



# Arizona Geological Society Newsletter

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FEBRUARY 2013

## February 5, 2013 DINNER MEETING

**Who:** Peter Vikre will be our featured speaker. See abstract below.

**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 *Oasis Room*. The Oasis room is located on the ground floor by the pool in the hotel courtyard.

**When:** Cash Bar at 6 p.m.—Dinner at 7 p.m.—Talk at 8 p.m.

**Cost:** Members \$27, guests \$30, Students are free with reservation (\$10 without).

**RESERVATIONS are REQUIRED: CALL 520-663-5295 by 5 p.m. Friday, February 1 or reserve on the AGS website ([www.arizonageologicalsoc.org](http://www.arizonageologicalsoc.org)).** Please indicate regular (sautéed chicken pasta with whole grain spaghetti, tomato sauce, and avocado), vegetarian, or cobb salad meal preference. Please cancel by Friday, February 1 at 5 p.m. if you are unable to attend—no shows and late cancellations will be invoiced.



The February dinner meeting is sponsored by:

**ARIZONA OIL AND GAS, INC.**

AGS is grateful for Arizona Oil and Gas sponsorship, which helps us to offset dinner meeting costs. Learn more about Arizona Oil and Gas by contacting

**Carmon Decker Bonanno, President**

**PH: 816-223-3712**

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## ABSTRACT

### Succession of Laramide magmatic and magmatic-hydrothermal events in the Patagonia Mountains, Santa Cruz County, Arizona

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<sup>1</sup> U.S. Geological Survey; <sup>2</sup> Exploration Management LLC; <sup>3</sup> University of Arizona

The Patagonia Mountains of southern Arizona, U.S.A., consist of Precambrian, Paleozoic and Mesozoic sedimentary, granitic, and volcanic rocks, Laramide volcanic rocks, and a core of Laramide intrusions that comprises the Patagonia Mountains batholith. Laramide igneous rocks and adjacent Paleozoic and Mesozoic rocks contain significant porphyry Cu-Mo deposits, Mo-Cu breccia pipes, Ag-Mn replacement deposits, and numerous other Cu-Pb-Zn-Ag replacement and vein deposits. Uranium-Pb and <sup>40</sup>Ar/<sup>39</sup>Ar ages of igneous and hydrothermal minerals define four magmatic and magmatic-hydrothermal events that formed the batholith and altered parts of it and adjacent rocks; cumulatively the events span at least 16 Ma, from ~74 to 58 Ma. The oldest event of this succession includes the 74 Ma Washington Camp stock and spatially

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associated Cu-Pb-Zn-Ag replacement deposits (0.45 Mt @ 2% Cu, 3% Pb, 8% Zn, 3.6 oz/t Ag) in Paleozoic carbonate rocks of the Washington Camp-Duquesne district in the southeastern part of the range. Some to most of these deposits could be 61-59 Ma, the age range of large-volume quartz monzonite, granodiorite, and quartz monzonite porphyry that make up most of the batholith and surround the Washington Camp stock and Paleozoic strata. The next youngest event was the eruption of 73-68 Ma-volcanic rocks in the northern part of the range, which temporally coincides with replacement and vein deposits in Paleozoic carbonate rocks at the Flux mine (~71 Ma; 0.85 Mt @ 2.5% Cu, 5% Pb, 8% Zn, 5 oz/t Ag). An event at 65-62 Ma is marked by emplacement of small-volume quartz monzonite, granodiorite, and diorite intrusions, formation of the Ventura breccia deposit in Jurassic granite (65-64 Ma; 3.6 Mt @ 0.24% Mo, 0.24% Cu), and formation of other Pb-Zn-Ag-Cu replacement and vein deposits (~62 Ma; Blue Nose and Morning Glory). The Red Mountain porphyry Cu-Mo system occurs in ~62 Ma-granodiorite and Laramide volcanic rocks (73-68 Ma) at the northern end of the batholith. It includes a deep, chalcopyrite-bornite resource (~60.4 Ma; 434 Mt @ 0.64 % Cu, 0.011 % Mo), associated with potassic and sericitic alteration, and a near-surface chalcocite-enargite resource (60 Ma; 140 Mt @ 0.31% Cu, 0.022% Mo), associated with advanced argillic alteration that has been supergene enriched.

The youngest event includes the Sunnyside porphyry Cu-Mo system, ~4 km (~2.5 mi) south of Red Mountain, and a Cu-Mo breccia deposit at Red Hill (Four Metals mine) in the south-central part of the batholith, both of which formed in large-volume quartz monzonite, granodiorite, quartz monzonite porphyry, and quartz feldspar porphyry (~61-59 Ma). Similar to the Red Mountain system, the Sunnyside system consists of a deep chalcopyrite resource (1.5 Gt @ 0.33 % Cu, 0.011 % Mo, 0.16 oz/t Ag), that occurs in ~60-59 Ma-quartz feldspar porphyry, and a near-surface, slightly younger (~59-58 Ma) enargite-chalcocite-tennantite resource (800 Mt @ 0.183 % Cu, 0.02 oz/t Ag), that occurs in quartz feldspar porphyry, quartz monzonite porphyry, and Mesozoic rocks. The Red Hill Cu-Mo breccia deposit (7.8 Mt @ 1.2% Cu, 0.11% Mo, 0.08 oz/t Ag) occurs in large-volume quartz monzonite, granodiorite, and quartz monzonite porphyry (~61-59 Ma). Discrepancies between field relationships and some analytic ages at Sunnyside and Red Hill preclude precise dating of mineralization stages, and reflect disturbance of isotope systems by multiple, co-spatial to juxtaposed intrusive and hydrothermal events, and/or unrecognized intrusions. Numerous vein and replacement deposits at the northern end of the batholith, including the Hardshell Ag-Mn resource (52.3 Mt @ 2.1 oz/t Ag, 7.3% Mn), and the Three R supergene chalcocite resource (79 Mt @ 0.32 % Cu), are distal deposits of the Sunnyside and Red Mountain systems. Small Cu-Mo deposits in the southern part of the batholith that consist of hydrothermal biotite, K-feldspar, K-mica, chalcopyrite, and molybdenite, are ~60-59 Ma.

Other lengthy magmatic-hydrothermal successions in the western U.S. that consist of episodic magmatism and associated porphyry Cu-Mo systems are the Wasatch-Oquirrh igneous trend, UT, and the Boulder batholith, MT. These successions span ~17 Ma and include the Bingham and Butte porphyry Cu-Mo, vein and replacement deposits, respectively. Magmatism and mineralization in the Pima district, AZ, which includes the porphyry Cu-Mo deposits at Sierrita-Esperanza, Mission-Pima-San Xavier North, and Twin Buttes, formed over an interval of ~14 Ma.

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**USGS Lunchtime Lecture Series**

Peter Vikre will be speaking on February 5 at 12:10 p.m. in Room 353 of the USGS office at the northeast corner of Park Ave. and 6th St. Parking is available in the parking garage to the east of the USGS building. The lunchtime talk will be on **Gold-silver mining districts and alteration zones in the Miocene Bodie Hills volcanic field, California and Nevada**. All are welcome.

## AGS Spring Field Trip – Saturday, February 23, 2013

### Commonwealth Silver and Gold Project near Pearce, Cochise Co., Arizona

Join AGS on a one-day field trip to the Commonwealth Project and nearby prospects in southern Arizona on **February 23**. We will examine the local geology, structure, low-sulfidation alteration, and mineralization at this epithermal gold-silver vein/stockwork deposit in mid-Tertiary volcanic rocks. We will also visit adjacent prospects with the potential to host additional discoveries. For history fans, we will visit the historic Renaud General Store, that supplied the historic mine operation in its hey day.

**Tour Leader:** Hall Stewart, RG, CPG, VP Exploration/Geologist  
Commonwealth Silver & Gold Corp.

**Location:** Carpool locations will be established from Phoenix and Tucson once participant interest and availability are known.

**Schedule:** Leave carpool location in Tucson at 8 a.m. and drive approximately 80 miles to site. The tour begins at the project site at 10 a.m. The tour is expected to last until 2-3 p.m.

**Lunch:** Bring your own lunch and water. AGS will provide snacks and beverages.

**Group Size:** Limit 50. Preference will be given to members. A backup list will be maintained in case of cancellations.

**Conditions and Recommendations:** Travel to the Commonwealth Project is by paved highways (I-10 and US-191S) and good all-weather dirt roads. The Commonwealth area is accessible by walking on dirt roads. Travel to the nearby Blue Jeep and San Ignacio prospects will require high clearance and/or 4x4 vehicles. Walking on site here will be cross-country on rough, uneven terrain with brush. Please bring sturdy footwear, walking stick as needed, and appropriate clothing for desert environment, including hat, sunscreen, and warm clothing as needed.

**Registration Fee:** Member registration is \$25/Non-member registration is \$30. Full-time student members are free. All registrations include water/sodas, simple snacks, and a guidebook.

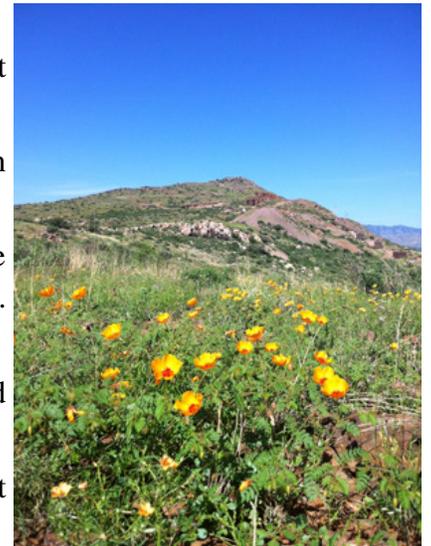
Register at <http://www.arizonaageologicalsoc.org/2013SprinfFT>. Payment will be accepted by: (1) advance check mailed to AGS, P.O. Box 409152, Tucson, AZ 85717, (2) cash/check at February dinner meeting in Tucson, or (3) secure credit card payment online.

**Cancellation Refund Policy:** A 100% refund will be made for cancellations made prior to February 15; a 50% refund will be given for cancellations prior to February 20.

**Reservations:** Detailed trip information, including directions, agenda, and carpool locations will be provided to trip participants. Log on to <http://www.arizonaageologicalsoc.org/2013SprinfFT> for information and reservations.

**Contact:** VP Field Trips Cori Hoag at [choag@srk.com](mailto:choag@srk.com) or 520-400-4135 with any additional questions.

**Support student attendance on the field trip:** Donate to the AGS' Greatest Needs Fund at <https://www.arizonaageologicalsoc.org/payment-form?id=88>. This defrays the costs of student participation so they can attend field trips at no cost to them.



## Summary of the Commonwealth Project

The Commonwealth Project is an advanced exploration project located in the historic Pearce mining district in southeastern Arizona. Historically the deposits mined at the Commonwealth Mine were high-grade silver-gold ores hosted in quartz veins and stockwork zones adjacent to the veins. Commercial-scale mining of the high-grade ores ended in the late 1920s, and remnants were mined by lessors through 1942. From the 1970s to the present, the project has been extensively explored and drilled by a number of companies who were seeking lower grade open-pittable and heap-leachable resources. No work was done on the project from 1997 to 2010 when Commonwealth Silver & Gold optioned the property and resumed exploration.

The mineral deposits on the Commonwealth Project are typical silver-dominant, low-sulfidation epithermal veins and stockworks. The veins are best developed in a series of Cretaceous to Tertiary volcanic rocks of andesite to rhyolite composition correlative with the Mexican Lower Volcanic Series. Cretaceous marine sediments of the Bisbee Group also host mineralization and are chemically favorable hosts. Sub-volcanic intrusive rocks (rhyolite flow-dome complexes) related to the nearby Turkey Creek caldera are altered and mineralized and are considered the likely heat sources that drove the epithermal systems in the district.

On the Commonwealth hill itself, the two most important veins are the Main Vein and the North Vein. This vein system has been mapped over 1 km of strike length and continues to the east under alluvial cover. Potentially economic mineralization occurs in the veins and in a structural wedge between the two principal veins. Drilling has tested at least 800 meters of strike length to a maximum depth of just over 200 meters. There is significant potential to find extensions to the known vein system both east, west, and down dip. The known veins in the district have a combined strike length of over 5 kilometers.

Commonwealth Silver and Gold has published a NI 43-101 compliant Technical Report on mineral resources that was completed in October 2011 by SRK Consulting, Inc.

### Mineral Resource Estimate

Mineral Resource Statement for the Commonwealth Gold-Silver Deposit, Cochise County, Arizona, SRK Consulting (Inc.), October 6, 2011\*

Resource Category	kTonnes	Au Grade (g/t)	Ag Grade (g/t)	AgEq grade (g/t)	Contained Metal (kOz)		
					Au	Ag	AgEq
Measured	0	0.00	0.00	0.00	0	0	0
Indicated	17,598	0.51	43.75	70.40	290	24,752	39,829
Measured + Indicated	17,598	0.51	0.51	70.40	290	290	39,829
Inferred	1,089	0.31	35.74	51.94	11	1,251	1,818

#### Notes:

- Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability. There is no certainty that all or any part of the Mineral Resources estimated will be converted into Mineral Reserves estimate;
- Resources stated as contained within a potentially economically minable open pit stated above a 26.0g/t Ag Equivalent cut-off;
- Pit optimization is based on assumed gold and silver prices of \$1,350/oz and \$26.00/oz, respectively; metallurgical recoveries of 90% and 75% for gold and silver, respectively, and a mining, processing, and G&A cost of \$19.50/t;
- Mineral resource tonnage and contained metal have been rounded to reflect the accuracy of the estimate, and numbers may not add due to rounding; and
- Mineral resource tonnage and grade are reported as diluted to reflect a potentially minable bench height of 3.0m.

## Celebration of Doug Shakel's Life

Doug Shakel, AGS VP of Field Trips, passed away on November 20. There will be a gathering in his honor on **Sunday, February 10, 2013, from 1 p.m. to 5 p.m.**

**Location:** Ed & Debbi McCulloch's home on Bush Hill Place east of the intersection of Catalina Hwy and Harrison Rd.

McCullough Residence  
9511 Bush Hill Place  
Tucson, AZ 85749  
520-760-1064

Bring any photo, travel souvenir, interesting rock/fossil, relic to share during the celebration. Send Brian LaReau any photo you would like to share in a memorial video (lash1971@gmail.com).

Instrumentalists are welcome.

**Bring a potluck item:** snack, warm dish, hors d'oeuvres, beverage or the like. Paper plates, cups, napkins, utensils will be provided. RSVP attendance to Sean Flannigan with potluck items, so they don't end up with too much potato salad (seanflan@fastmail.net or 575-313-6078).



## Arizona Geological Survey's 125th Anniversary



### Arizona Mining Review — Inaugural Broadcast of Online Video Magazine

On January 23rd, AZGS debuted the Arizona Mining Review, a live, online video magazine from the Arizona Geological Survey designed to explore and review the state of mining in Arizona—its challenges and successes. From potash to copper to gold, from mineral exploration to policy development, the monthly broadcast will include experts from industry, academia, research, and politics to discuss the current state and future of mining in Arizona.

During the inaugural broadcast, Lee Allison was joined by Nyal Niemuth, (Chief of AZGS's Economic Section). They provided an update and overview of mining in AZ in 2013. For more information visit [www.azgs.arizona.gov](http://www.azgs.arizona.gov). A recording of the episode can be view online at <http://www.youtube.com/user/azgsweb>.

### Publications

As part of our 125<sup>th</sup> anniversary celebration, AZGS will be reissuing some classic publications. In January AZGS reissued the 1924 Geologic Map of the State of Arizona compiled by N.H. Darton, C. Lausen and E.D. Wilson. The 1:500,000 scale map is available online at [http://repository.azgs.arizona.gov/uri\\_gin/azgs/dlio/1490](http://repository.azgs.arizona.gov/uri_gin/azgs/dlio/1490).

**NEW PUBLICATION**—AZGS just released the first ever, 1:50,000 scale geologic map of Petrified Forest National Park, Arizona. The map and accompanying 18-page report, the work of research teams from the U.S. National Park Service and Northern Arizona University, are available online at AZGS's Document Repository (<http://repository.azgs.arizona.gov/>).

## ANNOUNCEMENTS

### Welcome New AGS Members

Al Burch, Burch Consulting Services, Phoenix, AZ  
 Gaylord Cleveland, Reno, NV  
 Tomas Al, Phoenix, AZ  
 William Rohtert, Phoenix, AZ

Our thanks to these AGS members for their recent generous donations:

Mark Beeunas and AZ Oil and Gas donated to the Courtright Scholarship Fund, and Jeff Cornoyer donated to the AGS' Greatest Needs Fund

### AGS Dinner Meeting Cost Increased

The cost for a dinner at an AGS meeting has remained at \$24 for several years. However, starting in January 2013, the cost for a dinner has increased to \$27 for members and \$30 for non-members. Remember, dinner reservations are REQUIRED. The hotel may be able to accommodate you without a reservation, but the cost will be \$30, and there is no guarantee of availability.

**Attention Student Members:** AGS is pleased to provide free meals for student members with an online dinner reservation. Please keep in mind that these meals are paid for by AGS. If you make a reservation and do not attend, AGS must still pay for the meal. Please cancel your reservation by 5 p.m. on the Friday before the meeting, if you are unable to attend. If the cost of no-shows continue to be a problem, the AGS Executive Committee may consider charging for unclaimed student meals, as we do for regular members.

### 2013 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.

Enclosed is a \_\_\_\_\_ tax-deductible contribution to the AGS' Greatest Needs Fund.