Arizona Geological Society Newsletter

JULY 2016

July 5, 2016 DINNER MEETING

Who: Donald Applebee will present "Genesis of the Chilito Porphyry Copper Deposit"

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 $30, Guests $33, 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, July 1st. Please indicate Regular (Braised Short Rib with Natural Jus), Vegetarian, or Cobb Salad meal preference. Please cancel by **Friday, July 1st at 11 a.m.** if you are unable to attend - no shows and late cancellations will be invoiced.

The July Dinner Meeting is Sponsored by ASARCO LLC

The AGS is grateful for ASARCO's Sponsorship, which helps us offset the increasing costs of our dinner meetings and other activities of the society.

Genesis of the Chilito Porphyry Copper Deposit

by Donald Applebee, ASARCO LLC

Chilito Porphyry Copper Deposit is located in the Dripping Springs mountains 4 miles N-NW of Asarco's Hayden facility which includes both a concentrator and smelter. The site can be accessed by a dirt road along HWY 177 or from another dirt road via the back gate of the Hayden facility.

Early mining activities and prospecting began in the late 1880's. Larger mining operations in the early 1900's

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included the London Arizona Mine, Schneider Mine, Apex Mine, and 79 Mine. The London Arizona Mine produced 15,000 tons of copper ore (Tcu 4.5%) from the O'Carroll bed of the Martin formation. Smelter flux from the Troy quartzite was mined at the Schneider mine. Approximately $2,000 of gold was recovered from the Martin formation at the Apex Mine. Historical production from the 79 Mine has been estimated at 3,000 tons, averaging 24% Pb, and 1.75% Cu.

Chilito deposit is bounded by the Keystone fault to the west and the O'Carroll fault to the east. Both are normal high angle faults and the Chilito deposit is the horst block between the two faults. The Paleozoic section at Chilito has been eroded away leaving only the Precambrian section in place at the surface. Those Precambrian units exposed in outcrop include Troy quartzite, Mescal limestone, Apache group, and a Precambrian Diabase. Drill core has intersected the lower Apache group, Pioneer formation, Pinal Schist, and Ruin Granite. East of the O'Carroll fault, and west of the Keystone fault the Paleozoic section is exposed at surface within the grabens.

The Chilito Quartz Diorite was emplaced during the Laramide (66+/- ma.) and provided the hydrothermal fluids for mineralization. Favorable units within the Precambrian section became the host rocks for the pyrite, chalcopyrite, and minor molybdenum mineralization. Favorable hosts include the Mescal limestone, Diabase, sub-units in the Apache group, Pinal Schist, and Ruin Granite. Drilling over the last 50 plus years has demonstrated this mineralization does exist. Recent land acquisitions have opened up exploration potential in the Paleozoic section and that exploration work is ongoing.

About the July Dinner Speaker

Don Applebee began his geological career working for the U.S. Geological Survey's Astrogeology Branch in Flagstaff, Arizona while pursuing a Master's Degree in Geological Sciences from Northern Arizona University. After completing his degree in 1989 Don accepted a mine geologist position at the Oracle Ridge Mine in the Santa Catalina Mountains northeast of Tucson, AZ. His position entailed geologic mapping of development drifts in a copper skarn deposit, along with short range mine planning and mine site exploration. In 1996 he accepted a geologist position at Asarco's Mission Mine, a copper porphyry skarn deposit. His duties at Mission included both underground and open pit mapping, along with mine site exploration programs. In 2003 he became the Senior Geologist at the Silver Bell Mine. In addition to mine geology and exploration, he assisted faculty from the University of Arizona in numerous field trips and short courses. In 2007 Don took a Senior Geologist Position with Freeport McMoRan, Morenci Operation to manage the deep sulfide exploration program. In 2009 he accepted a Senior Mine Geologist position at Kinross Gold's Buckhorn Mine in Republic, WA, a gold skarn deposit where he was responsible for geologic modeling and short range mining. In 2011 Don returned to Tucson to work for Asarco's Exploration Department, eventually becoming Corporate Exploration Manager and oversees both mine site exploration along with advance stage exploration projects. His interests include porphyry copper deposits and structural modeling of these deposits.

Arizona Mining and Mineral Museum

Arizona Mining and Mineral Museum in Phoenix, Arizona (Photo provided by Jan Rasmussen)

While under the direction of the Arizona Department of Mines and Mineral Resources, the Arizona Mining and Mineral Museum averaged 50,000 visitors each year, half of whom were scheduled school tours. This museum had more than 3,100 minerals, crystals, gemstones and lapidary items, rocks, and fossils on display and an additional 20,000 specimens in storage cabinets in the basement. Displays included old historical mining equipment that has been restored to working order and a diorama of a modern open pit copper mining operation.

As an educational science museum, it helped future generations of Arizonans learn about rocks and minerals, how they are used by society, their importance to our nation's economy, and the role mining has played in Arizona's history. Educational products included workshops and teacher kits (40 numbered rocks and minerals plus an identification key and various activity booklets and CDs) that were provided free of charge to Arizona's teachers. These materials were greatly appreciated by thousands of teachers and students, who have used them for laboratory activities in their classrooms.

The Arizona Mining and Mineral Museum was able to accomplish this with funding for rent, maintenance and one salaried position provided by the state. Revenues generated from its gift shop provided funding for its gift shop employees and tour guides. Much of the other work was performed by volunteers from associated mineral, lapidary and prospecting clubs, who provided 10,000 hours of work, annually.

School Children learning about Mineral Specimens. (Photo provided by Jan Rasmussen)

All of this came to an end on April 30, 2011, only nine months after the Arizona Historical Society took administrative control of the Arizona Mining and Mineral Museum from the Arizona Department of Mines and Mineral Resources. At that time the museum's staff was fired without notice and the museum was closed. Furniture, fixtures and displays were disposed of and many of its irreplaceable mineral specimens distributed to other museums around the state. The building has remained vacant over the last five years and been allowed to deteriorate.

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With the approval of the Agency Consolidation Budget Bill (SB1530) by Governor Ducey, the Arizona Mining and Mineral Museum will be transferred from the Arizona Historical Society to the Arizona Geological Survey in August 2016. However, the building cannot be occupied until $700,000 to $900,000 in repairs are made and will require approximately $2.86 million over the next five years to make it like new. However, the state has provided no funding for these renovations and efforts to obtain funding from private sources has been further complicated by a clause in the legislation that returns the museum to the Arizona Historical Society if it is not refurbished and open by July 1, 2018.

Given the elimination of its modest state appropriation, added costs resulting from its consolidation with the University of Arizona, and small staff, the Arizona Geological Survey will be hard pressed to fund the renovations required to reopen the Arizona Mining and Mineral Museum. In absence of financial assistance from the state of Arizona, successful reopening of this important educational resource will require support from private and corporate sponsors. Those who may be interested in supporting this effort are encouraged to contact the Arizona Geological Survey to see how they can help make this a reality.

Diorama of Modern Open Pit Copper Mining Operation (Photo provided by Jan Rasmussen)

Mineral, Crystal and Rock Collection (Photo provided by Jan Rasmussen)

The Next Time You have a Beer

It is a well known fact that geologists are one group of professionals, who enjoy a good cold beer after a long day in the field.

But did you know that crushed diatomite (i.e. diatomaceous earth) is used during the production of much of the beer brewed in the United States. Composed of siliceous skeletal remains of diatoms, this very fine, porous material is used as a filtering media during the brewing process. In selecting a diatomite for beer filtering, the environment in which the diatomite deposited is very important. Only freshwater diatomite is used in the filtering process — because salty marine diatomite ruins the beer!

Hard Times at the Arizona Geological Survey

Arizona Geological Survey staff with some of the volunteers, who helped move their library and files from the Phoenix Office to the former Arizona Mining and Mineral Museum.

Nyal Niemuth and Diane Baine, long-time employees of the Arizona Geological Survey and the former Arizona Department of Mines and Mineral Resources have decided to take early retirement. Budget cuts and additional costs resulting from the transfer of the AZGS to the U of A have resulted in a reduction of its staff from 40 to 15 over the last year.

Some of the 800,000 pages of historical mining reports, 10,000 maps, and 7,500 photos being moved to dead storage at the former Arizona Mining and Mineral Museum in Phoenix. If the Arizona Geological Survey is unable to raise the funding to reopen the museum, much of irreplaceable data may end up in a landfill.

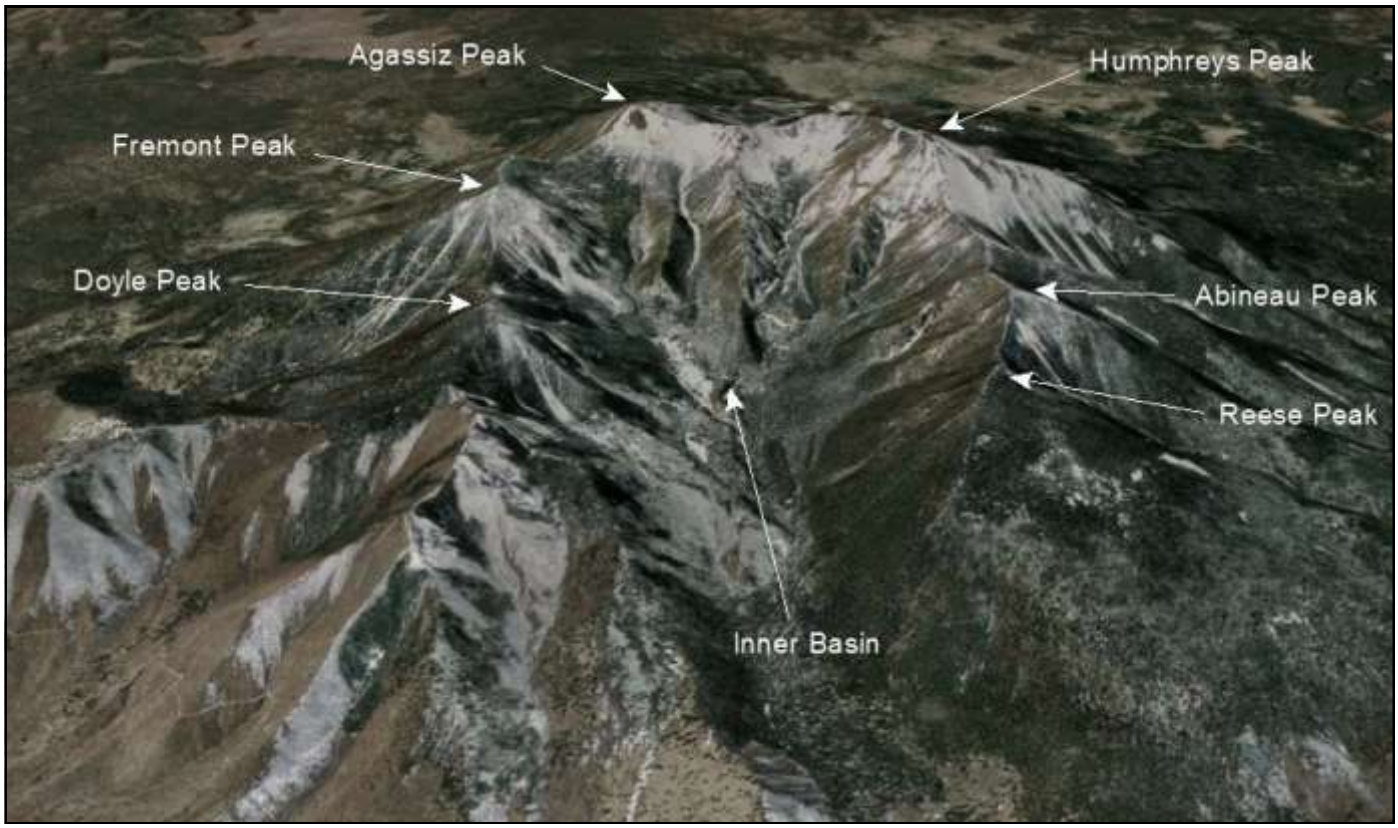
This is what a jeep with 24 boxes of "Geologic Highway Maps of Arizona" looks like. These publications were moved from the Tucson office to the Arizona Geological Society's storage unit.

San Francisco Peaks — The Remnants of a Stratovolcano

Covering approximately 1,800 square miles, the San Francisco Volcanic Field consists of more than 600 volcanic vents, which erupted over the last six million years along an east-west trending belt north of Flagstaff, Arizona. Most of the volcanoes are relatively small basaltic cinder cones that seldom exceed 1,000 feet in height and formed over a period of several months to years. Arizona's youngest volcano, Sunset Crater is a cinder cone that erupted in 1064 A.D. Other volcanic features within the San Francisco Volcanic Field include several lava domes composed of viscous dacitic and rhyolitic magmas that formed thick, steep-sided bulbous masses at the site of the eruption.

The San Francisco Peaks are erosional remnants of the only stratovolcano located within the San Francisco Volcanic Field. Formed by a series of eruptions characterized by andesitic lava flows, cinders and ash interspersed with volcanic mudflows that occurred between 1 and 0.4 million years ago, this volcano was a tall cone-shaped mountain that reached a height of approximately 16,000 feet.

Originally similar to Mount Shasta in California or Mount Fuji in Japan, much of this volcano has been removed to create the "inner basin," which is surrounded by Doyle, Fremont, Agassiz, Humphreys, Abineau and Reese Peaks that represent erosional remnants of the outer slopes of stratovolcano. The missing material that originally occupied this amphitheatre may had been removed by an explosive blast similar to the 1980 eruption at Mount St. Helens, Washington or removed slowly and incrementally by a combination of large landslides, water erosion and glacial scouring.



Areal View of San Francisco Peaks Looking Southwest (image modified from Google Earth)

Geology in the News

AZGS Moving Out of State Government to the University of Arizona; by Michael Conway, Arizona Geology Magazine, June 20, 2016

Public Access Shrinks with Geological Office Closure; by Tim Steller, Arizona Daily Star, June 23, 2016.

My Turn: Arizona Geological Survey is on Life Support and Needs the Public's Help; by David Briggs, The Arizona Republic, June 15, 2016.

Help Save the Arizona Geological Survey; by Dana Hunter, Scientific American, June 20, 2016.

Rio Tinto's Kennecott Wins Clean Air Lawsuit in the US; by Cecilia Jamasmie, Mining.com, June 9, 2016.

The Most Dangerous Fault in America; by Steven Newton, Earth Magazine; June 7, 2016.

Spectacular Dash Cam Video of Arizona Meteor; by Lee Allison, Arizona Geology Blog, June 3, 2016..

Here are the World's Top 10 Gold Producing Mines; by Frank Holmes, Mining.com, June 3, 2016.

Helium Production Resumes in Arizona; by Lee Allison, Arizona Geology Blog, June 5, 2016.

Bridge or Tunnel? Tonto Natural Bridge State Park Freezes a Geological Mystery; by Greg McKelvey, Payson Roundup, June 17, 2016.

Apache Powder put the Boom in Arizona Mining; by William Ascarza, Arizona Daily Star, June 12, 2016.

Dynamics and Legacy of 4.8 ka Rock Avalanche that Dammed Zion Canyon; Jessie Castleton, Jeffrey Moore, Jordan Aaron, Marcus Christi, and Susan Ivy-Ochs, GSA Today, June 23, 2016.

AGS Digest 22, Ores and Orogensis Now Available On-line

The proceedings volume from the 2007 Ores and Orogenesis: Circum-Pacific Tectonics, Geologic Evolution, and Ore Deposits Symposium is now available on-line at Arizona Geological Society Digest 22.

Arizona Geological Society Membership Stats (6/24/2016)

Total Membership	Professional Members	Student Members	Organizational Members
457	377	73	7

Up-coming Arizona Geological Society Dinner Meetings

Date	Speaker	Title of Presentation
8/2/2016	Lee Allison	The Politics of Geology in Arizona
9/6/2016	Keith Long	No Bonanza from Cheap Oil
10/4/2016	Hamish Martin	The Resolution Copper Deposit, Superior, Arizona: Progress in Understanding the Geology, Ore Genesis and Mine Development

ANNOUNCEMENTS

Welcome New AGS Members

Riley Millington

Alexander Neufeld

Kenneth Wohletz

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

FREEPORT-McMoRAN

Freeport-McMoRan sponsors student dinners for the 2016 AGS monthly meetings.

2016 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.