



Arizona Geological Society Newsletter

OCTOBER 2015

October 6, 2015 DINNER MEETING

Who: Caleb King will speak about “Eocene Hydrothermal Systems and Contrasting Hydrothermal Alteration in the Battle Mountain District, 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 Members free with on-line reservation (\$10 without).

RESERVATIONS ARE REQUIRED: Reserve on the AGS website (www.arizonageologicalsoc.org) by **11 a.m. Friday, October 2nd**. Please indicate regular (Baja Enchiladas with Chicken Machaca), Vegetarian, or Cobb Salad meal preference. Please cancel by Friday, October 2nd at 11 a.m. if you are unable to attend - no shows and late cancellations will be invoiced.

The October dinner meeting is sponsored by ASARCO LLC



**The AGS is Grateful for ASARCO’s Sponsorship, which helps us to offset
Dinner Meeting Costs**

Eocene Hydrothermal Systems and Contrasting Hydrothermal Alteration in the Battle Mountain District, Nevada by Caleb A. King and Mark D. Barton

The Battle Mountain district in north-central Nevada hosts numerous Eocene intrusive centers that have hydrothermal systems, many with associated Cu/Au mineralization. Mineralization types include porphyry-type Cu-Au(-Mo), distal-disseminated Au, and Au ± Cu skarns. These systems contain high-temperature quartz veins, potassic and sericitic alteration, and abundant sodic-calcic, calcic, and potassic-calcic alteration. Most systems, including Copper Canyon, Copper Basin, and Buffalo Valley and the deeply exposed Elder Creek porphyry system, have superimposed features. For these systems, crosscutting relationships, combined

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with published geochronology and 37 new U-Pb dates, demonstrate that the Au(-Cu) systems are Late Eocene (39-42 Ma). Conversely, mid-Cretaceous magmatism (94-98 Ma) generated porphyry Mo(-Cu) mineralization at Buckingham and Buffalo Valley Moly.

Alteration assemblages in these Eocene systems form distinct zones and were defined by mapping secondary mineral assemblages and by petrographic and electron microprobe studies. Alteration of siliciclastic rocks and igneous rocks in the district includes: potassic alteration (Qz + Bio + Kf ± Rut with Po + Asp + Cpy + Py ± Mt ± Au), sericitic alteration (Qz + Ser + Py with varying amounts of Chl + Asp + Cpy), sodic-calcic alteration (Na-plag + Act + Dio + Chl + Tit + Ep + Ap ± Gar ± Scap, associated with the removal of metals from the host rocks), potassic-calcic alteration (Kspar + Dio + Act + Gar + Ep + Tit + Ap with Cpy + Py + Mt ± Hm; Qz dissolution), and calcic alteration (Ca-plag + Act + Dio + Qz ± Gar with Cpy + Py + Mt ± Hm). Two types of skarn occur in the district. Fortitude-type skarns replace carbonate rocks and consist of Cpx + Gar + Po with Au + Cu mineralization, whereas Copper Basin-type skarns replace feldspathic and silicic as well as carbonate rocks and consist of Gar + Hem + Mt with Au + Cu mineralization.

The volume and distribution of these alteration assemblages, combined with petrologic considerations, indicates two main fluid sources: magmatic fluids generated potassic, sericitic, and Fortitude-type skarns, and moderately saline, non-magmatic fluids produced Na-Ca(-K) alteration mineral assemblages and Copper Basin-type skarns. Those features inferred to be magmatic-hydrothermal are restricted in their extent (ca. 1 km) and related to particular intrusive phases, whereas the Na-Ca-K alteration typically extends over many kilometers and is not correlated to any particular intrusive phase.

In addition to our work at Battle Mountain, reconnaissance and selected new mapping has revealed that other exposed Eocene plutons in northeastern Nevada may contain many analogous features. Many of these plutons exhibit local magmatic-hydrothermal features including potassic (secondary Bi ± Kf) alteration and quartz veins, yet the distinctive Na-Ca-K alteration is remarkably widespread and heretofore, largely unnoted. Observations within the Battle Mountain district and regionally indicate that a variety of fluids – magmatic and non-magmatic – played significant roles in Eocene intrusion-centered hydrothermal systems, and that the consequences of both fluid types, particularly the latter, need to be considered in interpreting Cenozoic metallogeny.

About the October Dinner Speaker



Caleb was born and raised in Wyoming, a fourth generation Wyomingite. Growing up in Wyoming led to an interest in geology and anthropology at an early age leading Caleb to pursue both subjects in college beginning in 2001. He attended Western Wyoming Community College in Rock Springs, Wyoming, where he got an Associates of Science degree and had the opportunity to do archeological work in the south Pacific including three and a half months of work on Easter Island. He then attended the University of Wyoming where he obtained a B.S. in geology and a B.A. in anthropology in 2006. Upon finishing his degrees he went to work in mineral exploration for Newmont on the Sundance project in Wyoming, then DiamonEx Ltd. conducting diamond exploration in the State Line District of Wyoming and Colorado, and then Newmont again working in the Belt Series rocks on the Toboggan project in Idaho. In 2009 Caleb went back to school at the University of Arizona and obtained an M.S. degree in

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2011 for his work on the Elder Creek porphyry system at Battle Mountain, Nevada. He then immediately began working on a Ph.D. examining the magmatic history of the Battle Mountain, the associated hydrothermal systems and alteration products, and the Au-Ag-Cu mineral deposits of Eocene age. His graduate research has been sponsored by Newmont, Science Foundation Arizona, and the Lowell Institute for Mineral Resources at the University of Arizona.

**Battle Mountain
Mining District**

Lander County, Nevada

Copper Canyon Area,
looking north, circa 2003
(Photo by David
Schumacher)

Copper Basin Area,
looking northwest, circa
2003 (Photo by David
Schumacher)



2016 Slate of Nominees—AGS Officers and Councilors

Don't miss the October 6th dinner meeting, when we will vote on the following slate of officers for 2016. If you are unable to attend the meeting you may vote online. All AGS members with a known email address will be sent an email with a link to the online ballot and a link to the 2015 Motions of Significance that the Executive Committee is asking the membership to approve.

If you wish to vote online, you must do so before 5 PM on Friday, October 2nd. If you vote online, you will not be permitted to vote again at the meeting. One vote per member.

President: Don Applebee, ASARCO LLC

VP Programs: Robert J. Kamilli, Retired U. S. Geological Survey

VP Field Trips: Robert S. Hildebrand, Research Associate, University of California, Davis

VP Marketing: Ann D. Pattison, Independent

Treasurer: Rachel C. Feuerbach, Independent

Vice Treasurer: Alison H. Jones, Clear Creek Associates

Secretary: David F. Briggs, Independent

Vice Secretary: Vacant

Past President: Michael Conway, Arizona Geological Survey

Councilor 1 (16-18): Jason (J. D.) Miser, Student, University of Arizona

Councilor 2 (16-18): Sarah E. Baxter, Independent

Councilor 2 (15-17): Carl Bowser, Emeritus Professor, University of Wisconsin

Councilor 2 (15-17): Marisa Lerew, ASARCO LLC

Councilor 3 (14-16): Bruce M. Walker, Retired Chevron Questa

Councilor 3 (14-16): Stanley H. Evans Jr., Retired Mineralogist

Up-coming Arizona Geological Society Dinner Meetings

Date	Speaker	Title of Presentation
11/3/2015	Karen Kelley	The Giant Concealed Pebble Cu-Au-Mo Porphyry Deposit, Southwest Alaska: Evolution and Exploration Implications
12/1/2015	Peter Smith	Lunar and Planetary Sciences Department, U of A - Title to be Announced
1/5/2016	Sarah Baxter	Calc-silicate Alteration and Ore Characterization, ASARCO Mission Complex: Implications for the Optimization of Molybdenum Recovery

Obituary - W. Gordon Wieduwilt



Long-time Arizona Geological Society member, W. Gordon Wieduwilt (87) passed away quietly at home on August 18, 2015 in Tucson, Arizona. He served as Vice Treasurer and Treasurer of the society during the early 1970s.

Gordon graduated from the Colorado School of Mines in geophysical engineering and began his career with Newmont Mining Corporation and Canadian Aero Surveys. In 1970, he opened Mining Geophysical Surveys in Tucson, which was in business for more than 25 years. His career in minerals exploration took him around the world making many friends along the way.

Gordon's warm nature and sense of humor touched many lives. He will be missed by all who knew him.

2015 Student Scholarship Announcement

The Arizona Geological Society is offering two scholarships--the Courtright Scholarship and the Arizona Geological Society Scholarship--both to be awarded at the December 2015 meeting.

The Courtright Scholarship, named after J. Harold Courtright, is awarded by the Arizona Geological Society to a graduate student pursuing a degree in the geological sciences at Arizona State University, Northern Arizona University, or University of Arizona. The Society is seeking student proposals for work on a field-related project in the North or South American Cordillera. The scholarship fund is designed to promote graduate research in all geology fields, but in recognition of Courtright's skills in mapping and porphyry copper exploration, the Society gives preference to proposals involving economic geology and the study of ore deposits.

In addition to the Courtright, the Society has established the Arizona Geological Society Scholarship to recognize a deserving graduate or undergraduate student working toward a degree in the geological sciences at one of the three universities in Arizona. The AGS Scholarship will be awarded to an individual who shows exemplary performance in and balance among areas of academic achievement, participation in research, and community service. Leadership ability, as demonstrated within the community or in the academic/research setting will be a consideration.

For both scholarships, the application deadline is Friday, October 23, 2015.

For each of the scholarships, a maximum of \$3,000 will be awarded. Further details and applications forms are available online at the [Arizona Geological Society web site](#).

Arizona Geological Society Membership Stats (9/19/2015)

Total Membership	Professional Members	Student Members	Organizational Members
521	399	115	7



FALL 2015 Field Trip
Arizona Geological Society
November 14-15

N. Plomosa Mtns
| Bouse Fm

Jon Spencer & Phil Pearthree
Arizona Geological Survey

More information about the Fall 2015 Field Trip is available on the [Events Page of the AGS Web Site](#).

Arizona Geological Survey News Brief



September [Arizona Mining Review](#) (AMR) will be available by 10am, Wed. 30 Sept.

- Arizona mining update with Nyal Niemuth (AZGS)
- 100 years of cyclic copper prices with Dr. Mary Poulton, Mining and Geological Engineering, University of Arizona

AZGS News

[AZGS built and deployed the Gold King Mine Spill Water and Sediment Sample Locations interactive map.](#) Currently, the map displays ~225 sample site with links to over 1,000 aqueous chemistry analysis. Data sources: EPA, ADEQ, UDEQ, NMED, and CDPHE; pending data sources: USGS and AZGFD

AZGS and AZ Dept. of Emergency Management and Military Affairs are again hosting the Great Arizona Shake Out earthquake preparedness drill. Scheduled for 10:15 am on 15 October, nearly 70,000 people are enrolled. Are you? Register at <http://shakeout.org/arizona/register/index.php>

AZGS' Lee Allison and Steve Richard are exhibiting the National Geothermal Data System at GEA's Geothermal Energy Expo 2015, September 20-23, 2015, Reno, NV.

New Publications – Online at the AZGS Document Repository

[Geologic Tour of Grand Canyon's South Kaibab Trail – A Story Map for Educators.](#)

Pearthree, P.A., Ferguson, C.A., Harris, R.C. and Cook, J.P., 2015, [Geologic map of the Wintersburg 7.5' Quadrangle and parts of the Arlington, Gillespie, and Tonopah Quadrangles, Maricopa County, Arizona.](#) Arizona Geological Survey Digital Map, DGM-77, one plate, map scale 1:24,000.

Spencer, J.E. and Duncan, J.T., 2015, [Fluid-inclusion characteristics of Oligocene to Miocene iron-oxide Cu-Au \(IOCG\) deposits in central western Arizona.](#) Arizona Geological Survey Open-File Report, OFR-15-05, 16 p., 3 appendices.

AZGS Online Map and Database Services page includes: AZ Oil & Gas Well Viewer, AZGS Document Repository, Natural Hazards in Arizona viewer, AZGS Mining Data, Geologic Map of Arizona, AZGeoBib, Seismic Stations in Arizona, and more.

ANNOUNCEMENTS

Welcome New AGS Members

Anne Billingsley

Leandra Marshall

Thomas Tuten

Robert Cairns

Evan Owen

Marcos Villasana

Caleb King

John Rockhill

Zida Wang

Arizona Geological Society is grateful to Freeport-McMoRan, Inc for their generous support of our student members!



Freeport-McMoRan is sponsoring student dinners for the 2015 AGS monthly meetings.

2015 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.