Arizona Geological Society Newsletter Newsletter

APRIL 2014

April 1, 2014 DINNER MEETING

Who: Eric Seedorff will speak about "Structural Dismemberment of a Porphyry Molybdenum System, Spruce Mountain District, Northeastern Nevada."

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 free with online reservation ($10 without).

RESERVATIONS ARE REQUIRED: CALL (520) 663-5295 or reserve on the AGS website (www.arizonageologicalsoc.org) by 11 a.m. by Friday, March 28 . Please indicate regular (Sautéed Chicken Pasta, whole grain spaghetti, tomato sauce, avocado, cilantro), vegetarian, or cobb salad meal preference. Please cancel by Friday, March 28 at 11 a.m. if you are unable to attend—no shows and late cancellations will be invoiced.

The April dinner meeting is sponsored by: BV-Inspectorate

AGS is grateful for BV-Inspectorate's sponsorship, which helps us to offset dinner meeting costs.

Abstract

Structural Dismemberment of a Porphyry Molybdenum System, Spruce Mountain District, Northeastern Nevada

Eric Seedorff [1] and James R. Pape [2]

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This study represents a structural reconstruction of complexly faulted rocks in the Spruce Mountain district that host a porphyry molybdenum system. It also places the mining district in the context of other porphyry molybdenum systems in the western United States and compares the extensional structure of the district to other extended areas in eastern Nevada.

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ABSTRACT - Continued from Page 1

The Spruce Mountain district exposes Ordovician through Permian miogeoclinal strata and sparse intrusive rocks that host a porphyry molybdenum deposit and associated skarn mineralization, as well as a Carlin-type gold prospect. A map-based structural analysis and stepwise, fault-by-fault cross-sectional restoration of normal faulting across the central portion of the district reveals that the Spruce Mountain area has been deformed by at least six crosscutting sets of normal faults with variable (east, west, and minor north) senses of displacement. Based on the restored cross section, it is estimated that normal faulting resulted in ~7 km (~130%) of extension and ~40° of net eastward tilting across the central portion of the Spruce Mountain district; faults of the first, second, and sixth generations of normal faults contributed to the net eastward tilting. The presently exposed normal fault network at Spruce Mountain reflects the overprinting of multiple phases of extension, ranging in age from Eocene to Quaternary. Six new U-Pb age dates on igneous dikes within the district, some of which crosscut and intrude the oldest fault sets, constrain the earliest phase of extension at Spruce Mountain as late Eocene (~38 Ma) or older, and the porphyry system to be late Eocene (also ~38 Ma). Cenozoic extension was distributed among numerous, initially high-angle, planar to curviplanar normal faults. All restored faults had initial dips of ~50° or greater.

Cross-sectional restoration of normal faulting results in a pre-extensional structure consisting of west-vergent folds and gentle westward dips of miogeoclinal strata, which suggests that the Spruce Mountain area may have formed the western limb of an anticline that connected to the adjacent Pequop syncline prior to the onset of extensional deformation. The porphyry molybdenum system formed in the late Eocene at ~38 Ma. At least some normal faults postdate porphyry mineralization and have partially dismembered the porphyry molybdenum system, with deeper levels of the system exposed on the western side of the district and shallower levels on the eastern side. Nonetheless, porphyry dikes at least locally intrude the early generations of normal faults, which are prospective as potential conduits for hydrothermal fluid flow that produced skarn and carbonate replacement mineralization.

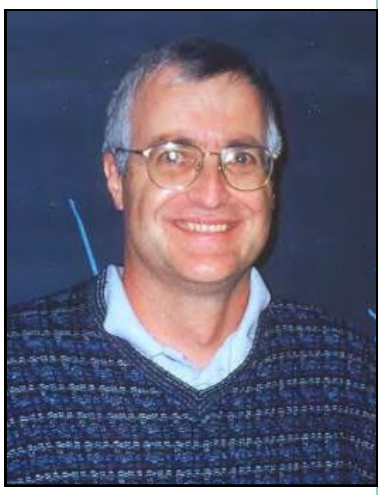
Large extensional strains within the Spruce Mountain district have been distributed among numerous, typically moderate-offset (<2 km) normal faults. This style of extension contrasts with that observed in the southern Ruby Mountains west of Spruce Mountain, which appears to have been accommodated primarily by large offset (13-22 km) on a single west-dipping fault that produced easterly tilting. A recent reconstruction there implies only ~45% extension, suggesting that the relative amount of extension at Spruce Mountain (~130%) is about three times the amount in the southern Ruby Mountains, although the absolute amount of extension at Spruce Mountain is similar to that in the southern Ruby Mountains.

Spruce Mountain is a rhyolitic porphyry Mo deposit, which includes end-member examples such as Climax and Henderson ("Climax-type" deposits) but also "transitional" deposits. The latter, which are characterized by less evolved igneous compositions and mineralization with higher Cu : Mo ratios, include Mount Emmons, Colorado, Mount Hope, Nevada, Pine Grove, Utah, and various other prospects in the Great Basin, many of which appear to have been forming near the inception of extension at any given locale. Most of the rhyolitic porphyry Mo deposits in the Great Basin are late Eocene, and late Eocene extension also played a role in localizing other types of deposits in the northern Great Basin, including porphyry Cu-(Mo-Au) ores at Bingham, Utah, Carlin-type Au deposits in several large districts, Au-Ag ores at Cove-McCoy, Nevada, and Au-Cu ores in the Battle Mountain district, Nevada.

AIPG Arizona Section Spring 2014 Field Trip

On Saturday April 12, 2014, Arizona Geological Survey senior geologist, Jon Spencer will lead a field trip to examine the Metamorphic Core Complex along the Catalina Highway . There is no charge for the field trip, but RSVP to James Adu (AIPG Secretary) at (520) 405-3656 or adunkansah@yahoo.co.uk by April 9, 2014. For more information about this trip please visit this link.

About the April Dinner Speaker



Eric Seedorff was born in Carlsbad, New Mexico, and raised in a mining family. Eric earned a BS degree in Geology from the University of California, Davis (1977), and MS (1981) and PhD (1987) degrees in the Ore Deposits and Exploration Program in the Department of Applied Earth Sciences, Stanford University. Eric's MS project was on the Royston porphyry copper prospect western Nevada that was faulted and tilted by Tertiary normal faults, and his PhD was an alteration study of the Henderson porphyry molybdenum deposit, Colorado. Before and during graduate school he held temporary jobs in exploration in Nevada, mostly for Noranda and mostly exploring for porphyry molybdenum deposits.

After completing graduate school, Eric was as an exploration geologist based in Reno, Nevada, working in Carlin-type, porphyry-related, and low-sulfidation epithermal gold systems, first for Chevron Resources and then for WestGold, each of which left the mineral exploration business. Eric joined Magma Copper Company in 1991 and moved to Ely, Nevada, to become Chief Mine Geologist for Magma on the Robinson project, first while it was still an operating gold mine and later as it became a copper development project. It was in 1991 that his obsession began to accomplish a 3-D structural reconstruction of Robinson. Prior to opening of the new Cu-(Mo-Au) mine at Robinson, Eric started traveling overseas for Magma evaluating exploration and development opportunities and in 1995 was transferred to Tucson to become Chief Geologist of Magma Copper Company. In his year in that position, he helped lead growth of their exploration program, including expansion of efforts in Mexico and Chile and initiation of programs in the Southwestern United States and in Mongolia. Magma was purchased by Melbourne-based BHP in January 1996, and Eric wound up in the Growth and Technology Group of BHP Copper that which was based in San Francisco, but he succeeded in remaining in Tucson. As Vice President Mineral Resources for BHP Copper, he had responsibilities in coordinating ore reserve reporting across BHP Copper, in being BHP Copper's liaison to BHP's global greenfields exploration group, in overseeing brownfields exploration at several sites, and as project manager for the scoping stage of the Magma Porphyry (now Resolution) project near Superior, Arizona. Eric chose to leave BHP in late 1999, after which he and two partners operated a failed entrepreneurial venture to build a new producing copper company from scratch.

Eric became a faculty member in the Geosciences Department, University of Arizona, in January 2002 as the first holder of the Lowell Chair in Economic Geology. He leads a post-graduate education and training program for geologists in the minerals industry and has students in conventional MS and PhD programs and in the Professional Science Masters in Economic Geology program. His principal research interests are in porphyry-related deposits, extensional tectonics, and hydrothermal alteration-mineralization processes.

Eric has been active in the Society of Economic Geologists and is a past President of both the Arizona Geological Society and the Geological Society of Nevada.

Geological Society of Nevada 2015 Symposium

The Geological Society of Nevada has announced a call for papers to be presented at its 2015 Symposium, which will be held at John Ascuaga's Nugget in Reno/Sparks, Nevada on May 14-24, 2015. Co-hosts for this event include the Society of Economic Geologists, Nevada Bureau of Mines and Geology and the U. S. Geological Survey. Its theme is New Concepts and Discoveries. Anyone wishing to present a paper at this meeting needs to submit a draft abstract no later than May 30, 2014. For more info on this event visit this link.

Second Annual Arizona Geological Society Doug Shakel Memorial Student Poster Event

Sponsored By

GEOTEMPS INC.
HUMAN RESOURCES FOR NATURAL RESOURCES

TODAY'S STUDENTS WILL BE TOMORROW'S LEADERS

AGS is grateful for Geotemps' sponsorship, which helps us to offset the costs of this event.

The AGS will host a special meeting on **Thursday, April 24, 2014** in **Tempe** at the **Embassy Suites Hotel** (address - 4400 South Rural Road; located at the intersection of South Rural Road and the Superstition Freeway, which is one mile due South of the ASU campus).

Viewing of the posters will begin at 6:00 PM. Dinner will be served at 7:00 PM. The students will make brief (3 minute) oral presentations, summarizing their posters between 7:00 and 9:00 PM. Prizes will be awarded at 9:30 PM.

DINNER RESERVATIONS ARE REQUIRED: CALL (520) 663-5295 or reserve on the AGS web site by 11 a.m., Thursday, April 17. DINNER WITH RESERVATION: MEMBER = $27.00, GUEST = $30.00. Student members, who make reservations eat free with student ID. Please indicate regular (Sautéed chicken), vegetarian, or salad meal preference. Please cancel by Thursday, April 17 at 11a.m. if you are unable to attend - no shows and late cancelations will be invoiced.

For additional details about this event, please visit this link.

Save the Date - GeoDaze 2014 at UA Student Union Grand Ballroom. Join the UA Department of Geoscience students, faculty, alumni, and friends at the 42nd annual student presentation forum to be held on April 10-11, 2014; the field trip will be held on Saturday April 12th. Registration will open soon. See http://earth.geo.arizona.edu/geodaze/14/index.html

MEMBER NEWS - AGS Life Member, **Dr. Spencer R. Titley** was honored at the Society of Mining, Metallurgy and Exploration Geology conference held in Salt Lake City in February. Spence was the 2013-2014 recipient of the **SME/AIME Mineral Industry Education Award**. Members **Will Wilkinson**, **Cori Hoag**, **Stephen Enders,** and **Robert Schafer** were on hand to celebrate Spence's well-deserved recognition. Stephen was also honored by SME's Mining & Exploration Division and received the 2013-2014 **Ben F. Dickerson Award**, recognizing Steve's well-known professionalism and contributions to the mining industry. Photo used with permission by SME, 2014.

AGS Spring Field Trip

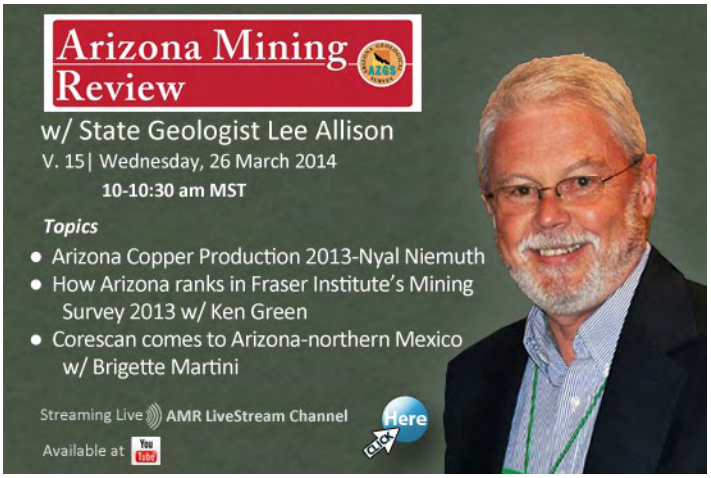
On Saturday, April 26, 2014, the AGS spring field trip is planned for Freeport-McMoRan's Christmas porphyry copper deposit in Gila County, Arizona.

The Christmas deposit is situated at the southeastern end of the Dripping Springs Mountains and is one of the last largely undeveloped deposits remaining in the prolific porphyry copper province of southeastern Arizona. The planned program will include an examination of core and stops at significant geologic outcrops in the vicinity of the mine.

The number of participants for this field trip is limited to 40. At the present time, all spaces have been filled. Anyone who wishes to attend can be placed on a waiting list by contacting David Briggs at (520) 663-5295 or at secretary@arizonageologicalsoc.org. For more information about this event, please visit our events page .

Thank You for Your Donation to the AGS Scholarship Fund

Don Applebee
Gary Bender
Michael Block
Linda Buczynski
John Hoyt
Kevin Mitchell
Brian St. Clair



Arizona Mining Review e-Video Magazine. The 26 March episode of the Arizona Mining Review (AMR) includes interviews with:

- Nyal Niemuth on 2013 copper production numbers for Arizona;
- Ken Green, Senior Director of the Centre for Natural Resources at Fraser Institute, joins host Lee Allison to discuss perceptions of the state of mining in Arizona, the United States, and globally. Arizona made strong gains in several critical fields in Fraser Institute's Survey of Mining Companies 2013.
- Corescan comes to Arizona-northern Mexico – Brigette Martini, Business Development Manager of the Australian-based Corescan, describes their new hyperspectral mineral mapping technology and their newest venture, expanding into the Southwestern U.S. and northern Mexico mining market. Corescan is coming to Tucson! Tune in for the details.

The March episode will be broadcast at 10:00 am MST on 26 March on Live Stream. Immediately thereafter it will be available on our AZGS YouTube Channel (https://www.youtube.com/user/azgsweb).

New Publications from Arizona Geological Survey

(Available online at the AZGS Document Repository)

Rauzi, S. L. and Spencer J.E., 2014, An evaluation of carbon dioxide sequestration potential of the Permian Cedar Mesa Sandstone, northeastern Arizona. Arizona Geological Survey Open File Report, OFR-14-03, 22 p.

Clark, R.C., Day, J. and Richard, S.M., 2014, The AZGS geologic map toolbar for creating geologic map data using the NCGMP09 database and ESRI ArcMap. Arizona Geological Survey Open File Report, OFR-13-13, 18 p.

Additionally, we recently added spatial data for the following map products.

Young, A. and Pearthree, P.A., 2012, Geologic Map of Parts of the Lukeville, Diaz Peak, South of Lukeville and Blankenship Wells 7 1/2 Quadrangles, Organ Pipe Cactus National Monument, Pima County, Arizona. Arizona Geological Survey DGM-74, one map sheet at 1:24,000 map scale.

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New Publications from the AZGS - Continued from Page 6

Pearthree, P.A., Youberg, A. and Young, J.J., 2012, Geologic Map of the Tillotson Peak 7 1/2' Quadrangle and part of the Mount Ajo 7 1/2 Quadrangle, Organ Pipe Cactus National Monument, Pima County, Arizona. Arizona Geological Survey DGM-73, one map sheet, 1:24,000 map scale.

Young, J.J. and Pearthree, P.A., 2012, Geologic Map of the Armenta Well 7 1/2' Quadrangle and part of the Gunsight 7 1/2' Quadrangle, Organ Pipe Cactus National Monument, Pima County, Arizona. Arizona Geological Survey DGM-72, 1 map sheet, 1:24,000 map scale.

Arizona Geological Society Field Trip Photos

Subsidence Crack & Fissures, Cochise County, Az.

October 2011

Rosemont Copper Project, Pima County, Az.

September 2012

Red Mountain, Santa Cruz County, Az.

October 2009

Commonwealth Ag-Au Project, Cochise County, Az.

February 2013

Earth Science Outreach. The AZGS is working with a number of Earth science groups, including the Arizona Geological Society, to host an informational meeting on the state of Earth science outreach in Arizona. The meeting is scheduled for the morning of April 4th at the Clarion Hotel, Phoenix, Arizona. The Flagg Mineral Foundation has graciously agreed to provide logistical support.

ANNOUNCEMENTS

Welcome New AGS Members

Paul Acosta	Adam Gorecki	Jerald Waldner
Jonathan Boswell	Ed Madson	Clancy Wendt
Gabby De La Cruz	Brian St Clair	Eric Wynne
Ron Deichman	Richard Thorneloe	Samuel Ybarra
Elizabeth Dyer		

Arizona Geological Society is grateful to Freeport-McMoRan Copper and Gold for their generous support of our student members!

Freeport-McMoRan is sponsoring student dinners for the 2014 AGS monthly meetings.

FREEPORT-MCMORAN COPPER & GOLD

2014 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.