



# Arizona Geological Society Newsletter

ARIZONA GEOLOGICAL SOCIETY, INC., TUCSON, AZ

MAY 2011

## May 3, 2011 DINNER MEETING

**Dr. Stephen J. Reynolds, Arizona State University** 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 pm—Dinner at 7 pm—Talk at 8 pm

**Cost:** With reservation, members \$24, guests \$27, Students \$10.

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 April 29, 2011.**

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.

## ABSTRACT

### Structural Evolution and Control of Gold Mineralization, Santa Gertrudis, Sonora

*Stephen J Reynolds, Jeff Geier, Bryan MacFarlane (ASU), John Wilson (Animas Resources), and John Reynolds (Durango Geophysics)*

The Santa Gertrudis (SG) mineral district of northern Sonora contains a number of sedimentary-hosted gold deposits that have been likened to those at Carlin. The SG deposits are hosted by Cretaceous clastic and calcareous rocks of the Bisbee Group, including the Morita, Mural, and Cintura Formations. In collaboration with an exploration effort by Animas Resources, we mapped and studied the structural geology of the area, focusing on the relationship between structures and mineralization. The district has a very complex structural history that controls the distribution of the deposits – aurally, at the outcrop scale, and as a function of depth.

Overall, the Cretaceous units strike northwest, dip southwest, and are upright. In the northern part of SG, they roll over to steep northeast dips and are overturned, defining a large, northwest-trending, regional fold that dominates the geology of the district. There are important structures that predate and postdate this regional fold. The earliest structures in SG, assigned to D1, include an early cleavage that is parallel to or at a low angle to bedding and at least one thrust fault that imbricates the Cretaceous units. We interpret D1 to be expressions of northeast-vergent Laramide thrusting. The early cleavage is folded by northwest-trending, outcrop-scale folds, which are in turn folded by the large regional fold. The outcrop-scale folds and regional fold all have a southwest vergence, and probably represent two phases of the same event (D2). Some late thrusts and cleavage zones cut across the folded and upturned beds. Hornfels, in part related to a late-Laramide, peraluminous pluton, overprint D1 fabrics and probably also the D2 folds.

North- to northeast-trending faults, some of which are active during mineralization, play a significant role in localizing silicification and other alteration, gold mineralization, and the mined deposits. Mineralization is also controlled by shear zones that we regard as originating during D1 and by zones of breakage, shear, and folding that probably formed during D2. A series of southwest-dipping normal faults, interpreted to be mid-Tertiary, cut and dismember the deposits, but some of these zones are also silicified and anomalous in gold. These faults locally limit the depth of mineralization exposed at the surface; some have cleavages that record a pre-extension history. The youngest major structures are northwest-striking, mostly high-angle normal faults, similar to Basin and Range faults, that uplift and downdrop large fault blocks. The complex array of pre-mineral, syn-mineral, and post-mineral structures poses challenges, and provides opportunities, for exploration in the district.

**Read about the speaker at our May meeting, Stephen Reynolds, on page 2.**

## About the Speaker:

**Stephen Reynolds** is a professor in the School of Earth and Space Exploration at Arizona State University, where he teaches upper and lower division courses, mostly involving structural geology, field geology, and natural resources. His geologic research is on the structural and tectonic evolution of the Southwest. He has worked on various types of ore deposits, including recent work on gold deposits in Baja and Sonora. He has authored or edited over 200 geologic maps, articles, and reports, including the 866-page *Geologic Evolution of Arizona*. In 2007, he published *Exploring Geology*, an innovative and successful college textbook designed from cognitive and educational research. He also coauthored *Structural Geology of Rocks and Regions*, one of the most widely used Structural Geology textbooks, and *Observing and Interpreting Geology*, a laboratory manual for Physical Geology. As a National Association of Geoscience Teachers (NAGT) distinguished speaker, he traveled across the country presenting talks and workshops on how to infuse active learning and inquiry into large introductory geology classes. He is a past President of the Arizona Geological Society and has received outstanding alumni awards from UTEP and the University of Arizona.

## Uranium Mining—Your Turn to Weigh In

On July 9, 2009, Secretary of the Interior Ken Salazar withdrew approximately 1 million acres of Federal land in the Colorado Plateau region from new mining claims for two years so that environmental impacts of uranium mining could be assessed by the Bureau of Land Management (BLM). On February 18, 2011, the BLM issued the draft Environmental Impact Statement. Due to the widespread interest, the deadline for public comment was recently postponed from April 4 to May 4, 2011.

The Environmental Impact Statement (EIS) is available for all to read online (see the References section below for the link). The study evaluates four alternatives, ranging from the “no action” alternative, which would allow resumption of mining, to the withdrawal of about 1 million acres from hardrock mineral exploration and mining for 20 years. The factors that were evaluated included air quality, cultural and American Indian resources, aquatic wildlife, economic conditions and values, environmental justice, public safety, noise, natural environment, recreation, transportation, vegetation, water resources, wildlife and others.

The subject of uranium mining on the Colorado Plateau has been fraught with emotion and disinformation. Mining is not permitted in Grand Canyon National Park, for example, but opponents often imply that it is. And the general public is often unaware of the simple fact that the Earth, in its natural and pristine state, can be a messy place. An example: 40 to 80 tons of dissolved uranium are naturally eroded into the Colorado River every year according to Arizona Geological Survey calculations (Spencer and Wenrich, in press) based on U.S.G.S. data (Alpine, 2010).

AGS members are encouraged to review and comment on the draft EIS by the May 4 deadline. In their February 2011 newsletter, the BLM requested that the public make comments as specific as possible. Comments will be more helpful if they include suggested changes, additional sources or alternate methodologies, and if they reference a page number. Comments must be written and can be submitted electronically to [NAZproposedwithdrawal@azblm.org](mailto:NAZproposedwithdrawal@azblm.org) or mailed to: Northern Arizona Proposed Withdrawal Project, Attn: Scott Florence, District Manager, Bureau of Land Management Arizona Strip District Office, 345 E. Riverside Drive, St. George, UT 84790-6714.

### References:

- Alpine, Andrea E., ed., 2010, Hydrological, geological, and biological site characterization of breccias pipe uranium deposits in northern Arizona: U.S. Geological Survey Scientific Investigations Report 2010-5025, 353 p., 1 pl., scale 1: 375,000.
- Bills, D.J., Brown, K.M., Alpine, A.E., Otton, J.K., Van Gosen, B.S., Hinck, Jo Ellen, and Tillman, F.D., 2011, Breccia-pipe uranium mining in northern Arizona; estimate of resources and assessment of historical effects: U.S. Geological Survey [Fact Sheet 2010-3050](#), 4 p.
- BLM Draft Environmental Impact Statement: <http://www.blm.gov/az/st/en/prog/mining/timeout/maps.html#handouts>.
- BLM Newsletter 2, February 2011: <http://www.blm.gov/pgdata/etc/medialib/blm/az/pdfs/withdraw.Par.15542.File.dat/Newsletter-2.pdf>.
- Spencer, Jon E., and K. Wenrich, in press, "Breccia-Pipe Uranium Mining in the Grand Canyon Region: Implications for Uranium Levels in Colorado River Water," AZGS Open-file Report 11-04, 13p.

## Annual Spring Meeting – Arizona SME

Hosted by: **QuadraFNX – Carlota Copper Company**

Please join us for the Annual Spring Meeting at the Arizona SME Conference hosted by QuadraFNX – Carlota Copper Company on **Saturday, May 7, 2011** at the Freeport-McMoran Training Center, Cobre Valley Plaza, 2250 E Highway 60 (@ HWY 188 turnoff to Lake Roosevelt), Globe Arizona, 85501.

Presentations: 9:00 am – 11:00 am

Lunch Served: 11:30 am – 12:30 pm

Mine Tour: 1:00 pm – 3:00 pm

Transportation for the tour will be provided.

NOTE: Participants will be accepted on the mine tour of Carlota on a limited first-come, first-served basis. The mine tour is limited to 90 participants. The technical presentations are limited to 125 participants.

Please RSVP [via e-mail](mailto:SME.Carlota@quadrafnx.com) with the requested information to: [SME.Carlota@quadrafnx.com](mailto:SME.Carlota@quadrafnx.com)

Name \_\_\_\_\_

Company or Affiliation \_\_\_\_\_

Attend Entire Session \_\_\_\_

Attend Technical Presentations \_\_\_\_

*Note: Please bring your own PPE (hardhat and safety glasses). Steel toed shoes are preferred but close-toed shoes with a good tread are required at a minimum for the mine tour.*

Good news for students! Each month, a limited number of meals at our dinner meeting will be FREE to students who make **advance online** reservations on a first-come, first-served basis. This is made possible through monthly sponsorship of the dinner meeting. Students are also encouraged to sign up for free membership. AGS is a great way for students to make contact with prospective employers!

If your company is interested in a sponsoring a dinner meeting, please contact Ann Pattison, AGS VP of Marketing.

The May dinner meeting will be sponsored by:



Rosemont and its employees have been enthusiastic supporters of AGS for many years. If you have a chance to speak with any Rosemont staff at the meeting, please thank them for their contributions!

## Kartchner Caverns Field Trip—May 28, 2011

Circle the last Saturday in May for the next AGS field trip. This will be a family event — a special “after hours” visit to Kartchner Caverns State Park. The cave visit will be entirely ADA accessible (including wheelchair access, if required), and AGS will provide van transportation, leaving from the southwest corner of the University of Arizona campus. Times are still tentative, but it’s looking like we may leave campus around 2 p.m. and return at approximately 9 p.m.

Our visit is being arranged by the “Friends of Kartchner Caverns State Park” and will include a special program in the Visitor Center, as well as our own tour of the caverns. Following our cavern tour, we will have a catered meal in the picnic area and a private question and answer session with cave experts.

*Reservations and payments will be accepted starting April 25th on the AGS website. Cost (including transportation, dinner, beverages, entrance fees): Adults \$55, Children \$48. If you provide your own transportation, the cost will be \$33 for adults and \$26 for children.*

NOTE: There is one opening for the [Grand Canyon Geology Raft Trip](#) on July 10-17. For information call Alison Jones at 520-622-3222.

