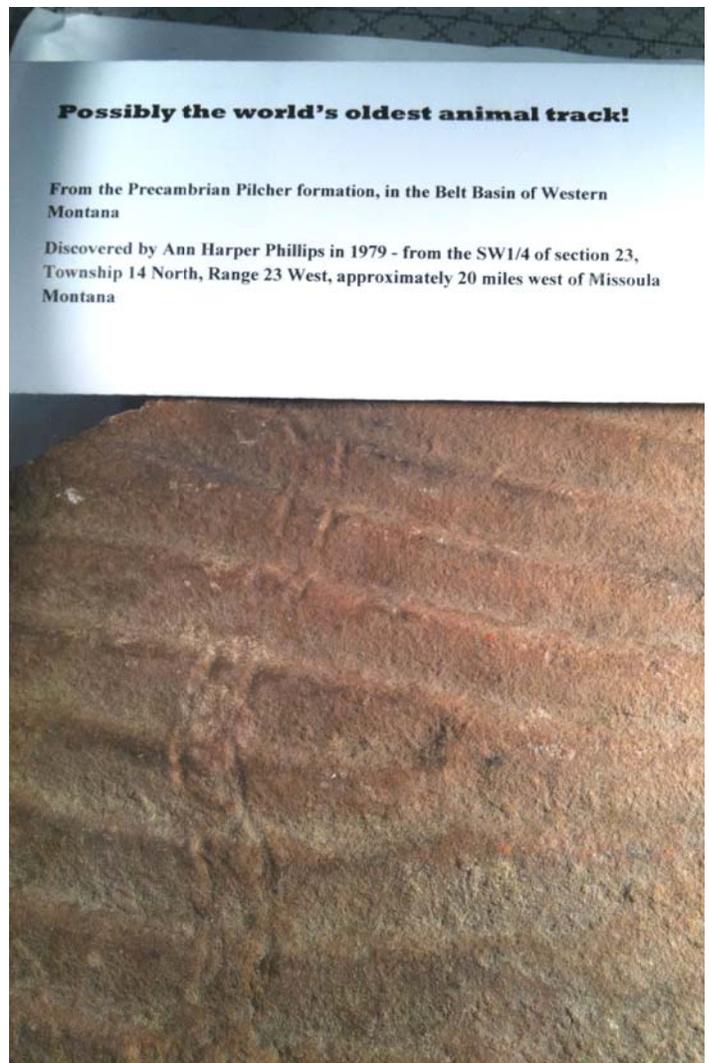
$K Na_2(Fe, Mn, Al)_2Li_3Si_{12}O_{30}$ — also known as Sugulite.

Gem Show Scenes—Continued from Page 3

Left: This quartz specimen was on display in a private room at the “Bug House”. It is from a quarry near Jessieville, Arkansas.

Price tag: \$3.1 million.

Kind of gives new meaning to the old phrase, “You break it, you bought it.”



Right: I would like to know more about these tracks. . .

ANNOUNCEMENTS

SME Awards

The Society for Mining, Metallurgy and Exploration (SME) recently announced its annual awards and citations for distinguished members. Several AGS members were among the honorees. **Pamela Wilkinson**, Outreach Coordinator for the Lowell Institute for Mineral Resources at University of Arizona was given a President's Citation for her participation on the GEM/MII Ad Hoc Committee. **Peter K. M. Megaw**, President of IMDEX/Cascabel and co-founder of Minera Cascabel and MAG Silver was awarded the Robert M. Dreyer award "in recognition of his imaginative application of the science of geology to the discovery of carbonate replacement deposits (CRD) and epithermal silver-gold vein deposits (EVD) in Mexico and for his untiring efforts in the study and understanding of how CRD and EVD deposits fit in the geologic evolution of Mexico."

Welcome New AGS Members!

- Paul Albers, Freeport McMoran, Oro Valley, AZ
- Robert Gay, Mission Heights Preparatory, Casa Grande, AZ
- Robert Wilhelm, Hargis + Associates, Tucson, AZ
- Jeffrey Bickel, Excelsior Mining Corp., Phoenix, AZ

Thanks to the following AGS members for their recent generous donations to the J. Harold Courtright Scholarship Fund:

- Paul Albers

FIELD TRIPS

AGS announces **Arizona Centennial Fieldtrips** to be scheduled throughout the year. If you have an idea for a trip you'd like to lead or coordinate (with or without guidebook), please contact Cori Hoag at choag@srk.com.

48th Annual Forum on the Geology of Industrial Minerals

The Arizona Geological Society will co-host the 48th Annual Forum on the Geology of Industrial Minerals with the Arizona Geological Survey, Arizona Rock Products Association, and the Arizona Mining Association. The event will take place on May 1-5, 2012 in Scottsdale at the Scottsdale Cottonwoods Resort and Suites. The annual forum is generally field-trip oriented, and this year will be no exception.

Full registration for the 3-day conference is \$250.

Go to <http://geologyofindustrialminerals.org> for more information and to sign up online.



New AGS Policy in 2012

AGS loses money on dinner meetings, largely because of no-shows. Therefore, the AGS Executive Committee has decided to invoice those members who reserve a meal and do not show up for the meeting. ***This new policy went into effect on January 3, 2012***. Reservations can be cancelled *without penalty* by calling the AGS reservation line (520-663-5295) before 8 a.m. on the Monday before the dinner meeting. We are unable to respond to every message left on the answering machine, but if you cancel a reservation in time, you will not be charged. Even if you are unable to cancel before Monday at 8 a.m., please let us know you are unable to attend. We may be able to give the reservation to someone else who forgot to reserve a meal.

In order to encourage interaction between students and working professionals, **BHP Billiton** is proud to sponsor student dinners at monthly Arizona Geological Society dinner meetings. **BHP Billiton** is a global mining, oil and gas company headquartered in Melbourne, Australia. The company mines copper, iron, gold, and coal, and has proven oil reserves. It is the world's largest mining company measured by revenue and, as of February 2011, the world's third-largest company measured by market capitalization.

AGS is grateful to BHP Billiton for their generous support of our student members!

2012 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 Scholarship Fund.