



Arizona Geological Society Newsletter

OCTOBER 2013

OCTOBER 1, 2013 DINNER MEETING

Who: Mark Logsdon 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 *Pima Room*. The Pima Room is located on the second floor in the northwest corner of the hotel.

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 an online dinner reservation (\$10 without).

RESERVATIONS are REQUIRED by 11 a.m. Thursday, September 26. Reservations can be made on the AGS website (www.arizona-geological-soc.org). If you do not have internet access, you may call 520-663-5295. Please indicate regular (grilled tilapia with caper butter sauce), vegetarian, or cobb salad meal preference. Please cancel by Thursday, September 26 at 11 a.m. if you are unable to attend.

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The October dinner meeting is sponsored by: Major Drilling Group International, Inc.

AGS is grateful for Major Drilling's sponsorship, which helps to offset dinner meeting costs.

ABSTRACT

What Does “Perpetual” Management and Treatment Mean? Toward a Framework for Determining an Appropriate Period-of-Performance for Management of Reactive, Sulfide-Bearing Mine Wastes

Mark Logsdon

Principal Geochemist with Geochimica, Inc.

Mine wastes at closure typically amount to millions to billions of metric tonnes by mass and occupy hundreds to thousands of hectares of surface, with some structures extending over several hundreds of metres of vertical relief. Regardless of the specific climate of the mine site, reaction rates for sulphide oxidation show that the wastes will remain geochemically reactive for centuries to millenia if exposed to air and water. Additional issues, some related to geochemical ones, arise for geomechanical and geomorphic stability of engineered features and structures. Establishing a coherent basis for determining how far into the future proposed mine-site closure must be effective has too often been neglected.

Engineering structures, including mine structures, are designed to perform with respect to specific design criteria related to material properties and the natural environment, often organized around response to

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external forces with statistically-defined probabilities of occurring per unit. In engineering, one speaks of “design-basis events” and also considers the risks from “extreme events”, incorporating both into the detailed design criteria for an entire project that ultimately will be defined. The geotechnical conventions deserve to be extended to considerations of geochemistry also.

Mine closure can be considered in terms of three overlapping, but distinguishable periods:

- Construction and active reclamation
- Final reclamation
- Long-term maintenance and monitoring that will document that the expectations for stable slopes with controlled water-quality performance have been met.

Consideration of these periods, the scientific basis for understanding closure risk, and established engineering practice leads us to suggest that a reasonable, total planning period for management of mine wastes should be in the range of 200 to 500 years, and it probably should include a semi-quantitative assessment of whether or not major changes in performance are likely to occur between approximately 500 and 1,000 years. Plans should include (1) identification of risks to surface and groundwater in terms of adverse impacts to beneficial uses, (2) presentation of a case that mine-waste structures would be stable with respect to erosion by flooding or deep-seated shear failures, and (3) presentation of a case that reactive wastes as disposed for those periods will remain physically stable.



Photo: Mark and colleagues are standing on about 90 m thickness of mine waste in the upper Ok Mani (Papua New Guinea), immediately below Ok Tedi pit and waste rock dumps.

About the October Dinner Meeting Speaker

Mark Logsdon is a geochemist with 40 years of experience in geology, hydrogeology, and environmental chemistry related to mining and mine-waste management. He is a graduate of Princeton and has work experience that includes teaching, mine-exploration geochemistry, government service, research, and consulting. Since 1984, Mark has been in private consulting, focusing on mining issues, particularly (a) acidic and metalliferous drainage; (b) water-quality conditions in natural and mined ground, including surface and groundwater; (c) planning for and executing mining exploration, development, operations, closures, and remediation/restoration. Such assessments typically involve not only geochemistry, but also the underlying geology and mineralogy and the relationships of hydrogeology, mining and site-engineering practices and costs. Mark has worked on more than 250 mining projects, including metal and nonmetal mines in the U.S.A., Canada, Mexico, Guatemala, Honduras, Argentina, Brazil, Chile, Columbia, Peru, Venezuela, Ireland, France, Portugal, Russia, Spain, Guinea, Mozambique, South Africa, Tanzania, Australia, Laos, Mongolia, New Zealand, Indonesia, Papua New Guinea, and the Philippines.

Geologic Society Newsletters from the Southwest

Four Corners Geological Society

<http://www.fourcornersgeologicalsociety.org/News/newsletters.asp>

Rocky Mountain Association of Geologist

<http://www.rmag.org/i4a/pages/index.cfm?pageid=3342>

Utah Geological Association

<http://www.utahgeology.org/wp/announcements/newsletters>

Geological Society of Nevada

<http://www.gsnv.org/info/newsletters.php>

New Mexico Geological Society

<http://nmgs.nmt.edu/news/home.html>

Member News

Arizona Geological Society offers condolences to the family of long-time member and well-respected exploration geologist **Albert (Al) Perry**, 83, who passed away in Tucson on August 24, 2013. He began his career in southern Utah in uranium exploration in the 1950s. His career took him to Australia (10 years), Fiji, Ghana, and Eritrea. He was an active participant in AGS and SME, and was an Arizona-registered geologist.

Lunch Talk

In addition to the AGS dinner meeting presentation, Mark Logsdon will be giving a lunch talk on the University of Arizona campus.

When: October 1 at 12:10 p.m. - 1:15 p.m.

Location: Environment and Natural Resources Building, Room 353, NE corner of 6th Street & Park Avenue. Park in 6th Street Garage immediately to the East of ENRB

Abstract: Does acid-rock drainage lead to waste-rock instability? Geological, hydrological, and geochemical framework for the Questa Mine, New Mexico

The Questa Weathering and Stability Study included detailed earth-science characterization of hydrothermally-altered igneous rock-pile and analog materials and associated groundwater. Radiometric dating demonstrates that natural weathering processes and their mineralogical outcomes have been active at Questa over a million years or more. Dissolution of pyrite, calcite, and silicate minerals is the predominant geochemical reaction that results in low-pH, high-TDS seepage and precipitation of gypsum, jarosite, and iron hydroxide minerals.

Silicate minerals in the Questa rock piles dissolve congruently, without producing clay minerals. Seepage waters are thermodynamically under-saturated with respect to all silicate minerals (including clay minerals), sulfides, and carbonates, but are saturated with respect to jarosite, ferric oxides, and gypsum. Clay minerals at Questa formed under hydrothermal, not weathering, conditions. Secondary precipitates predicted from water chemistry are directly observed, and locally they act to cement rock fragments in rock piles and debris flows.



Field Trip



October 4 - H. Wilson Sundt Generating Station in Tucson near I-10/Irvington Rd. No charge, but the participant registration list is required by TEP early, so please sign up now. This coal-fired and natural-gas powered facility is the primary electrical generating station in the Tucson area. Tour the power plant, coal yard, rotary train dumper, recycling area, equipment and training yards, and the solar test yard. Children over 16 welcome. See AGS Events page for additional information.

<https://arizonageologicalsociety10.wildapricot.org/Default.aspx?pageId=1559889>

SAVE THE DATE: AGS Fall Field Trip, Saturday November 9. More details soon.

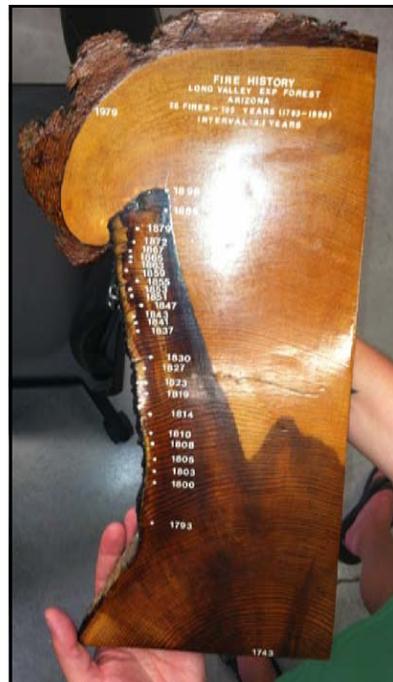
Field Trip Report

By Alison Jones

About 30 AGS members, friends, and family converged on the University of Arizona Laboratory of Tree Ring Research (LTRR) on the afternoon of Friday, August 29. Dendrochronology began at the UA in 1906, when astronomer Andrew E. Douglass joined the faculty. While searching for a natural record of sunspot cycles, he pioneered the scientific use of tree rings. The laboratory was founded in 1937, and until earlier this year, it was housed in Arizona Stadium, where many of the specimens continue to be stored. The new building is functional, beautiful, and filled with natural light.

In the lobby is a 10-foot diameter slice of a sequoia that was blown down in 1913. It started growing in the year 212. Scars from forest fires can be seen periodically in the tree's rings. A healthy forest requires burning every 8 to 10 years or so. More infrequent fires are larger and more damaging because they burn the crowns of the mature trees, killing them.

The group was fascinated by a complete slice of the Curry Tree, a bristlecone pine that started growing in California in 2930 BC. The tree lived for 4900 years until a graduate student (not from UA) cut it down in 1964 in an effort to help date the moraine on which it was growing. He was mortified to learn how old it was after he counted the rings.



This slice shows the years of fire scars (in white). Healthy forests require frequent (8-10 year) forest fires. When this tree was cut down in 1979, it had not experienced a fire for about 80 years.

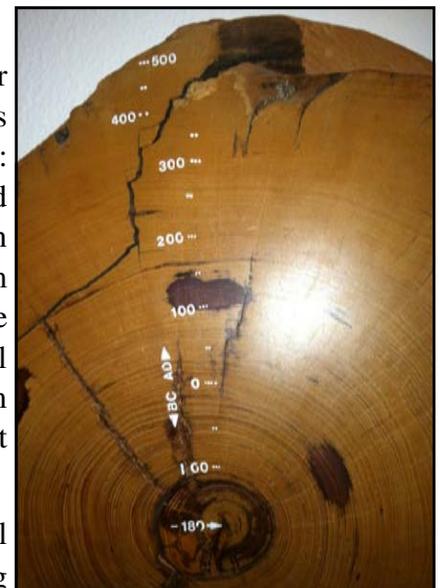
Dendrochronology is not used only for recent history. LTRR is now studying petrified wood using isotopes to help constrain the age dates. They have had success correlating rings in petrified wood samples, applying the principle of "crossdating" to these specimens.

Alex, one of the volunteer docents, told our group that the science of dendrochronology is generally divided into three sub-disciplines: dendroclimatology, dendroarcheology, and dendroecology. UA does not grant degrees in dendrochronology. Rather, students from various departments, including the geosciences, use dendrochronology as a tool in their areas of research. Thus, students from many different departments can be found at the LTRR.

AGS would like to thank our guides, Neil and Alex, and the LTRR for a fascinating tour. It is easy to see why UA is considered a world leader in dendrochronology.



Carl Jones (left) and LTRR docent Neil looking at the sequoia slice in the lobby. The tree was over 1700 years old when it was blown down in 1913.



This slice of a beam was used for archeological dating. It indicates that the tree was cut down in approximately 550 AD.

Announcements for Fall Conferences, Fundraisers, and a Short Course

- October 12 — SME Tucson Chapter UA Scholarship Fundraiser, Savoy Opera House in Trail Dust Town. See <http://www.smetucson.org/fundraiser>

Arizona Mining Weekend events all scheduled at JW Marriott Starr Pass Resort & Spa in early December.

- December 7 — 18th Annual Diggers & Duffers Golf Tournament, hosted by UA SME Student Chapter <http://diggersandduffers.eventbrite.com/>
- December 7 — American Mining Hall of Fame Awards Ceremony, Fundraiser, & Banquet hosted by Mining Foundation of the Southwest. For sponsorship info & tickets, see <http://www.smenet.org/public/Core/Events/eventdetails.aspx?iKey=AZ2013&TemplateType=A>
- December 8 — AMIGOS Vendors Party
- December 9 — SME Arizona Conference. For program & registration see <http://www.smenet.org/public/Core/Events/eventdetails.aspx?iKey=AZ2013&TemplateType=A>

University of Arizona Short Course on Porphyry Cu, Mo, and Au Deposit December 3-12, 2013

The 9-day short course is designed for members of the industry and for graduate students. The short course will be led by Eric Seedorff and Mark Barton and will include a series of guest lecturers. It will focus on exploration geology and will include approximately 3 1/2 days of lectures, 2 days of labs, and 3 1/2 days of field trips to representative porphyry systems in Arizona.

Outline of Topics

The lecture topics will include:

- distribution and geologic setting
- character of related igneous systems
- hydrothermal alteration and ore mineral assemblages
- space-time-temperature relationships
- structural aspects – pre-, syn-, and post-mineral
- geochemistry of ore-forming systems
- comparative geophysics
- economics and metallurgy

The laboratory topics will include:

- rock suites from a variety of deposits, and
- alteration and ore mineral types and textures

Field trips will visit accessible examples of a number of these types of systems in southern and central Arizona.

The fee for the short course is \$3,200 before the early registration deadline on October 15, 2013, and \$3,400 thereafter. The cancellation policy provides for a refund of 1/2 the registration fee by November 1, 2013. Thereafter, there will be no refund; however, substitutions can be made. Register soon, space is limited for this popular course. Contact Misty Stroud for applications and more information

Misty Stroud, Ph.D.

Program Coordinator, Lowell Program in Economic Geology

The University of Arizona Department of Geosciences

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E-mail: mistymichele@email.arizona.edu

Welcome New AGS Members

Rick Bennett	Brandon Combs	John Mastor	Peter Reiners
Patrice Brun	Heather Conrow	Mitchell McMillan	Allison Severson
John Carroll	Gabriel Gowell	Zachary Naiman	Doug Standart
Christy Caudill	Garrison Loope	Devon Orme	Kory Wiley



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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 you are a registered geologist/engineer, indicate your 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 Scholarship Fund.

Enclosed is a _____ tax-deductible contribution to the AGS Greatest Needs Fund.