Arizona Geological Society Newsletter

MAY 2016

May 3, 2016 DINNER MEETING

Who: **Peter Modreski** will present "Pegmatites: Mineralogy, Gemstones, Economic Geology, and maybe not quite the same Giant-Crystal Rocks you always thought they were"

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, April 29th.** Please indicate Regular (Chicken Cacciatore), Vegetarian, or Cobb Salad meal preference. Please cancel by **Friday, April 29th at 11 a.m.** if you are unable to attend - no shows and late cancellations will be invoiced.

The Arizona Geological Society is looking for sponsors for this and other monthly dinner meetings. More information about dinner meeting sponsorship can be found on our website.

The AGS is grateful for our sponsors, who help offset the increasing costs of our dinner meetings and other activities of the society.

Pegmatites: Mineralogy, Gemstones, Economic Geology, and maybe not quite the same Giant-Crystal Rocks you always thought they were

by Peter Modreski, U. S. Geological Survey

Pegmatites are exceptionally coarse-grained igneous rocks, typically occurring as dikes or pods within igneous or metamorphic host rocks. Some common definitions are that most grains are larger than 1 cm or 1 inch, but crystals can be huge, up to meters in size — feldspar crystals up to 35 feet in length have been described.

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Granitic pegmatites are the most common, in which the typical minerals are quartz, microcline, albite, and micas, but pegmatites can occur in syenite and other types of igneous rock. The classic description of pegmatites is that they form from unusually water-rich magma, which promotes the growth of large to "giant" crystals, and that they represent the last, highly fractionated portion of a granite pluton to crystallize. Many "incompatible" chemical elements become concentrated in pegmatites, leading in some cases to economic concentrations of lithium (spodumene, lepidolite), beryllium (beryl), cesium (pollucite), tantalum and niobium (tantalite, microlite, columbite), tin, rare earths, uranium, and other metals. The concentration of light elements (lithium, beryllium, boron, fluorine, phosphorus) in pegmatites, plus the water-enriched environment, sometimes results in the growth of gem minerals, especially tourmaline, beryl, and topaz.

Granitic pegmatites can be classified as simple (unzoned) pegmatites, zoned pegmatites which typically have a quartz core surrounded by feldspar-rich shells, and complex pegmatites in which late-stage aqueous fluids have altered the primary minerals to produce metasomatic zones enriched in lithium or rare metals. Chemically, pegmatites can be classed as NYF (niobium-yttrium-fluorine) enriched, or LCT (lithium-cesium-tantalum) enriched. The former are most often found in anorogenic or extensional environments and directly associated with granite plutons; the latter, at deeper levels in orogenic belts and emplaced within metamorphic host rocks. The Pikes Peak batholith, Colorado, is a classic host of NYF-type pegmatites; examples of the LCT type include the Harding pegmatite, New Mexico and the White Picacho pegmatite district, Arizona. Famous pegmatite districts worldwide include San Diego County, CA; the Black Hills, SD; the White Mountains, NH; Minas Gerais, Brazil; Madagascar; and Pakistan-Afghanistan.

Although it was always tempting to conceive of the large or perfect crystals in pegmatites as forming by very slow cooling, recent experimental studies, especially the work of David London (Univ. of Oklahoma) and his students, have inclined toward the view that pegmatites may crystallize quite rapidly—in years or weeks (or days?) rather than in thousands or millions of years. As well, crystal growth in pegmatites is now being interpreted in terms of growth from a disequilibrium boundary layer enriched in incompatible elements. There is also much debate about which pegmatite magmas originate by partial melting, rather than fractional crystallization—that not all pegmatites have necessarily been derived from any "parent granite".

About the May Dinner Speaker

Dr. Peter J. Modreski has been a geochemist since 1979 with the U.S. Geological Survey, Lakewood, Colorado. He has a B.A. (chemistry) from Rutgers College and an M.S. and Ph.D. from Penn State (geochemistry). His research interests include mineralogy, gemstones, luminescence, Colorado geology, ore deposits, pegmatites, meteorites and impacts, alkaline igneous rocks, kimberlites, and volcanology, and he is the USGS geological resource specialist for abrasives, gemstones, quartz, beryllium, cesium, and rubidium. He is presently responsible for public and educational outreach at the USGS. Pete was a co-author of Minerals of Colorado (1997) and he is a Consulting Editor of Rocks and Minerals magazine and a Department Associate with the Earth Sciences Department, Denver Museum of Nature and Science.

It's Still Time to Sign Up for the 2016 Arizona Geological Society Spring Trip

An Introduction to the Pinal Schist in Southeastern Arizona

Field Trip Leader: Arend Meijer

Date/Time: Saturday April 30/8:30 am to Sunday May 1/ 6:00 pm

Starting Location: To be announced, but somewhere in Tucson.

Level of Difficulty: Most stops along the field trip route will be short and close to the vehicles. The longest walk will be a couple of hundred yards.

Guidebook and Lunch Costs: $50 (members and guests), Student members are free.

Field trip guidebooks will be provided to trip participants. Additional guidebooks will be produced by the AGS following the trip, which can be purchased at our dinner meetings.

A lunch and bottled water will be provided both days. Participants should bring snacks and other beverages to suit their needs. Dinner and breakfast in Globe are on your own, but we might try to do a special group dinner if we can find a suitable venue.

Car Pooling Arrangements: Carpooling is strongly encouraged to reduce travel costs and number of cars at each stop for safety and logistical reasons. High clearance vehicles will be required as we will be traveling some wash roads. Participants names/contact information will be circulated to registered attendees for participants to make arrangements as needed.

Additional Transportation Costs: Rental vans may be required depending on the group size and need to reduce the number of caravan vehicles at field trip stops. An additional fee to cover these costs will be evaluated once trip registration begins.

Motel Accommodations: We will overnight Saturday, April 30th in Globe. Participants will be responsible for their own motel accommodations. See AGS web site for list of motels and camping options in Globe.

Tour Description: The Spring AGS field Trip will take place over the weekend of April 30-May 1 and will be led by Arend Meijer, who will provide us an introduction to the Paleoproterozoic Pinal Schist, which he interprets as a subduction complex. The trip will start in Tucson, Saturday morning, overnight in Globe, where there are reasonable priced motels and camping, and return to Tucson late afternoon Sunday.

Field Trip Continued on Page 4

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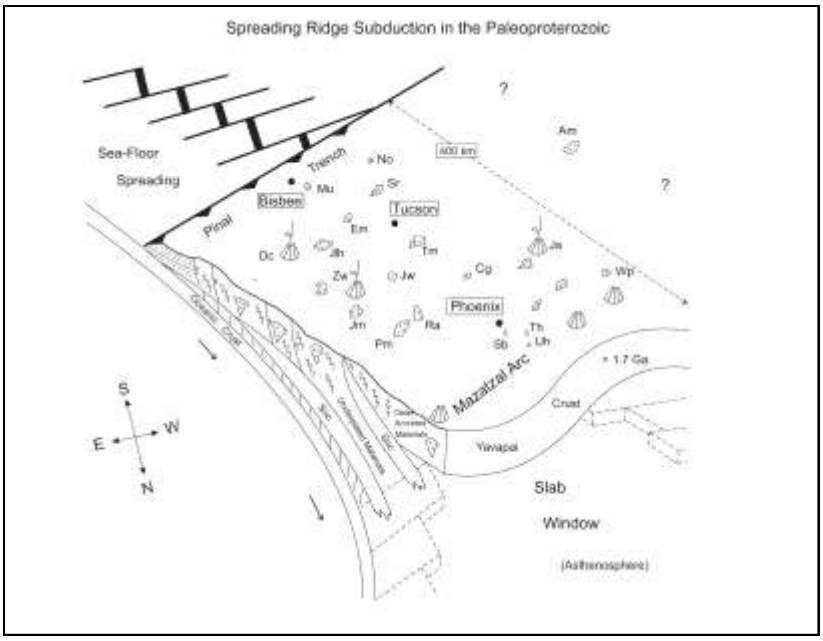
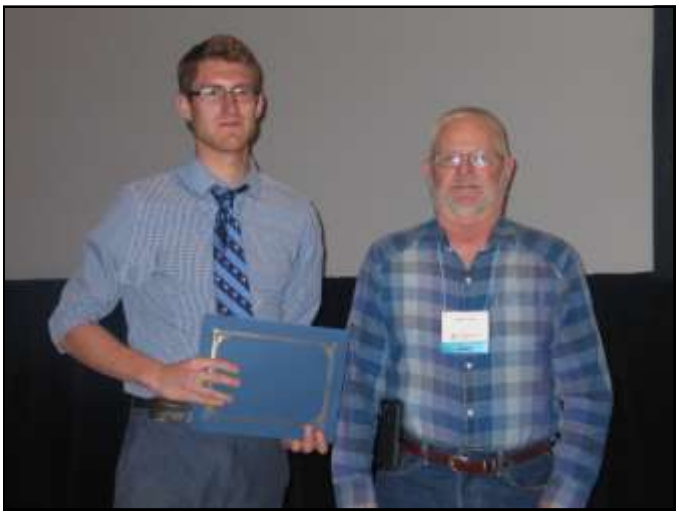


The Paleoproterozoic Pinal Schist of southern Arizona shows many characteristics consistent with the hypothesis that it was part of a subduction complex associated with a Paleoproterozoic arc complex in central Arizona. In a (NW-SE) direction perpendicular to the trend of the arc complex, the Pinal Schist is exposed over a distance of at least 300 km in southeastern Arizona (from Phoenix area to Bisbee). this distance is within the range of modern arc-trench gaps. The Pinal Schist is predominantly composed of interbedded quartz-sericite/muscovite schist, and meta-wacke (interpreted as turbidite sequences) with minor meta-chert, meta-conglomerate, and rare marble. The Pinal schist/wacke sequences contain randomly distributed blocks/pods of mafic meta-volcanic rocks some of which appear to have oceanic affinities (for example, EMORB) while others appear to have arc affinities based on trace element abundances. Isolated felsic flows, dikes, and hypabyssal intrusions with arc-like trace element pattern are also present. In addition, there are several larger mafic to felsic volcanic centers within the terrane. Granitoid intrusions also of Paleoproterozoic age are relatively common in the Pinal terrane and these can be divided into two groups. A "pretectonic to syntectonic" group that shows various degrees of foliation, ranges in age from 1.74 Ga to 1.65 Ga, and occurs mainly in the northern portions of the terrane. A post-tectonic" group that is only locally foliated, shows an unusual consistency in ages clustered around 1.65 Ga, is found through much of the Pinal terrane. The metamorphic grade of non-plutonic rocks in the Pinal terrane is mostly greenschist facies although there are local occurrences of higher-grade assemblages. High P/T facies rocks (for example, blueschists) have not been identified in the Pinal terrane in over 100 years of mapping. Structural/tectonic features of Paleoproterozoic ages associated with the Pinal terrane include meta-melanges, shear zones, major thrust faults, and other structures typical of subduction complexes. The geologic and structural characteristics of the Pinal terrane suggest it reflects progressive growth of the Laurentian margin towards the southeast (present-day) between 1.74 and 1.65 Ga. The meta-volcanic rocks with arc-affinities and "post-tectonic" granitoids exposed within the Pinal terrane are here interpreted to reflect a spreading-ridge subduction event at around 1.65 Ga. The volcanic rocks with arc affinities were metamorphosed to greenschist facies assemblages not long (<10 Ma) after they were erupted onto the Pinal fore-arc. This metamorphic episode is thought to reflect an arc accretion/obduction event that buried the Pinal fore-arc beneath the fore-arc of an island arc terrane that came from the south. Most of this accreted arc terrane was eroded off the Pinal fore-arc terrane in the 300 Ma following accretion (prior to the deposition of the Neoproterozoic Apache Group). What may be remnants of this arc terrane are now exposed in northern Mexico. The creation of the Pinal terrane involved a high continental growth rate. The magmatism associated with the ridge subduction event and extensive plutonism within the terrane around 1.45 Ga likely contributed to the high continental growth rate reflected in this terrane and to the preservation of the terrane.

Contact: VP of Field Trips, Bob Hildebrand at bob@roberthildebrand.com or (520) 743-5176 if you have any additional questions.

Arizona Geological Society Helps Sponsor the University of Arizona Department of Geosciences' 2016 Geodaze Event



Stan Evans presents the Doug Shakel Memorial Award for Best Undergraduate Presentation to Jordan Abell at the University of Arizona Department of Geosciences' 2016 Geodaze event . Jordan's presentation was titled: "Evidence of Urine in a Neolithic Tell in Relation to Animal Domestication."

Volunteer Needed

The Arizona Geological Society needs a volunteer to serve as a councilor on the Executive Committee through December 2018. Anyone who may be interested in filling this position contact Don Applebee.

AGS Executive Committee Votes to Proceed with Lindgren Collection

On April 21, 2016, the AGS Executive Committee committed to a long-term (up to 10 years) effort to curate the Lindgren Collection. This project will include documenting what is present in the collection, photographing the specimens and ultimately producing a database that will be accessible on the Internet.

Carl Bowser was appointed Chairman of the Lindgren Committee, for a term of one year. Dr. Mark Barton will represent the U of A's interest in the project. Designed to play a leadership role, this committee will establish protocols for working on the collection (photographing and documentation), providing a consistent framework for subsequent committee membership and ensuring uniformity of the quality of documentation.

Arizona Geological Society Membership Stats (4/20/2016)

Total Membership	Professional Members	Student Members	Organizational Members
472	378	87	7

Up-coming Arizona Geological Society Dinner Meetings

Date	Speaker	Title of Presentation
6//7/2016	Robert Hildebrand	Collisions, Slab Failure Magmatism, and the Development of Cordilleran Batholiths
7/5/2016	Don Applebee	Geology and Genesis of the Chilito Porphyry Copper Deposit, Hayden, Arizona
8/2/2016	Lee Allison	The Politics of Geology in Arizona

Geology in the News

Geology is Responsible for Some Phenomena Blamed on Global Warming: by Jonathan DuHamel, Arizona Daily Independent, April 17, 2016.

Three R Mine Contributed to Arizona's Rep for Copper Production: by William Ascarza, Arizona Daily Star, April 10, 2016.

Major Earthquake Overdue in California's Eastern Sierra, Study Finds: Associated Press, Los Angles Times, April 21, 2016.

Fossil Creek: Geology in Real Time: by Greg McKelvey, Payson Roundup, April 20, 2016.

Scientists Set to Drill into Extinction-Event Crater in Mexico: by Bill Chappell, KNAU Arizona Public Radio, April 8, 2016.

Rocking and Rolling In Northwest Arizona

On April 19, 2016, the Arizona Geological Survey reported an earthquake swarm in Northwestern Arizona that consisted of up to 42 events since March 28. The depths of the quakes ranged from near surface to approximately 14 km.

While most of the quakes were very small and not felt locally, the largest event registered 3.7 on April 17, 2016. It was felt in Littlefield, Arizona and Mesquite, Nevada.

This earthquake swam is located along the physiographic boundary separating the Colorado Plateau and the Basin and Range.

For more information about this seismic activity visit Lee Allison's Arizona Geology Blog.

3-5 May 2016 - IDEAS 2016

Expo Discover Mining Innovations @ Port of Tucson, 7000 East Century Park Drive, Tucson, Arizona. To register or for additional information contact Stefan Baumann (stefan@portoftucson.com; 520.668.6667).

Underwriting Arizona Mining Review

The Arizona Mining Review, the premier e-Video Magazine addressing mining in the Southwestern U. S., is seeking underwriters for 2016 to help offset production and broadcasting costs.

Please contact Mike Conway (Michael.conway@azgs.az.gov | 520.209.4146) for additional information and to discuss the benefits of underwriting.

Arizona Geological Survey News Brief

Arizona Mining Review (AMR) e-Video Magazine will be filmed on 4 May at the IDEAS 2016 'Focus on Mining Expo' and released in the following week.

AZGS News

We still await final word on the fate of the Arizona Geological Survey. As you know, Governor Ducey's 2017 budget zeros out AZGS funding and recommends consolidating the Arizona Geological Survey with the University of Arizona. The Governor's staff has been negotiating with the University of Arizona regarding a future for AZGS there.

Stay tuned to Lee Allison's Arizona Geology blog or our AZGS Facebook page for updates on AZGS going forward in 2016.

New AZGS Publications: Online at the AZGS Document Repository

Pearthree, P.A., Gootee, B.F., Richard, S.M. and Spencer, J.E., 2015, Geologic Map Database for Aggregate Resource Assessment in the Phoenix Metropolitan Area and Surrounding Regions, Arizona, v2.0. Arizona Geological Survey Digital Information DI-43, 11 p., map sheet, Shape files, ArcGIS Map Packages, polygons and geologic features.

Publication Updates – Geodatabase (GIS data) released

Cook, J.P., 2013, Geologic Map of the Artesia 7 ½' Quadrangle and the Northeastern Corner of the Mount Graham 7 ½' Quadrangle, Graham County, Arizona. Arizona Geological Survey Digital Geologic Map, DGM-106, 1 map sheet, 1:24,000 map scale.

Youberg, A., 2013, Geologic Map of the Thatcher 7 1/2' Quadrangle, Graham County, Arizona. Arizona Geological Survey Digital Geologic Map, DGM-105 v. 1.0, one map sheet, map scale 1:24,000.

Cook, J.P. and Youberg, A., 2013, Geologic Map of Safford 7 1/2' Quadrangle, Graham County, Arizona. Arizona Geologic Survey Digital Geologic Map, DGM-104 v.1.0, one map plate, map scale 1:24,000.

Outreach Story Map Tour – Geologic Tour of Northern Arizona Dinosaur Country – Gray Mountain to Black Mesa.

Arizona Geological Survey Mining Data site now complete comprises more than 20,000 documents from Arizona's mining and mineral history that are online, geolocated, discoverable and accessible.

For the latest news on Arizona's geology, tune in to AZGS daily updates at our Facebook and Twitter feeds.

May Map Highlight – Interactive Geologic map of Grand Canyon and vicinity. Ryan Clark, formally of AZGS, stitched together the geologic mapping of George Billingsley and others to showcase the spectacular geology of Grand Canyon.

ANNOUNCEMENTS

Welcome New AGS Members

Stephen Conger
Christopher Shepard
Donald Stuart
Robert Newcomer
Jesse Silverman
Christopher Seligman
Ankit Singh

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.