



Arizona Geological Society Newsletter

APRIL 2019

April 2nd, 2019 DINNER MEETING

Who: **Dan Johnson** is the 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 **SABINO 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 \$30, Guests \$33, Students Members free with online reservation (\$10 without).

RESERVATIONS ARE REQUIRED: Reserve on the AGS website (<http://www.arizonageologicalsoc.org/events>) by **11 am on Friday, March 29th**. Please indicate Regular (Bacon Carbonara Pasta), Vegetarian (Spinach and Mushroom Polenta), or Salad (Chicken Caesar Salad) meal preference. Please cancel by **Friday, March 29th at 11 am** if you are unable to attend - no shows and late cancellations will be invoiced.

The April dinner meeting is sponsored by:



ABSTRACT

Florence Copper: Copper Recovery Using In-situ Technology

by **Dan Johnson,**
BSc, MSc, PE; Vice-President and General Manager, Florence Copper Inc.

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The Florence Copper In-Situ Copper Recovery (ISCR) project hosts a near-surface porphyry copper deposit located in Florence, Arizona. The copper oxide portion of the deposit comprises a measured and indicated resource of 429.5 million tons grading 0.331 percent total copper for a contained 2.84 billion pounds copper at a 0.15% total copper cutoff. The Florence Copper porphyry deposit is buried by a minimum of 370 feet of unconsolidated basin-fill formations, consisting of Tertiary-Quaternary gravels, fines, and alluvium. It formed when numerous Laramide-age dike swarms of granodiorite porphyry intruded Proterozoic quartz monzonite. Hydrothermal solutions associated with the intrusive dikes altered the host rock and deposited copper and iron sulfide minerals in disseminations and thin quartz-sulfide veinlets. The region was later faulted and much of the Florence deposit was isolated as a horst block. This horst block was exposed to weathering, intense fracturing (material resembles porous media), and erosion.

Fluctuations occurred in the water table level over time causing the rock to be dissolved by naturally formed acids and were remobilized along fractures and re-deposited, generally at a lower elevation. The copper sulfide minerals in the oxidized zone above the water table were converted to copper silicates and copper oxides, primarily chrysocolla and tenorite.

The alluvial zone above the oxide consists of two distinct groundwater production units (the upper and lower basin fill groundwater units) separated by a clay aquitard. The highly fractured nature of the rocks in the oxide portion of the deposit, the presence of the aquitard in the alluvium above, and the abrupt change from the oxide to sulfide mineralization below creates excellent conditions for ISCR. Florence Copper confines the ISCR production to the oxide bedrock unit by maintaining hydraulic control of the injected solutions within these confining units.

The former owner of BHP Copper conducted extensive geological and metallurgical studies at the Florence Copper site, including the installation and operation of over 50 injection, production and monitoring wells to conduct ISCR production testing. The ISCR testing was initiated in 1997 and conclusively demonstrated hydraulic control of the ISCR process at Florence. Following a major decline in world copper prices in late 1998, BHP Copper shut down the ISCR testing prior to metallurgical evaluations and divested its interests in the Florence Copper project to a private developer in 2001. Following a major decline in residential development in Arizona, Curis Resources Ltd (TSX: CUV) acquired a 100% interest in the property in December 2009 to seek the development of the Florence Copper ISCR operation.

In 2014, Taseko Mines Ltd. acquired Curis Resources Ltd. and secured operating permits for a one-year Production Test Facility (PTF), which commenced operations on Dec. 14, 2018. The PTF, also known as Phase 1 operations, is a small-scale demonstration of ISCR and consists of a series of injection, recovery, observation and perimeter monitoring wells. The soluble copper mineralization is extracted using ISCR, which involves injecting a dilute acidic solution into the oxide zone that dissolves the copper mineralization as it passes through the naturally occurring fractures in the oxide deposit. Enriched copper solution is then processed by using commercially-proven solvent extraction/ electro-winning technology.

Florence Copper is estimated to create close to 500 jobs for Pinal County and create \$3.4 billion in economic activity for the state of Arizona throughout the 27-year commercial life of the project.

ABOUT THE SPEAKER

Dan Johnson is a resident Arizonan with a career spanning over 25 years of environmental management, hydrological engineering, and project management experience in the state's mining industry. Dan is a graduate of the University of Arizona, and is a registered Geologist, Hydrologist, and Professional Engineer.

Prior to joining Florence Copper, Dan worked with QuadraFNX, where he served as Technical Services and Environmental Manager/Director for projects in North America and

Chile. He has also worked at senior levels for Phelps Dodge, Freeport-McMoran, Rio Tinto, and Montgomery Watson.

Dan joined Florence Copper in 2011 and has led the company's environmental, permitting and technical efforts with the support of the project team. He currently sits on the Arizona Mining Association Board of Directors as Secretary/Treasurer.



Arizona Geological Society Membership Stats (3/27/2019)

| Total Membership | Professional Members | Student Members | Organizational Members |
|-------------------------|-----------------------------|------------------------|-------------------------------|
| 426 | 349 | 70 | 7 |

Society Announcements

Arizona Geological Society's Topical Session for Geological Society of America Conference 2019 Accepted



The Arizona Geological Society's GSA Topical Session, "Porphyry Copper and Related Mineral Deposits of Arizona, the Basin and Range Province, and Beyond," has been accepted for the GSA Annual Meeting in Phoenix, Arizona – 2019. Members are encouraged to submit abstracts and register for this Topical Session.

Important dates:

- Topical Sessions will open April 1st, 2019.
- Topics will be posted on the GSA 2019 web site.
- The Abstract deadline for Topical Sessions will be on June 25th, 2019.
- Additional information about the event can be found at:

http://www.geosociety.org/GSA/Events/Annual_Meeting/GSA/Events/2019info.aspx

Regarding Future AGS Dinner Meetings

Hello AGS Membership,

At the March dinner meeting, the attending membership discussed possible changes to the length and format of future dinner meetings at the Sheraton. The Executive Committee has since received inquiries via e-mail regarding when these changes would be implemented, and if they were to apply to the upcoming meeting on April 2nd, 2019.

The upcoming dinner meeting on April 2nd, 2019 will run on the same schedule as our previous meetings with the dinner beginning at **6:00 PM and the meeting ending at **9:00 PM**. We will provide an update on the new format for our meetings in the near future, but the current format will stay in place for the time being.**

Thank you for your patience and understanding.

April 2nd Event Details and Registration:

Florence Copper: Copper Recovery Using In-situ Technology By Dan Johnson, BSc, MSc, PE; Vice-President and General Manager, Florence Copper Inc.

<https://www.arizonageologicalsoc.org/event-3318379>

Registration closes at 11:00 AM on Friday (March 29, 2019).

Preliminary evaluation of mineral resources of the Santa Cruz Valley National Heritage area, Arizona

By Arizona Geology e-Magazine, Arizona Geological Survey (AZGS)



In March 2019, President Donald Trump signed a public lands bill creating the Santa Cruz Valley National Heritage area encompassing parts of Santa Cruz and Pima Counties. This followed more than a decade of effort on the part of U.S. Representative Raul Grijalva and others working towards cultural preservation, economic development, and geotourism in the area (Nogales International, 18 Mar. 2019).

The Santa Cruz Valley National Heritage Area covers a broad swath of historic and productive porphyry copper mining in southern Arizona. Our newest Open-File Report, Preliminary evaluation of mineral resources of the Santa Cruz Valley National Heritage Area, Arizona, provides a brief assessment of the mineral re-

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sources of the roughly 3,600 square miles (9,378 square kilometers; 2,304,000 acres) of the Santa Cruz Valley National Heritage Area.

Mineral assessment is largely confined to metallic minerals - copper, gold, silver, lead, zinc and molybdenum extracted from 20 metallic mineral districts. Hundreds of mines were worked in these mineral districts. Aggregate resources, the building blocks of human society, are also an important component of the mineral resources of the Santa Cruz Valley area.

The report includes six figures, and citations and active links for more than 50 AZGS and US Geological Survey published maps and reports.

Citation: Pearthree, P.A. and Conway, F.M., 2019, Preliminary evaluation of mineral resources of the proposed Santa Cruz Valley National Heritage Area, Arizona. Arizona Geological Survey Open-File Report OFR-18-03, 7 p.

Read the AZGS report at the link below:

http://repository.azgs.az.gov/uri_gin/azgs/dlio/1911

Nogales International article regarding the Santa Cruz Valley National Heritage Area:

https://www.nogalesinternational.com/news/long-desired-heritage-area-designation-signed-into-law/article_4f4edc7a-46b6-11e9-a8d7-3f500035a134.html

Please contact the AGS Secretary if your company is interested in advertising in this monthly newsletter.

The USGS Responds to Record Flooding in the Midwest

by U.S. Geological Survey



Crews from the U.S. Geological Survey are in the field measuring flooding in the Midwest caused by rainfall and snowmelt. During the recent and ongoing period of rain and increased runoff due to warmer weather and melting snow from higher-than-normal amounts of snowpack, more than 75 USGS scientists and technicians have been mobilized across the affected regions.

Crews are in the field to keep the USGS's streamgage network working properly, perform on-site measurements of flooded rivers, and measure high-water marks as flood waters recede. In the coming days and weeks, USGS crews will continue to monitor streamgages, make flood measurements in the field to determine how much water is flowing, and provide data to aid the response in the Midwest.

Read the USGS article at:

<https://www.usgs.gov/news/usgs-responds-record-flooding-midwest>

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

Freeport-McMoRan sponsored student dinners for the 2018 AGS monthly meetings.



AGS MEMBERSHIP APPLICATION OR RENEWAL FORM

YOU CAN RENEW OR SIGN UP as a new member and pay online. Please go to our website, arizonageologicalsoc.org. Or use the form below if you are more comfortable with the old school approach.

Please mail check with membership form to: Arizona Geological Society, PO Box 40952, Tucson, AZ 85717

Dues (check box) 1 year: \$35; 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 M. Lee Allison Scholarship Funds.