



## Colorado Scientific Society

*The objective of the Society is to promote the knowledge and understanding of Earth science, and its application to human needs*

***Thursday, Nov. 19 meeting, 7:00 p.m. (social time 6:30)  
Shepherd of the Hills Church, 11500 W. 20<sup>th</sup> Ave., Lakewood CO  
All are Welcome! Program:***

### **The variability of hydrothermal ore deposits in the North American Cordilleran orogenic belt - insights into metallogeny from ore fluid analysis**

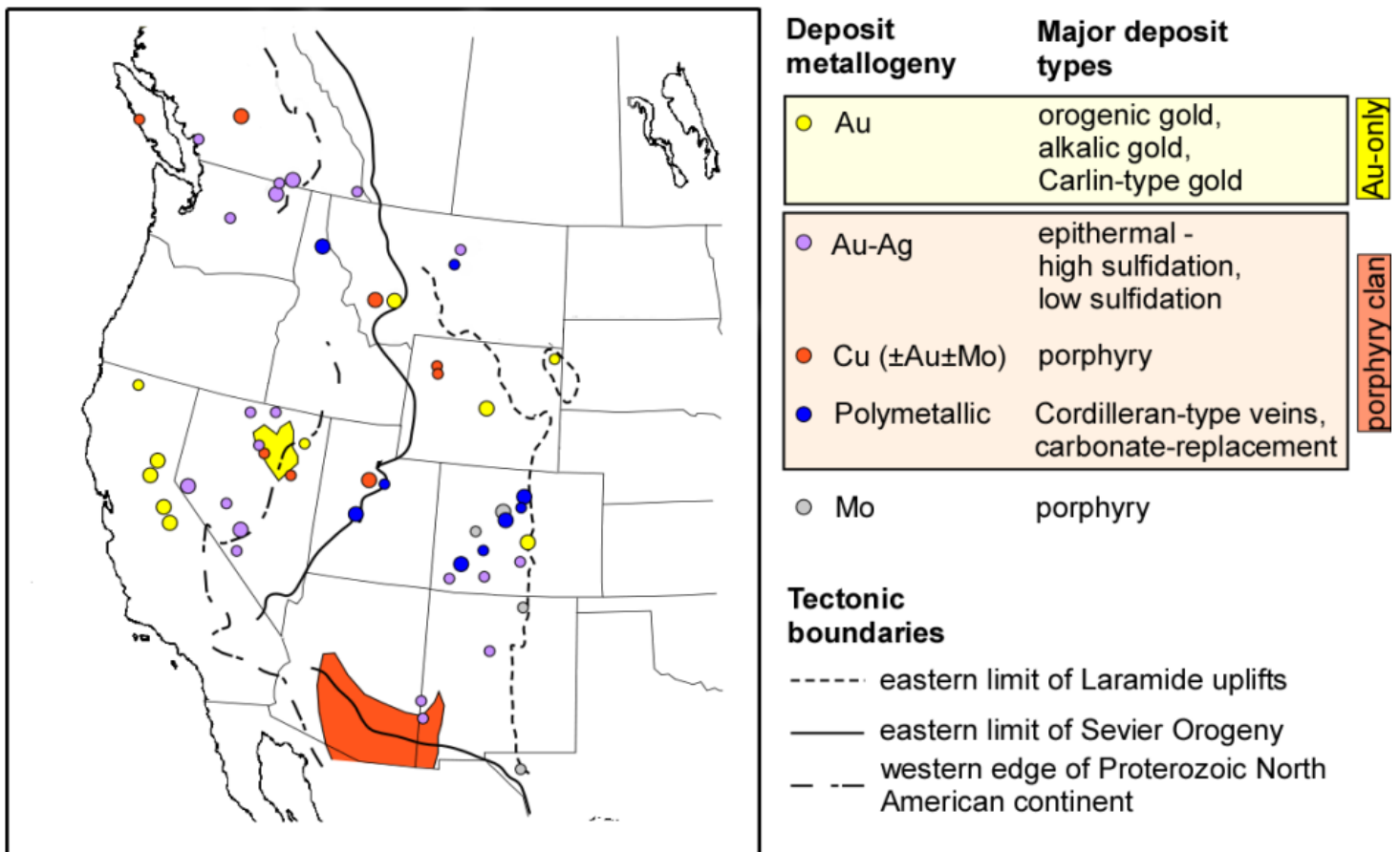
**by John Ridley, Department of Geosciences, Colorado State  
University, Fort Collins, CO**



*John Ridley holds the MacCallum Chair of Economic Geology at the Department of Geosciences, Colorado State University. He took up this chair ten years ago after earlier holding faculty positions in Australia, Switzerland and Zimbabwe. He has recently published a new comprehensive textbook "Ore Deposit Geology". His research uses field studies, structural geology, petrology, fluid inclusion studies and a broad gamut of geochemistry applied to ore deposits and their environments. He received his B.A. in Geology from The University of Cambridge (1978) and a Ph.D. from The University of Edinburgh (1982).*

**Abstract:** The Cordilleran orogenic belt of western North America has been the site of formation of a bewildering array of hydrothermal ore deposit types – Cu and Mo porphyries, high and low-sulfidation epithermal, polymetallic veins, orogenic gold veins, Carlin-type gold deposits and others. Although there is dispute in some cases over ore fluid sources, all deposit types are broadly related to magmatism in this convergent-margin setting. There are, however, few clear spatial or temporal patterns to where and when one rather than another type of deposit formed. Site specific processes of magmatic evolution, or of evolution of hydrothermal fluids after release from magma, may play roles. Some variability is further relatable to depth of erosion of magmatic centres. None of these factors can explain a first-order division of metallogeny between polymetallic (Cu, Au, Ag, Mo) ores and gold-only ores.

Ore fluids are typically studied as fluid inclusions in hydrothermal minerals. Laser-ablation inductively-couple plasma mass spectrometry (LA-ICP-MS) newly allows analysis of metal concentrations in inclusions. Interestingly, fluids of all ore deposit types appear to have broadly similar bulk compositions – relatively low-salinity and CO<sub>2</sub>-bearing. Few clear correlations between fluid metal content and ore metallogeny are apparent, but there are subtle differences between the contents of non-ore elements between multi-element ores and gold-only ores. Clues to the origins of the different metallogenies will likely come from understanding these differences in the context of magmatic and hence tectonic process in the history of the orogen.



## President's November message – Paul Morgan, Colorado Geological Survey



The first snow fell in Denver this morning, at least on the east side of town. Many of you are probably thinking, “we had snow a couple of weeks ago.” I must confess that I have been enjoying views of beautiful snow-capped peaks for almost two weeks. However, all of these signs are saying that the field season is coming to a close. I am leaving for the field tomorrow and hope that I can squeeze in one more week of mapping at 9,000 feet before all I will be mapping is snow.

Unfortunately where I will be mapping lacks cell phone reception and I do not know if I will be able to use some of the very useful cell-phone apps that Jim Reed demonstrated how to integrate into field mapping in his talk to CSS in October. Strike, dip, latitude and longitude at the press of a button on your phone, and then download the data directly to a GIS map. What will be available next? Do I need to throw away my colored pencils?

Our speaker for November is a native of Scotland and currently holds the MacCallum Chair of Economic Geology in the Department of Geosciences, Colorado State University. John's title is The Variability of Hydrothermal Ore Deposits in the North American Cordilleran Orogenic Belt - Insights into metallogeny from ore fluid analysis. Ore deposits are a subject known well to John, as may be seen in the book that he published in 2013: Ore Deposit Geology (Cambridge University Press). Colorado is the second location that John and I have crossed paths: we were both faculty members at Macquarie University in Sydney, Australia, at the end of the last millennium. That sounds so long ago!

Life as a geologist is difficult to live without experiencing, or at least knowing a colleague who has experienced unemployment during a downturn in the market for a particular geological specialty. I am sad to see the number of geologists in the petroleum industry who are currently experiencing this hardship. I serve on a committee for the Energy and Minerals Division of the American Association of Petroleum Geologists and received an e-mail yesterday informing me that a long-serving AAPG staff member, who works with the committee, would be accepting an early retirement package as part of an AAPG reduction in force. Financial support for AAPG from the oil and gas companies has decreased so much during the past year that AAPG is reducing staff. Low gas prices are nice at the pump but the prolonged depression in oil revenues is having a human major toll through unemployment in the industry.

December is less than a month away when I will be passing the gavel to Peter Barkmann, the CSS President Elect. I will also have the honor of being the speaker for the December Meeting. My subject will somewhat of a follow-on to the November speaker as it will include geothermal systems, and geothermal systems are simply the shallow manifestations of hydrothermal ore-forming systems. However, not everything that I propose to include in my talk will be hydrothermal. My tentative title also borrows from the October speaker: Heat flow: then and now, here and there.

Before the October Meeting the CSS Council voted to continue the recent practice of having a pot-luck Christmas Dinner prior to the December Business and Speaker Meeting. There will be more details of this event in the December newsletter.

I look forward to seeing as many of you as possible on November 19 for our next meeting with John Ridley speaking on the subject of ore deposits. ---Paul

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***Is CSS interested in preparing one or more Field Trips for the 2016 GSA meeting?*** The 2016 Geological Society of America Annual Meeting, in Denver, will be held unusually early next year, Sept. 25-28. The deadline for submitting field trip proposals is accordingly earlier than usual—Dec. 1, 2015. If you are interesting in helping to plan a trip—please contact one of the CSS officers!



## October's Where is this Rock? --

As one or two of you wrote and knew (forgive me, I haven't relocated the emails to report who!), these images are both from NASA's *New Horizons* planetary probe. On left is a remarkably sharp image of Charon, Pluto's largest moon. The second shows Pluto's atmosphere, taken as Pluto eclipsed the sun—as *New Horizons* passed into its shadow. The image shows that Pluto's atmosphere extends surprisingly far from the planet [oops, I mean dwarf planet, or Kuiper Belt object, or whatever you like to call it].



And the blue color “results from scattering of sunlight by very small particles. On Earth, those particles are very tiny nitrogen molecules. On Pluto they appear to be larger - but still relatively small - soot-like particles we call tholins. Scientists believe the tholin particles form high in the atmosphere, where ultraviolet sunlight breaks apart and ionizes nitrogen and methane molecules and allows them to react with one another to form more and more complex negatively and positively charged ions. When they recombine, they form very complex macromolecules, a process first found to occur in the upper atmosphere of Saturn's moon Titan. The more complex molecules continue to combine and grow until they become small particles; volatile gases condense and coat their surfaces with ice frost before they have time to fall through the atmosphere to the surface, where they add to Pluto's red coloring.”

(<http://solarsystem.nasa.gov/news/2015/10/08/new-horizons-finds-blue-skies-and-water-ice-on-pluto>)

## Where is this Rock? -- November

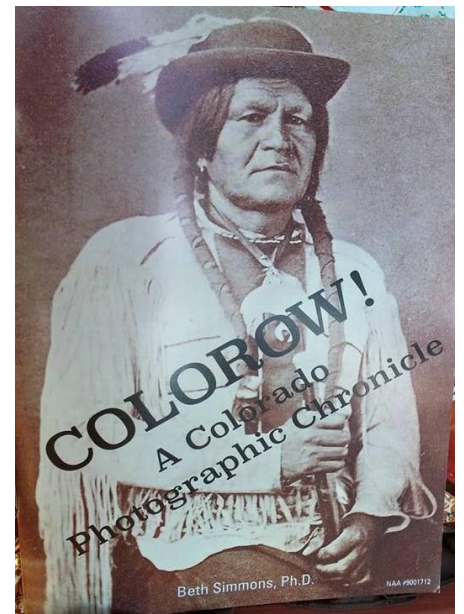


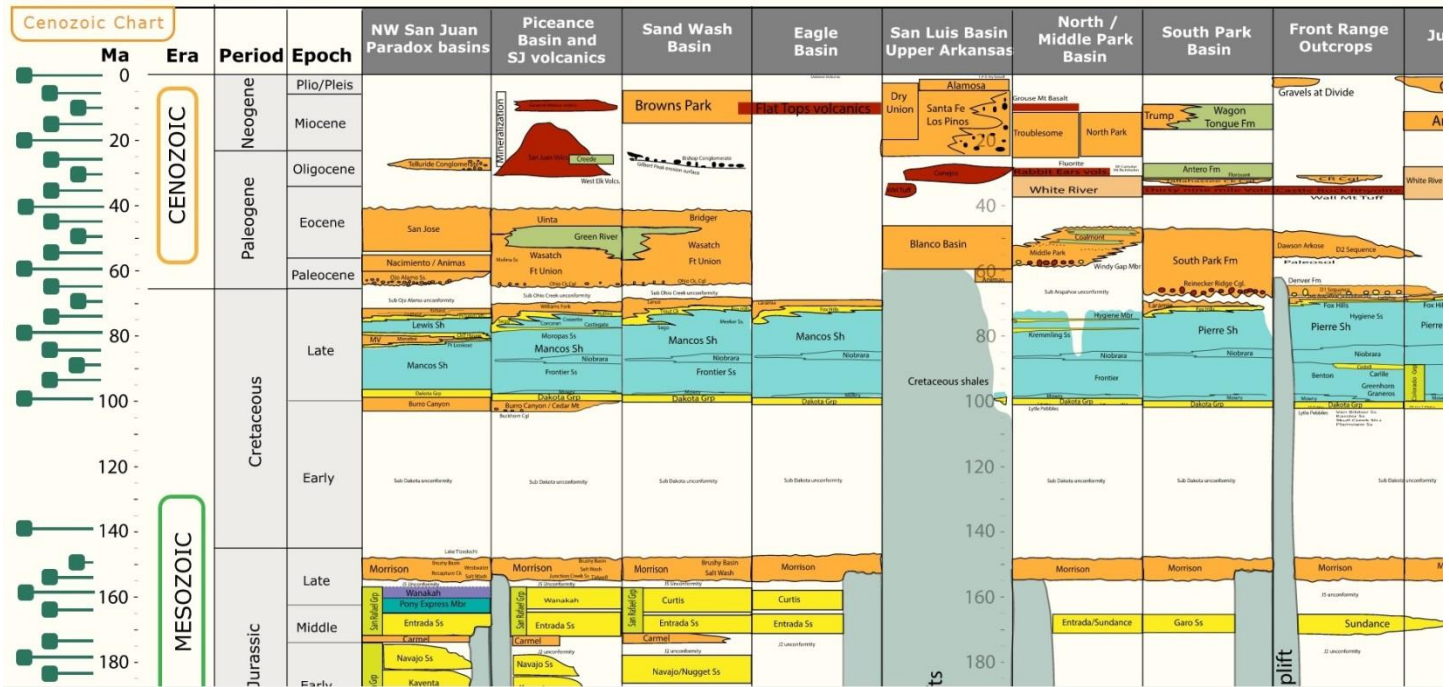
\* \* \* \* \*



Here once again are a pair of pictures—both from the same locality, in Colorado. Write to Pete Modreski, [pmodreski@usgs.gov](mailto:pmodreski@usgs.gov) or 303-202-4766, if you think you have an answer to “where and what” these are.

**New book, by Beth Simmons!** “*Colorow! A Colorado Photographic Chronicle*, 47 p., 2015, is the product of a great deal of historical research and study of historic photographs, many of which are reproduced here. It is a joint publication of the Jefferson County Historical Commission and the Friends of Dinosaur Ridge. I learned “several remarkable new things” about Chief Colorow, just from my first few pages’ browsing of the book! Available at the Dinosaur Ridge Visitors Center.





Have you seen this *Colorado Stratigraphy Chart*? Prepared by Bob Reynolds and James Hagadorn, both of the Denver Museum of Nature & Science, it is (their own description): “This living digital chart has been built directly from a chart of Colorado Stratigraphy assembled by Richard H. Pearl published by the Rocky Mountain Association of Geologists in Special Publication 2 in 1977. The chart has been reproduced in various ways for field guides and handouts. We have recast it against the 2012 Geological Society of America Time Chart (v.4.0) and slightly modified the organization and lay out. It is designed, like Colorado, to evolve with time.” You can view the whole chart (this is just one corner) and more, at <http://coloradostratigraphy.com/index.html> .

**2016 Officer Nominations:** Lisa Fisher (chair), Scott Minor, and Matthew Sares are our nominating committee for 2016 Sci. Soc. offices; nominees are being sought for President-elect and for two expiring Council positions. Please, if any members have nominations to propose, send them to any of these nominating committee members. A ballot will be in the December newsletter, and elections will be conducted and announced at the December 17 meeting. All who would like to nominate someone or volunteer themselves for one of these positions, please contact any of the nominating committee.

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**Calendar of Coming Events**

**Tues., Nov. 17, 6:30-8:30 p.m.** Three more segments of “**The World’s Greatest Geological Wonders**” course of videos will be shown again at Mount Vernon Country Club in a 2-hour session. The DVD lectures will be:

- Lecture 16 Bryce Canyon Creative Carvings of Erosion
- Lecture 17 Uluru/Ayer's Rock - Sacred nature of rocks
- Lecture 18 Devil's Tower - Igneous Enigmas

The price for adults is \$5 each session, to go towards the Club’s audio/visual setup charge for the Grill, but children are free. For more information please contact Jim Keller, [kellerjb10@aol.com](mailto:kellerjb10@aol.com).

**Nov. 14-15, New Mexico Mineral Symposium, Socorro, NM.** This promises to be an extra good symposium; it will feature a reception for the Grand Opening of the new Mineral Museum (Headen Center) at the NM Bureau of Geology. The featured speaker will be Dr. Robert Cook, “An overview of five great American gold specimen location”. The symposium runs from Friday evening (Museum reception) through Sunday afternoon (silent auction), with talks all day Saturday and Sunday morning. See <https://geoinfo.nmt.edu/museum/minsymp/home.cfm> for full details.



**Sun., Nov. 15, 1:00 p.m.**, Auraria Campus, Science Building Room 2009, **meeting of the FSS (Florissant Scientific Society)**, no food (normally the group brings lunch when it meets), Jason Janke, chairman of the Earth and Atmospheric Science Department at Metro State, will discuss **Rock Glaciers**, the topic of his Ph.D. thesis. Our group has become interested in these unusual rock/ice formations after hiking to the rock glacier at Lake Agnes in August. Maybe Jason can answer some of our questions! The FSS is an informal group that meets once a month for either a lecture or a field trip (sometimes, but not necessarily, in Florissant, CO). All are welcome; “membership” simply consists of giving Beth Simmons (cloverknoll@comcast.net) your email address, and you will be informed of each meeting. Park in campus Lot M (Maple), reached off southbound Speer Blvd. Parking is free on Sundays. Walk north along 12th Street to Science building, enter southwest door, go upstairs and find 2009; signs will be posted.

**Tues., Nov. 17, 6:00 p.m.**, **After the Storm; Charting a Career in Minerals Exploration into the Next 20 Years**; Auraria Campus Science Building, Room 1067, Denver CO. “Please join us for a free dinner & seminar by Ken Witherly, President of Condor Consulting.” No charge and all are welcome, but please RSVP to reserve a space via [www.condor.rsvpify.com](http://www.condor.rsvpify.com). Sponsored by the MSU (Metro State University) Denver Geoscience Organizations: AAPG (American Association of Petroleum Geologists), AIPG (American Institute of Professional Geologists), and GSA (Geoscience Association).

**Thurs., Nov. 19, ~11:30-1:30 p.m.**, monthly luncheon meeting of SIPES, Society of Independent Professional Earth Scientists; **“The Geology of the Colorado Trail”**, by Ned Sterne, Consulting Geologist. Wynkoop Brewing Co., Denver. “Why not take six weeks, head out your Denver back door and walk 487 miles south on the Colorado Trail to Durango? While you are at it, track the rocks you see across southwestern Colorado from the Front Range to the Paradox Basin. If that doesn’t quite make your bucket list, join me instead for a lunchtime stroll as I build a cross section that follows the trail. My hope is that this section and accompanying maps will provide a geologic overlay for the Colorado Trail Databook...” “SIPES is The Society of Independent Professional Earth Scientists (SIPES) is the only national organization designed exclusively for the independent or consulting professional earth scientist. Members include geologists, engineers, geophysicists, geochemists, and other earth scientists. “ RSVP to attend the luncheon via their website, <http://sipes-denver.org/> or by calling 303-730-2967. New members are always welcome.

**Thurs., Nov. 19, 4:00 p.m.**, **A Simplified Guide to Sequence Stratigraphy: Nomenclature, Definitions, and Method**, by Vitor Abreu, ExxonMobil Research. Van Tuyl lecture at Colorado School of Mines, Berthoud Hall Room 241; all are welcome.

**Thurs., Nov. 19, 7:00 p.m.**, Colorado Scientific Society, **“The variability of hydrothermal ore deposits in the North American Cordilleran orogenic belt - insights into metallogeny from ore fluid analysis”**, by John Ridley, Colorado State University. Shepherd of the Hills Presbyterian Church, 11500 W. 20th Ave., Lakewood. All are welcome. See <http://www.coloscisoc.org/>.

**Thurs., Nov. 19, 7:30 p.m.**, **Friends of Mineralogy, Colorado Chapter** bimonthly meeting; speaker, **Dan Wray, Cave Minerals in 3-D**. Denver Museum of Nature & Science, in the “Africa Station” room, 3rd floor; no charge and all are welcome. See <http://friendsofmineralogycolorado.org/>.

**Fri., Nov. 20, 8 a.m. to 4 p.m.**, **Colorado Science Conference for Professional Development** (a.k.a. Colorado Science Teachers’ Conference), held at the Denver Mart, 58<sup>th</sup> Ave. at I-25. The year’s major educational conference for all fields of science teachers in Colorado. See <http://coloradoscience.org/> for full information about registration and presentations. The keynote presentation, “The Power of Place: Children, Education, and Nature in the 21st Century” will be by Dr. Scott Sampson of the Denver Museum of Nature and Science, author of “How to Raise a Wild Child” as well as “Dinosaur Odyssey: Fossil Threads in the Web of Life”. Some 100+ other presentation sessions will be given, plus exhibits and networking opportunities. Anyone interested in science education topics is invited to attend the conference, whether or not they are involved in formal K-12 education.

**Fri., Nov. 20, 8:00 p.m.**, at the monthly meeting of the Mile Hi RAMS (Rock And Mineral Society), **“Pegmatite mineralogy and analysis with hands on demo of XRF and micro-Raman spectroscopy”** by Dr. Markus Raschke, Professor of Physics and Chemistry, University of Colorado. The meeting is in Berthoud Hall (corner of Illinois & 16th St.), Room BE 108-109, Colorado School of Mines campus, Golden, CO; the society business meeting begins at 7:30

p.m. All are welcome to attend. It sounds like this may be an opportunity to bring a puzzling specimen or two of your own, to get an on-the-spot partial chemical analysis via XRF or attempted mineral identification via Raman spectra!

**Sat., Nov. 21, Littleton Gem & Mineral Club Silent Auction** (all are welcome!). Columbine Hills Church, 9700 Old Coal Mine Avenue, Littleton, CO. “Seller set up starts at 11 AM, Silent auction starts at noon, Verbal auction starts at 1 pm; Checkout starts at 3:30 pm,”

**Nov. 20-22, Denver Area Mineral Dealers Public Show**, Jefferson County Fairgrounds. “Open to the public. 23 dealers featuring minerals, fossils, gemstones, jewelry, cabochons, beads, books, carvings and findings. Free admission and plenty of free parking.” 10-5 Fri., 10-6 Sat., 11-4 Sun.

**Wed., Nov. 25, 7:00-8:30 p.m., “Non-Dinosaur Reptiles”** at the Dinosaur Ridge Visitor Center (16831 W. Alameda Parkway, Morrison, C-470 and Alameda Parkway). A free evening lecture on critters that often times get mixed up and called dinosaurs, even though they aren’t. Learn about flying and swimming reptiles, crocodylians and their relatives, and how these animals certainly aren’t dinosaurs even though they were alive at the same time. Come on over this evening to see a presentation done by Erin LaCount on dinosaur cousins and other non-dinosaurian reptiles! Recommended for adults only (12 years and older).

**Thurs., Dec. 3, 4:00 p.m., Fifty-one Shades of Gray: The Deposition and Diagenesis of North Sea Chalks**, by Petter Scholle. Bob Weimer Distinguished Lecture in the Van Tuyl lecture series, Colorado School of Mines, Berthoud Hall Room 241; all are welcome.

**Dec. 11-13, Flatirons Gem & Mineral Show**, “Rocks & Rails” (the Boulder Model Railroad Club show is combined with the gem & mineral show); Boulder County Fairgrounds, Longmont, CO, 10 a.m. – 5 p.m. each day. We (USGS) will have an exhibit booth at the show.

**Thurs., Dec. 17, Colo. Sci. Soc. Annual Meeting, Presidential Address, and Potluck Dinner.** Shepherd of the Hills Presbyterian Church, 11500 W. 20th Ave., Lakewood. Full details in the December newsletter!

*New announcement—upcoming pegmatite symposium, July 2016:* All are invited to attend the “**2<sup>nd</sup> Eugene E. Foord Symposium on Pegmatites, Golden Colorado**”, to take place on the CSM campus, July 15-19, 2016. There will be a welcoming reception, two days of oral and poster presentations, and two days of field trips to Colorado pegmatite localities. Look for further information on the Friends of the Colorado School of Mines Geology Museum page, <https://www.facebook.com/LikeCSMGeoMuseum/>. Pegmatite researchers from around the country are expected to attend, as well as local presenters. If you would like to receive future updates about the symposium or would like to offer to present a paper, please contact Mark Jacobson, markivanjacobson@gmail.com.

***Special exhibits continuing in 2015:***

**The Mining Art of Buck O’Donnell**, special exhibit at the Western Museum of Mining & Industry. “JC (Buck) O’Donnell created a series of pen and ink drawings for various mining related supply and informational magazines during the early to mid-20th century. His work appeared in magazines like Shaft and Development Machines and Machinery Center, Inc. O’Donnell’s works served to provide visual evidence of how miners lived, how they worked, and what the western mining boom looked like to those who lived it.” The exhibit opened on Sept. 10; regular admission charge. See [www.wmmi.org](http://www.wmmi.org) for more details.

**Steps in Stone: Walking Through Time**, at the University of Colorado Museum of Natural History, CU campus, Boulder. “A new exhibition that features real fossil tracks and trackways from the University of Colorado Museum of Natural History collections”. Open 9-5 weekdays, 9-4 Saturdays, 10-4 Sundays; closed on university holidays. Exhibit runs through December 2015; see <http://cumuseum.colorado.edu/>.

**Explore Colorado's Mining and Mineral Heritage:** Colorado minerals, gemstones, and mining history material from the Colorado School of Mines Geology Museum and Colorado's State Mineral Collection continues on display on the third floor of the Colorado State Capital Building in Denver, at least through the end of the year. You can explore this

online by following this link to the Friends of the CSM Geology Museum facebook page (you don't need to have a personal Facebook account to view this information.):

<https://www.facebook.com/pages/Colorado-Mining-and-Mineral-History-on-Display/358587847669017>

***For more lecture series during the year see:***

CU Geological Science Colloquium (Wednesdays, 4 p.m.) see <http://www.colorado.edu/geolsci/colloquium.htm>

CSU Dept. of Geoscience Seminars (Fridays, 4 p.m.), see <http://warnercncr.colostate.edu/geo-news-and-events/department-seminars>

Van Tuyl Lecture Series, Colorado School of Mines, (Tuesdays, 4 p.m.) see [http://inside.mines.edu/GE\\_Lecture-Series](http://inside.mines.edu/GE_Lecture-Series)

Denver Mining Club (Mondays, noon), see <http://www.denverminingclub.org/>

Denver Region Exploration Geologists Society (DREGS; 1<sup>st</sup> Monday, 7 p.m.), <http://www.dregs.org/index.html>

Rocky Mountain Map Society (RMMS; Denver Public Library, Gates Room, 3<sup>rd</sup> Tuesday, 5:30 p.m.), <http://rmmaps.org/>

Western Interior Paleontology Society (WIPS; Denver Museum of Nature & Science, 1<sup>st</sup> Monday, 7 p.m.),

<http://westernpaleo.org/> .

**2015 CSS Elected Officers**

President.....Paul Morgan, 303-384-2648, morgan@mines.edu  
President Elect.....Peter Barkman, 303-384-2642, barkmann@mines.edu  
Treasurer.....Don Sweetkind, 303-236-1828, dsweetkind@usgs.gov  
Secretary.....Lisa Fisher, 303-215-0480, lisa.fisher@escalantemines.com  
Past President..... Scott Lundstrom, 303-917-2849, pslundstrom@msn.com

**Councilors**

2013-2015: Marieke Dechesne, 303-236-1289, mariekedechesne@gmail.com

2013-2015: Liz Pesce, pesce.e@gmail.com

2014-2016: Celia Greenman, celia.greenman@earthlink.net

2014-2016: Chris Morrison, chris-morrison@comcast.net

2015-2017: Bruce Geller, 303-273-3823, bgeller@mines.edu

2015-2017 Pete Modreski, 303-202-4766, pmodreski@aol.com

**Committee Chairpersons**

Best Student Paper Competition:

Database Manager: Don Sweetkind, 303-236-1828, dsweetkind@usgs.gov

Field Trips: Cal Ruleman, 303-236-7804, cruleman@usgs.gov

History: Beth Simmons, cloverknoll@comcast.net

Hospitality: Jack Krajewski, gjack08@gmail.com

Membership/Mentor: Liz Pesce, pesce.e@gmail.com

Student Research Grants: Scott Lundstrom, 303-917-2849; csslund15@gmail.com

Newsletter Editor: Pete Modreski, 303-202-4766, pmodreski@aol.com or pmodreski@usgs.gov

Outreach: Linda Barton Cronoble, 720-338-1237, lbarton1611@gmail.com

Program: Open

Publicity: Open

State Science Fair: Chuck Weisenberg, 303-238-8806, cweisnrg@msn.com

Webmaster: Barb Warden, 303-278-2701, bwarden@tablemtn.com

**Colorado Scientific Society, P.O. Box 150495, Lakewood CO 80215-0495 <http://www.coloscisoc.org>**

**Colorado Scientific Society dues** are \$20 for regular members, \$10 for corresponding members (outside the Colorado Front Range area) and only \$5 for students. Mail a check to the CSS or pay with a credit card using PayPal on the CSS website. Contact CSS Treasurer Don Sweetkind at 303-236-1828 or dsweetkind@usgs.gov if you are uncertain of your dues and membership status. Extra payments to contribute to our Memorial Funds or Endowment Fund are always most welcome (you'll see a list of them on the membership form). See our website for a membership form,

<http://www.coloscisoc.org/membership/dues.html>.