Arizona Geological Society Newsletter

ARIZONA GEOLOGICAL SOCIETY, INC., TUCSON, AZ JANUARY 2011

January 4, 2011 DINNER MEETING

Richard A. Goldfarb, Senior Research Geologist, USGS, and SEG International Exchange Lecturer 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 December 31, 2010.

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

Supercontinent History and Global Metallogeny

by Richard A. Goldfarb

The temporal pattern of ore deposits on a constantly evolving Earth reflects the complex interplay between the evolving global tectonic regime, episodic mantle plume events, overall changes in global heat flow, atmospheric and oceanic redox states, and even singular impact and glaciation events. Within this framework, a particular ore deposit type will tend to have a time-bound nature. It is now well established that the temporal patterns of many types of mineral deposits reflect the formation or break-up of supercontinents, and the preservation potential of deposits formed during these periods. Approximate time periods for such formation and break-up, respectively, include 2800-2500 and 2450-2100 Ma for Kenorland, 2100-1800 and 1600-1300 Ma for Nuna/Columbia, 1300-1100 and 850-600 Ma for Rodinia, and 600-300 Ma and 200-60 Ma for Gondwanaland-Pangea. Beginning about 250 m.y. ago, a new supercontinent, Amasia, began to form, thus overlapping the Pangea break-up. Many of the formation-preservation patterns are themselves controlled by progressive cooling of the Earth, the change from a mantle-plume buoyancy style to subduction-dominated tectonics, a decreasing buoyancy of the subcontinental lithospheric mantle, and depth of ore formation. In general, orogenic Au, volcanogenic massive sulfide (VMS), epithermal Au-Ag, and porphyry Cu±Au and Mo porphyry deposits form in active margins during periods of supercontinent assembly. Numerous other ore deposit types show an association with supercontinent formation, but develop inland of the active margin. These include many of the Mississippi Valley-type Pb-Zn deposits and unconformity-type U deposits. The Tertiary Carlin-type deposits within the deformed shelf sequences along the North American craton margin also appear to have formed during the ongoing growth of Amasia. Those ores associated with periods of supercontinent breakup or attempted breakup are more difficult to define. They probably include diamond, Bushveld-type Ni-Cu-Platinum Group Elements, iron oxide-copper-gold, and clastic-dominated (CD) Pb-Zn (or SEDEX) deposits in intracontinental areas of failed rifting, and other CD Pb-Zn deposits in areas of actual breakup. In all cases, however, these temporal/spatial distributions are ultimately controlled by the secular character of Earth history.

Richard J. Goldfarb is a senior research geologist with the Mineral Resources Program of the U.S. Geological Survey, where he has been employed for more than 30 years. Rich's major expertise has been on the geochemistry and geology of ore deposits with emphasis on Phanerozoic lode gold. Much of his earlier career work was on the Tertiary orogenic gold deposits of southern Alaska. Results from this work were used to develop ore genesis models for giant gold deposits elsewhere in Alaska and in other parts of the North American Cordilleran. In recent years, Rich has conducted detailed studies on the understanding of the distribution of gold deposits through space and time, compiling the most comprehensive global description of their distribution and evaluating the controlling tectonic/geologic features. He has senior-authored and co-authored more than 190 refereed publications in economic geology. Rich has served as President of the Society of Economic Geologists, is a past Silver Medalist and Thayer Lindsley lecturer of the society, has served as chief editor of *Mineralium Deposita*, and is presently on the editorial boards of *Economic Geology* and *Gondwana Research*.

January Member Spotlight—Corolla K Hoag

Corolla K Hoag (Cori) was born in Tacoma, Washington in 1960. She received a B.S. in Geology from Western Washington University. From there she went to the University of Arizona where she earned an M.S. in Economic Geology as Dr. Spencer Titley's 100th graduate student. It is probably safe to say that there has not been a more active member in the history of the Society. Over the past 19 years she has held the offices of Vice Treasurer, Treasurer, President, Past President, VP of Field Trips, Councilor, and VP of Marketing. In fact, 2011 will mark the first year since 1992 that Cori has not served on the AGS Executive Committee. In appreciation of her dedication and contributions to AGS, Cori was awarded honorary lifetime membership in AGS at the December 2010 dinner meeting.

Cori Hoag became an honorary lifetime member of AGS in December 2010. She is pictured here with Spence Titley (center), who presented the award, and her husband, Kevin Horstman.

Cori is a Principal at SRK Consulting, and she serves on the Board of the Mining Foundation of the Southwest. She met her husband of 18 years, Kevin Horstman, in a geology class at the University of Arizona. They live in Tucson.

How did you first become interested in geology? My father was a botanist and birder so we were exposed to the outdoors at an early age. My first hike was to the ice caves at Mt. Rainier at age 2. We were constantly hiking, camping, birding, and bicycling on weekend trips in the Northwest and on extended summer vacations to national parks, wildlife refuges, and historical sites around the western U.S. We camped out in a tent trailer, and my mother called it the "pit-toilet tour of America". She definitely deserved an occasional stay in a hotel but we were roughing it. We visited the desert areas in Southern California, Arizona, and New Mexico, but our trips to the Arches, Canyonlands, Canyon de Chelly, and other beautiful parks on the Colorado Plateau cinched it for me…I wanted to be a geologist.

What was your first job? My twin sister was interested in the nursing profession and got us jobs at a Lutheran elder care facility in Seattle. I worked as a Certified Nurse's Aide for three summers in high school. It was a great life experience for a teenager and I learned a lot about the human condition. The first naked man I ever saw growing up, however, was 85-years old!

A hiking adventure at Machu Pichu: Cori with her father and Kevin.

What was your first job as a geologist? In 1980, I worked for the Bureau of Mines on a RARE II mineral assessment of the Glacier Peak Wilderness Area in the Cascades. We were in a helicopter-assisted camp at the base of a glacial cirque valley waking up every morning to small avalanches in the cliffs above, mountain goats grazing on the wildflowers, and washing with icy cold water. We hiked to prospect pits and workings to collect samples, describe the mineralization, and map the adits. We scrambled down stopes in historic underground mines held up by water-soaked mine timbers. Occasionally we got to swoop off in the helicopter to nearby alpine lakes to relax and fish. It was wonderful.

What is your most memorable field experience? Like other exploration

Continued Page 3

Member Spotlight—Corolla Hoag (continued from page 2)

geologists, I've been shot at and had narrow escapes hanging off steep cliff faces where I shouldn't have been. The most difficult field condition I encountered was in western Arizona, working for Cyprus Copperstone with fellow AGS members Greg Baugh and Phil Gyger. I couldn't take the intense Mojave Desert heat and black varnished rocks. To survive the summer, I wore a brimmed hat with sun flap, long-sleeved shirt with turned up collar, long pants, and garden gloves. I felt like a traditional Muslim woman with only a small bit of face exposed around my eyes. Saw lots of chuckwallas that summer.

What do you consider your greatest professional achievement? Unlike Walt Heinrichs, I can't point to a single greatest professional achievement. I'm particularly proud of the science work I was able to do with Magma/ BHP to develop the Florence in-situ leach project and for mentoring and training many young geologists. I'm proud to be a principal of SRK and to have the opportunity to work as consultant and colleague with many fine geologists in Arizona and on the board of AGS.

How about your greatest achievement EVER? Hopefully my greatest achievement is still to come. A recent father-daughter achievement was to tour the Galapagos Islands and Inca ruins in Peru with my father and Kevin. My father was 77 years old with stage 3 Parkinson's disease, somewhat frail, and not too steady on his feet. It was truly inspirational to watch him as a disabled senior climb up the rugged stairs at Machu Pichu with no hand rails — just slow and steady progress learned from his training as a mountaineer — and passing much younger folks in the process.

What are your hobbies? Researching the history in copper mining communities, genealogy work, and playing the flute are my main hobbies. I like to photograph cemetery markers and do a little research on each person. I'm an obituary connoisseur and follow them for research purposes in many newspapers across the country … plus I need to make sure I'm not in them yet!

Water, Whiskey or Wine? I like a nice glass of vino, but water is tops in Arizona.

Thanks, Cori!

Do you know an AGS member who would be an interesting subject for the Member Spotlight column? Please contact Alison Jones at ajones@clearcreekassociates.com with your suggestion.

REMINDER: AGS dues are payable by January 1, 2011. Don't delay! You may offer to pay up at the January meeting if you are able to attend.

AGS BYLAWS UPDATE

Periodically, the AGS Executive Committee reviews the AGS Bylaws to ensure that they are current, an accurate reflection of the current practices of the Society, and easy to read. The Executive Committee has just completed a thorough review and found that updates were required to:

- Correct minor typographic and grammatical errors,
- Clarify and update the duties of some of the Committee positions,
- Clarify the role of the AGS webmaster and the purpose of the website,
- Create a permanent Publications Committee to compile and archive AGS publications, and
- Clarify other administrative procedures such as how and when AGS records may be inspected.

The Executive Committee is seeking your input and comment on the draft AGS Bylaws, which can be viewed on the AGS website. Go to http://www.arizonageologicalsoc.org/208/ags-bylaws and click on the link to look at a revised copy of the 2008 Bylaws (with redline, so you can see what is changed). Member comments will be incorporated into the draft version to be submitted for approval by the members attending the dinner meeting on January 4th. Please submit your comments to AGS Secretary Alison Jones at ajones@clearcreekassociates.com or to (520) 663-5295.

Your AGS Officers and Councilors

The agenda for the December meeting was so full that we were unable to thank outgoing AGS Executive Committee Members!! Thanks to the following outgoing Executive Committee members for their service to the society:

- **Kris Hefton**, Treasurer (6 years of service)
- **Cori Hoag**, Vice Treas., Treas., Pres./Past-Pres, Sec., VP Field Trips, Councilor, VP Marketing (19 years of service)
- **Kevin Horstman**, Past President (2 years of service)
- **Karl Sandwell-Weis**, Councilor (3 years of service)

The Executive Committee Members for 2011 are as follows:

President	Greta J. Orris, U.S. Geological Survey
VP Programs	Robert J. Kamilli, U.S. Geological Survey
VP Field Trips	Doug Shakel, Retired
VP Marketing	Ann D. Pattison, Independent
Treasurer	Coleen Brown, Retired
Vice Treasurer	Michael Conway, Arizona Geological Survey
Secretary	Alison H. Jones, Clear Creek Associates
Vice Secretary	David F. Briggs, Independent
Past President	Mark D. Cocker, U.S. Geological Survey
Councilor 1 (11-13)	Anthony B. Williams, Diligent Investor
Councilor 1 (11-13)	Robert E. Powell, U.S. Geological Survey
Councilor 2 (10-12)	Jeffrey Cornoyer, Rosemont Copper
Councilor 2 (10-12)	Claudia Stone, SRK Consulting
Councilor 3 (09-11)	M. Lee Allison, Arizona Geological Survey
Councilor 3 (09-11)	Diana C. Kamilli, Retired

We are grateful to the dedicated AGS members who serve on the Executive Committee. In particular, we wish to acknowledge ***Coleen Brown***, who has had 10 continuous years as Vice Treasurer, and ***Bob Kamilli***, who has served 17 years on the Executive Committee, 11 years as VP Programs. Serving on the Executive Committee is fun and a great way to get to know your fellow AGS members. If you are interested in serving in 2012, please notify any Executive Committee Member.

Announcements

Welcome New Members!!

Lyle Slater, General Manager, AeroTech Mapping Technologies, Phoenix

Arizona Water Resources Tour—February 16-18, 2011

The Water Education Foundation, together with the Bureau of Reclamation, Lower Colorado Region, is offering a three-day, two-night tour February 16-18, 2011. The tour is designed to educate public policy decision makers, attorneys, consultants, and state and federal government staff members about the challenges facing Arizona's water management. Arizona is a microcosm of the water resources issues facing the arid West and how agencies within the state are dealing with drought, groundwater management, surface water distribution and conservation, and the needs of the urban, agricultural, rural and environmental communities will be discussed. For more information or to register for the tour, please visit the tour section of the Water Education Foundation's website at: http://www.watereducation.org/toursdoc.asp?id=823.

USGS Noontime Lecture

***Richard Goldfarb*, SEG International Exchange Lecturer, will speak at noon on January 4, 2011 on *Orogenic Gold Deposits—Geology, Exploration Criteria, and Global Metallogeny*.**
Where: USGS offices, Room 353. The USGS is located on the U of A campus at 520 North Park Ave. Parking is available in the parking garage to the east of the building. Bring a bag lunch and join us!

Atomic Weights of Ten Chemical Elements About to Change

For the first time in history, a change will be made to the atomic weights of some elements listed on the Table of Standard Atomic Weights of the chemical elements found in the inside covers of chemistry textbooks worldwide. The International Union of Pure and Applied Chemistry's (IUPAC) Commission on Isotopic Abundances and Atomic Weights is publishing a new table that will express atomic weights of ten elements as intervals, rather than as single standard values. The new table is the result of cooperative research supported by the U.S. Geological Survey, IUPAC, and other contributing Commission members and institutions.

Standard atomic weights commonly are thought of as constants of nature, despite the fact that atomic weights of many common chemical elements show variations as a result of physical, chemical and biological processes.

"For more than a century and a half, many were taught to use standard atomic weights — a single value — found on the inside cover of chemistry textbooks and on the periodic table of the elements," said Ty Coplen, director of the USGS Reston Stable Isotope Laboratory. "Though this change offers significant benefits in the understanding of chemistry, one can imagine the challenge now to educators and students who will have to select a single value out of an interval when doing chemistry calculations."

The standard atomic weights for hydrogen, lithium, boron, carbon, nitrogen, oxygen, silicon, sulfur, chlorine and thallium previously were expressed as central values with uncertainties that reflected natural atomic-weight variations. The weights of these elements now will be expressed as intervals to more accurately convey this variation in atomic weight. For example, boron is commonly known to have a standard atomic weight of 10.811. However, its actual atomic weight can be anywhere between 10.806 and 10.821, depending on where the element is found.

The atomic weight of an element depends upon how many stable isotopes it has and the relative amount of each stable isotope. Isotopes are atoms of the same element that have different masses. Variations in atomic weight occur when an element has two or more naturally occurring stable isotopes that vary in abundance. Modern analytical techniques can measure the atomic weight of many elements precisely, and these small variations in an element's atomic weight are important in research and industry. For example, precise measurements of the abundances of isotopes of carbon can be used to determine purity and source of food products, such as vanilla and honey. Isotopic measurements of nitrogen, chlorine and other elements are used for tracing pollutants in streams and groundwater. In sports doping investigations, performance enhancing testosterone can be identified in the human body because the atomic weight of carbon in natural human testosterone is higher than that in pharmaceutical testosterone.

Elements with only one stable isotope do not exhibit variations in their atomic weights. For example, the standard atomic weights for fluorine, aluminum, sodium and gold are constant, and their values are known to better than six decimal places.

The USGS has a long history of research in determining atomic weights of the chemical elements. As far back as 1882, Frank W. Clark, chief chemist of the USGS, prepared a table of atomic weights.

The year 2011 has been designated as the International Year of Chemistry (IYC). The IYC is an official United Nations International Year, proclaimed at the UN as a result of the initiative of IUPAC and UNESCO. IUPAC will feature the change in the standard atomic weights table as part of associated IYC activities.

This fundamental change in the presentation of the atomic weights is based upon work between 1985 and 2010 supported by IUPAC, the USGS, and other contributing Commission members and institutions. IUPAC oversees the evaluation and dissemination of atomic-weight values.

This article was reprinted with permission of the USGS from a USGS press release. The USGS contacts regarding this work are Tyler Coplen, Fabienne Myers, and Kara Capelli. For more information, including how to contact USGS scientists regarding this work, go to:

http://www.usgs.gov/newsroom/article.asp?ID=2661

ARIZONA GEOLOGICAL SOCIETY

P.O. Box 40952
Tucson, AZ 85717-0952
Phone: 520.663.5295
www.arizonageologicalsoc.org

NON-PROFIT ORG.
U.S. POSTAGE PAID
TUCSON, ARIZONA
PERMIT NO. 1346

RETURN SERVICE REQUESTED

www.arizonageologicalsoc.org

AGS books and maps are sold at the monthly dinner meeting and by the Arizona Geological Survey. Visit the AZGS website www.azgs.state.az.us and click on Non-AZGS Publications

2011 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 ☐

Starting in 2011, 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.