Arizona Geological Society Newsletter

FEBRUARY 2018

February 6th, 2018 DINNER MEETING

Who: **Paul F. Hlava** 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, February 2nd. Please indicate Regular (BBQ Rubbed Chicken), Vegetarian (Veggie Scampi/Sauté Zucchini and Mini Bell Pepper/Penne Pasta) or Salad (Chicken Caesar Salad) meal preference. Please cancel by **Friday, February 2nd at 11 am** if you are unable to attend - no shows and late cancellations will be invoiced.

The February dinner meeting is available for sponsorship.

If you are interested in sponsoring the February dinner meeting, please email
vpmarketing@arizonageologicalsoc.org
or visit:
https://arizonageologicalsoc.org/page-1586802

ABSTRACT
Causes of Color in Minerals and Gemstones
Paul F. Hlava, Access to Gems and Minerals

The colors that one sees when looking at a mineral or gemstone are due to the response of that person's eye to the energies of the light coming from the mineral, the emission spectrum of the illumination, and, most importantly, physical phenomena in the material that cause some colors to be absorbed while others are undisturbed or enhanced. It is beyond the scope of this talk to do more than touch on the physiology of the eye that allows us to see colors. Likewise, we will not dwell on the emission spectra of various light sources. Rather, we will concentrate on the various ways in which materials, especially minerals and their heights of perfection - gemstones, produce color from white light.

Light is a form of energy (electromagnetic energy) and white light is a mixture of all of the visible energies (or wavelengths). In order for a mineral to cause color from white light it has to somehow perturb the balance of the light energies. Kurt Nassau has separated the causes of color into 15 mechanisms based on 5 physical groupings. While there are some color mechanisms that depend on direct emission of certain colors, most of the mechanisms we are interested in depend on the ability of certain ions in minerals to

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preferentially absorb certain energies of light. When these energies are removed from the white light, the mineral is colored by the complimentary color as demonstrated by the CIE* Chromaticity Diagram.

Light absorption by the electrons of transition metal (or rare earth element - REE) ions, either as major portions of the mineral chemistry or impurities, is one of the most important and well known of the coloring mechanisms. Most common, rock-forming elements have electronic structures that mitigate against causing colors. On the other hand, transition metal (and REE) ions have electrons that can be excited to open, higher energy levels. The electrons gain the necessary energy for the excitation by absorbing a particular energy (color) from white light and thus cause the mineral to show the complementary color. Three prime examples of this mechanism are rubies, emeralds, and alexandrites, but there are many, many more.

Fluorescence and phosphorescence can be explained as a perturbation of the transition metal absorption model. In most minerals the electrons return to their ground state by losing infrared energies so the emissions are invisible. The excited electrons in fluorescent / phosphorescent minerals return to ground state by losing some energies that are in the visible part of the spectrum. They therefore emit a different color of light from the original. If this relaxation is quick we call the phenomenon fluorescence. If the relaxation is slow enough to linger, we call it phosphorescence.

Many minerals are dichroic or pleochroic meaning they exhibit different colors in different directions. These are caused by excited energy levels that are closer or farther apart in different directions. This, in turn, is controlled by the crystal structure of the mineral squeezing the transition metal ion into an irregular shape.

ABOUT THE SPEAKER

Paul Hlava retired from Sandia National Laboratories in Albuquerque, New Mexico in 2007, after 33 years. He was in the electron microprobe laboratory (as staff member in charge of the lab since 1980) the entire time. Because the EMP lab is part of the Materials Characterization Department, a centralized analytical facility for Sandia, Paul got to work on a wide variety of prosaic to exotic materials and projects. He normally analyzed many alloys and joins (welds, brazes, solders, metal/ceramic and glass/metal seals, etc.) but also worked on high tech ceramics, high-temperature superconductors, electronic materials, phosphors, contamination, corrosion, failure analyses, nuclear waste simulants, thermal batteries, et hoc genus omne. As a result, he has written, co-authored, and/or presented over a hundred papers on a wide variety of materials. Many of these were given at annual meetings of the Microbeam Analysis Society. Paul was the Director of the MAS Affiliated Regional Societies and Coordinator of the Tour Speaker Program for almost 28 years, retiring in 2012.

Paul attended Tulsa University for 2 years and, when the geology program hit a snag, went to the University of Wisconsin at Madison from 1964 to 1967 attaining a BS in geology there. After 3 years teaching at what is now

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The U of Wisconsin River Falls campus, he then transferred to the University of New Mexico where he graduated with a geology MS in 1974. At UNM he worked as a research graduate doing electron microprobe research under Klaus Keil in the Institute of Meteoritics. He worked on moon rocks, Hawaiian basalts, ultramafic rocks, meteorites, and inclusions in diamonds. Paul occasionally used his geological and mineralogical expertise on Sandia projects but also did some personal research on minerals. He has been co-discoverer and co-author on the descriptions of several new mineral species.

Paul stays active in the area of geology, mineralogy, crystallography, and gemology. He has been president of the Albuquerque Gem and Mineral Club three times. He is the Chair for AGMC's annual spring show (25 or so years now), he acts as the geological/mineralogical/gemology expert for the New Mexico Facetors Guild, and often gives talks on geological/mineralogical/ crystallographic/ gemological subjects. About twenty five years ago, Paul started a side business, Access to Gems and Minerals, Inc., dealing in gemstones, jewelry, and related items. This has not only given him access to wholesale rooms full of gemstones but it has piqued his interest in the research side of this field. He has given several well-received talks on gem related subjects such as this one on the causes of color.

THANK YOU!

The following AGS members recently made generous contributions to AGS:

Richard Jones—M. Lee Allison Scholarship Fund

David Briggs—Greatest Needs Fund

Eric Seedorf—Courtright and M. Lee Allison Scholarships

Thank you to Crystals Unlimited for their generous donation!

Crystals Unlimited is donating the twelve 2018 mineral specimens for the small trophies that are presented to each speaker at the end of their talk. Crystals Unlimited will be exhibiting at the main Tucson Gem and Mineral Show in the Tucson Convention Center from February 8-11 in booth 1600.

Arizona Geological Society Membership Stats (1/19/2018)

Total Membership	Professional Members	Student Members	Organizational Members
423	343	73	7

Kelsey Lua Boltz (1930-2017)

Condolences to the friends and family of former long-time member Kelsey L. Boltz, 87, of Phoenix who passed away October 9, 2017. Kelsey had a 65-year career as a geological engineer and entrepreneur and lived life with gusto. He was also a professional baseball player, a pilot flying aerial acrobatics competitions at age 70, an outdoorsman, and a musician. His memorial service is **Sat. February 10th, 10 am at Royal Palms Resort, 5200 E. Camelback Rd., Phoenix.**

Obituary:

https://www.legacy.com/obituaries/azcentral/obituary.aspx?pid=187828266

AGS Executive Committee Members Needed!

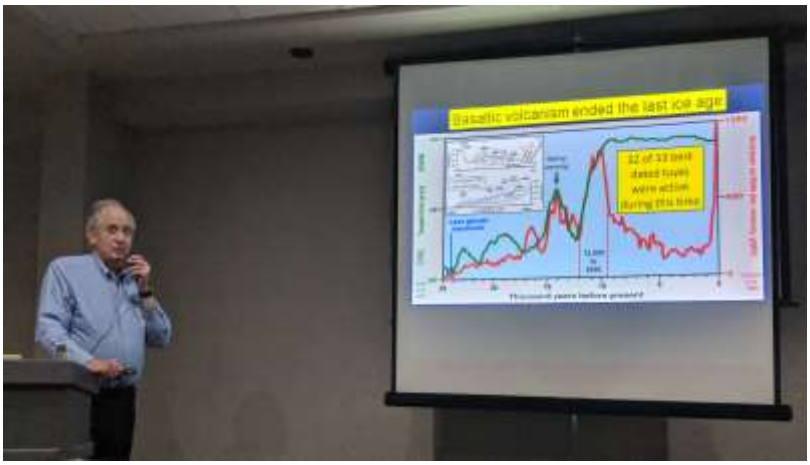
Are you interested in the future of the **Arizona Geological Society (AGS)**? Would you like to make a meaningful contribution to the geology profession in Arizona? If so, the AGS needs you! The **Arizona Geological Society Executive Committee** is currently looking for volunteers – professional geologists and students – to serve in these four open committee positions:

- **Vice Treasurer**
- **Vice Secretary**
- **Councilor**
- **Councilor**

The Executive Committee meets **once a month from 6 pm to 7:30 pm**. Your small commitment of time each month can make a huge difference for the AGS. If you are interested in one of these volunteer positions and would like more information, please contact the Arizona Geological Society by email at:

info@arizonageologicalsoc.org

January Dinner Meeting Highlights



AGS members were treated to an engaging talk by Dr. Peter L. Ward, who worked at the U.S. Geological Survey in Menlo Park, California for 27 years.

Left: Dr. Ward presents at the AGS dinner meeting.

Below left: Dr. Ward answering questions after the presentation.

Below: AGS members conversing during dinner service.

New Dinner Payment Policy

The AGS Executive Committee voted in November to institute a pre-pay policy for dinner meetings, beginning in January 2018. This action was necessary due to the numbers of no-shows who never pay for the meal they reserved, even after frequent reminders. This has resulted in financial losses that are not sustainable for the Society.

For those members who need assistance with navigating the online payment, please contact an officer and we will be happy to walk you through the process.

It's Gem Show season in the desert again!

By Leandra Marshall

The Tucson Gem, Mineral & Fossil Showcase kicks off on January 27th and runs through February 11th, 2018. The largest gem and mineral gathering of its kind in the world, the showcase includes more than 40 different expositions in town with visitors and dealers attending from all across the globe (VisitTucson.org, 2018). The City of Tucson and Visit Tucson® provide a Gem Show phone app guide available for Android on Google Play and iPhone on the App Store, which allows potential attendees a window into the various showcase offerings around Tucson.

The main show, the 64th Annual Tucson Gem and Mineral Show® (TGMS) organized by the Tucson Gem & Mineral Society®, will be held at the Tucson Convention Center February 8th-11th, 2018. The show theme this year is "Crystals and Crystal Forms". Apart from the bountiful gem, mineral, and fossil dealers, the show also contains a Junior Education section for families with young children which is managed by the University of Arizona's Society of Earth Science Students. TGMS also offers relevant lectures and symposiums that are open to the public and free of charge.

For more information on the 64th Annual Tucson Gem and Mineral Show®, visit the Tucson Gem & Mineral Society® website at: http://www.tgms.org/show/

Photo Credit: 2011 Tucson Gem and Mineral Show, Wikimedia Commons.

Photo Credit: 2012 Tucson Gem and Mineral Show, Wikimedia Commons.

Critical Minerals of the United States

By U.S. Geological Survey, December 19th 2017

It would be no exaggeration to say that without minerals, no aspect of our daily lives would be possible.

From the high-tech devices we use to access the information superhighway to the cars and trucks we use to drive the freeways, from the urban jungle to rural farms, every aspect of our lives relies on minerals. Thus, access to sufficient supplies of these minerals is a crucial part of keeping our economy and our security running.

In this new volume, entitled Critical Minerals of the United States, USGS geologists provide the latest and greatest on the geology and resources of 23 mineral commodities deemed critical to the economy and security of the United States. This work is meant to provide decision-makers, researchers, and economists with the tools they need to make informed choices about the mineral mix that fuels our society.

What is Critical?

USGS tracks the industries of about 88 different mineral commodities, but not all of these are considered critical. So what makes the 23 in this report critical?

Mineral commodities that have important uses and no viable substitutes, yet face potential disruption in supply, are defined as critical to the Nation's economic and national security. A mineral commodity's importance and the nature of its supply chain can change with time, such that a mineral commodity that may have been considered critical 25 years ago may not be critical now, and one considered critical now may not be so in the future.

A good example of this is aluminum. Aluminum has always been one of the most common elements in the Earth's crust, but it has not always been so easily obtained. In fact, the ceilings of the Library of Congress and the crown of the Washington Monument were once covered in aluminum as a symbol of status, because aluminum was worth more than silver. However, once scientists figured out how to extract aluminum from bauxite ore, aluminum suddenly became much easier to produce, and its value plummeted in turn.

As Time Goes By

This report updates another USGS report from 1973, which was published when many of the commodities that are covered in this new volume were only of minor importance. Today, advanced technologies have increased the demand for and production of mineral commodities for nearly all elements in the periodic table.

For instance, in the 1970s, rare-earth elements had few uses outside of some specialty fields, and were produced mostly in the United States. Today, rare-earth elements are integral to nearly all high-end electronics and are produced almost entirely in China.

Since 1973, there has also been a significant increase in knowledge about geologic and environmental issues related to production and use. This report addresses the sustainable development of each mineral commodity in order that the current needs of the Nation can be met without limiting the ability of future generations to meet their needs.

For each mineral commodity, the authors address how the commodity is used, the location of identified resources and their distribution nationally and globally, the state of current geologic knowledge, potential for finding additional deposits, and geoenvironmental issues that may be related to the production and uses of these mineral commodities.

Access the report here: https://pubs.er.usgs.gov/publication/pp1802

Meet the Minerals

So what are the 23 minerals and why are they critical?

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Image shows a sample of **tantalite**, the primary ore of **tantalum**. Tantalum can both store and release energy, which allows electronic parts be exceptionally small.

Image credit: Andrew Silver

http://libraryphoto.cr.usgs.gov/htmllib/btch571/btch571j/btch571z/byu01075.jpg, Public Domain, https://commons.wikimedia.org/w/index.php?curid=7598843

Image shows a sample of **fluorite** and **tellurium** in rock. Tellurium's primary use is for manufacturing films essential to photovoltaic solar cells. Tellurium is one of the least common elements on Earth.

Image credit: USGS.

A sample of **stibnite**, the most common ore of **antimony**. Antimony's leading use is as a fire retardant in safety equipment and in household goods, such as mattresses. Almost all the world's antimony either comes from China, or passes through China for smelting.

Image credit: Scott Horvath, USGS.

Image shows a sample of **Spiegeleisen**, an alloy of **manganese**. Manganese is essential and irreplaceable in steelmaking. The combination of total import reliance for manganese, its essential nature, and the potential for supply disruptions makes manganese among the most critical minerals for the United States.

Image credit: By Andrew Silver - United States Geological Survey, Public Domain

Image shows **Selenium** hosted in **sandstone**. In the late 1990's, the use of selenium (usually with bismuth) as an additive to plumbing brasses to meet no-lead environmental standards became important.

Image credit: By James St. John - Selenium in sandstone (Westwater Canyon Member, Morrison Formation, Upper Jurassic; Section 23 Mine, north of Grants, New Mexico, USA) 1, CC BY 2.0.

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Image shows a nugget of **platinum**. Platinum group elements are strategic and critical materials for many nations because they are essential for important industrial applications, have no adequate substitutes, and are mined in a limited number of places.

Image credit: By Alchemist-hp (talk) (www.pse-mendelejew.de) - Own work, FAL, https://commons.wikimedia.org/w/index.php?curid=9579015

See more of the United States' critical minerals at:

https://www.usgs.gov/news/critical-minerals-united-states

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

~~Welcome New Members~~

James Davis **David Reid** **Chris Wanless** **Russ Franklin**

Joan Barry **Wayne Edgin** **Seymour Sears** **Matthew Wetzel**

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.

FREEPORT-MCMORAN

AGS MEMBERSHIP APPLICATION OR RENEWAL FORM

YOU CAN RENEW OR SIGN UP as a new member and pay online. Please go to our website, arizonageological-soc.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