Newsletter of the Society **December 2015**

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, Dec. 17: Annual Meeting, Holiday Potluck Dinner, and President's Address

Dinner at 6:00 p.m. (come ahead of time if you can help set up)
Meeting will begin at 7:00 p.m.

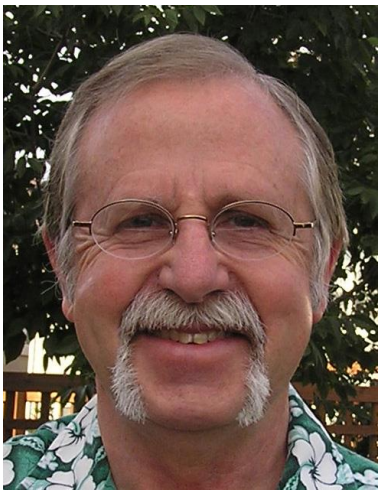
Shepherd of the Hills Church, 11500 W. 20th Ave., Lakewood CO ***All are Welcome!***

"We are asking all who attend to bring a holiday favorite side-dish, dessert, or appetizer to share. In the past, CSS provided "meats", but will not this year, so we are requesting some of you bring ham or turkey. In the spirit of cooperation, please consider one of these options to help make this our best dinner/meeting yet!
1) Bring a favorite holiday dish to share.
2) Bring a main course such as ham or turkey.
3) Commit to help setup before, or clean-up after the meeting.
4) Donate cash for "extras".
Please contact Linda Cronoble at 720-338-1237 or email- lbarton1611@gmail.com to volunteer. Either way, wishing you all a safe and blessed holiday!"
Linda Barton Cronoble (who has kindly offered to organize this year's dinner)

Presidential address:

Heat Flow, Then and Now, Here and There

Paul Morgan, Colorado Geological Survey

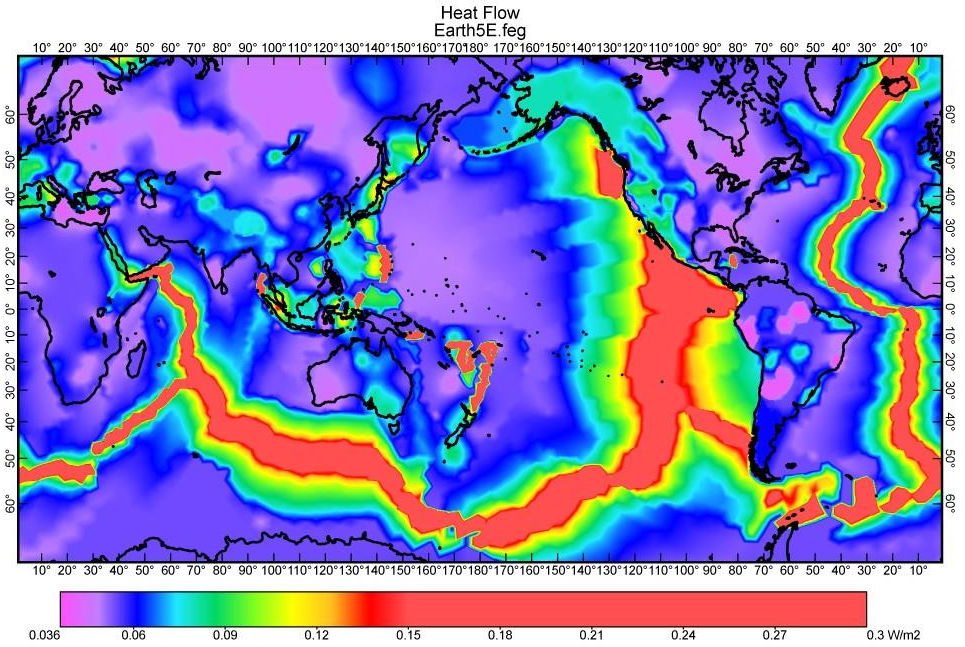


Paul Morgan received his formal education in Great Britain but his real education in the United States. He has been measuring heat flow since his doctoral studies in Cyprus and Kenya. His thermal interests range from laboratory and field measurements to heat flow theory, and from mantle xenoliths to geothermal studies on five of the seven continents and three of the eight (or nine) planets and the Moon. He is a member of the science team for the next NASA mission to Mars, InSIGHT, which will be measuring heat flow and seisAmicity on Mars. This will be the first robotic mission to place a scientific instrument on another planet. He is currently compiling and analyzing geothermal data in Colorado with the Colorado Geological Survey. December brings to an end his year as President of the Colorado Scientific Society.

Heat Flow: Then and Now, Here and There

Heat flow is the energy source that drives the earth's internal engine, the little engine that could, working uphill against the process driven by the overwhelming energy source of the Sun. The average daily rate of energy gain and loss from the Sun (~340 W/m^2) is 4,250 time greater than the average rate of energy loss from the Earth (~0.08 W/m^2). Energy from the Sun drives atmospheric circulation and the hydrologic cycle resulting in erosion, generally working with gravity to move earth materials from higher elevations to lower elevations, and eventually to below sea level. Earth's heat flow, counter-balances the effects of the Sun, rebuilding topography through global tectonics and volcanism.

Heat flow can rarely be directly observed at the surface – the energy flux is roughly equivalent to the light from a cell-phone screen on a medium intensity setting, but in the form of heat. Dramatic manifestations of heat flow are volcanoes, and, on a smaller scale, geysers and hot springs, but these are but a small fraction of the total heat budget. Geologists are probably more familiar with fossil results of heat flow such as metamorphism and hydrothermal ore deposits. There are reasons to believe that the earth is cooling: should we expect to see a signature of higher global heat loss in the rock record?



Heat flow from oceanic crust is dominated by very high heat flow at mid-ocean ridges, at which new oceanic lithosphere is created, decreasing as the sea-floor ages as it moves away from the ridges. This simple pattern is complicated by thermal convection in the crust until a blanket of sediments seals the crust from the circulation of sea-water. Continental heat flow is more complex than oceanic heat flow because it is generally older and more complex in its evolution, it is more chemically heterogeneous, its upper boundary is constantly changing, and heat-transfer by groundwater flow in the upper continental crust is common. The most significant difference is that a significant component of continental heat flow comes from heat generated by radiogenic decay of U, Th, and K in the crust, but the magnitude of this component is variable and unpredictable. In terranes dominated by large granitic plutons, a linear relation has been established between surface heat flow and surface heat production in the plutons. This relation is only valid for terranes dominated by large plutons, however. For heat-flow measurements from Archean terranes there is less scatter and a lower mean than for younger terranes suggesting a general lower heat production (U, Th, K) content in crust of Archean age. This suggests that either, 1) Archean crust was only generated with low heat production, or 2) high heat production Archean crust was recycled.

All planets and planetary bodies have heat flow and a thermal history. To date, the only extra-terrestrial heat-flow measurements made were during the Apollo mission on the Moon. Two data points were collected but unfortunately the results were sufficiently divergent that at least one more point is needed before any conclusions may be drawn. The next data should come from Mars, the InSIGHT mission, scheduled for launch in early 2016 with thermal data return from a single heat-flow experiment in 2017.

World heat flow map added by the editor, from http://peterbird.name/publications/2008_torque_balances/2008_torque_balances.htm

President's December message – Paul Morgan, Colorado Geological Survey

Last month I was writing about snow; today the temperature in Denver is in the high 50s with 60s forecast for the next two days before snow returns in time for the weekend. Perhaps the field season is not yet ended. For those of you who may remember that I was wondering about using cell-phone apps in an area without cell-phone reception, my field work gave me the answer. I wanted to use a strike and dip app (that also gives lat., long, time, and stores the information with notes). The app worked fine most of the time as it only used the GPS on the phone – I lost GPS service a couple of time in a canyon. Many thanks to Jim Reed (CSS October speaker) for bringing me into the 21st Century.

John Ridley's talk in November on North American hydrothermal ore deposits was very well attended. John gave a very interesting presentation grouping the ore deposits in time and space with the development of the North American Cordilleran Orogenic Belt. I think that this work is long overdue and hope that John and his students are able to continue the analysis, a step beyond the Colorado Mineral Belt.

I feel rather awkward publicizing the December talk on *Heat Flow* as I am the speaker. Perhaps I can tell about the journey along which heat flow has taken me. I chose the subject for my Ph.D. dissertation because the choice at the time was analysis of seismic records for newly discovered North Sea oil fields, or heat flow field work in Africa. I knew nothing about heat flow, but I knew that I wanted to go to Africa. With my Ph.D. in hand, finding a job, any job, was difficult. However, Oil Crisis #1 came along and I was picked up for a geothermal post-doc at Southern Methodist University, by Dave Blackwell, one of the best heat-flow experts in the world. Dave taught me everything that I needed to know about heat flow and opened my eyes to the broad horizons of the subject. I will not go into the details of the places that this has taken me, but, from measuring heat flow, I have branched out into hydrothermal ore deposits, thermal isostasy, basin evolution, thermal evolution of the Earth, Archean tectonics, geobarometry and geothermometry of lower crustal and mantle xenoliths, thermal conductivity measurements at temperatures up to 900°C, heat flow and tectonics on Venus, instrumentation to measure heat flow on the Moon, Mars and Venus, etc. In all these activities I believe that am building my knowledge of heat flow and geothermal. My talk will be a few stops along this journey.

The December Meeting will also be the *Pot-Luck Christmas Dinner* and the *Annual Colorado Scientific Society Business Meeting*. With the permission of the CSS Council, I am trying something a little different for the business meeting this year: Certain business is required to be transacted at the meeting, including the formal election of new CSS Council Members and Officers, the passing of the gavel to the new President, Best Paper Award, etc. I would also like to acknowledge the unselfish work of individuals in their service to CSS during the past year. There are many important reports that have traditionally been orally presented at the meeting: As many of these reports as possible are summarized in this newsletter. Any reports that did not make the newsletter will be available at the meeting. I will identify the authors of the reports at the meeting, but the reports will not be read at the meeting. You may talk with the authors informally if you have any questions or comments.

I look forward to seeing as many of you as possible on December 17 for our final meeting of 2015, Christmas Dinner, Business Meeting, and Speaker Presentation.

I have been honored to serve as your President for 2015.

Paul

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A Brief History of Colorado Through Time is a product of the Interactive Geology Project, IGP, at the Denver Museum of Nature and Science. "This 25-minute movie illustrates the geologic evolution of Colorado through time, and premiered at the Opening Ceremony of the AAPG Convention in Denver on 31 May 2015. This version has been modified slightly from the version previously shown." They've done a great job; see it at http://igp.colorado.edu/library/video/143654356 .

November's Where is this Rock? was…

I believe I only received one response to these photos this month, from Jeff Blackmon, of Newmont USA Ltd. Jeff said "mega-spherulites" in volcanic rock, but didn't have a guess as to the exact locality. He's right, of course; this is the "Black Obsidian Quarry" on the north edge of Silver Cliff, Custer Co., Colorado, and it's a classic locality for these megaspherulites, formed by devitrification of rhyolite obsidian. The photo on the left shows much smaller spherulites (looking like some kind of fossil?) in rhyolite adjacent to the quarry. I don't immediately know an exact age or unit name for the obsidian, which is semi-glassy; one might also call it pitchstone, or vitrophyre, but I'm sure it is c. 30 Ma in age—likely, someone from CSS who is reading this may be able to provide more details. The quarry is active, so is posted, fenced, and gated, but a road (graveled with black obsidian!) leads to it, and one can get good views (like this one) of the quarry from outside the fence.

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Where is this Rock? – December

If I don't have red and green, at least I have a partly red rock for the holiday season! And I'll just add, that this locality is not real far—about 25 miles—from the site of last month's pictures. Write to Pete Modreski, pmodreski@usgs.gov or 303-202-4766, if you think you have an answer to the "where and what".

2016 Officer and Councilor Nominations: Lisa Fisher, on behalf of our nominating committee, reports these candidates nominated for our 2016 positions. We are very pleased to have several new people willing to serve in these posts:

President-Elect - Marith Reheis
Councilor - Melissa Foster
Councilor - Linda Barton Cronoble
Secretary - Lisa Fisher (incumbent)
Treasurer - Don Sweetkind (incumbent)

We will vote on these positions at the Dec. 17 Annual Meeting. Paul Morgan, current President, becomes our Past President, and Peter Barkman, 2015 President-Elect, automatically becomes 2016 President. Councilors Bruce Geller, Chris Morrison, and Pete Modreski remain in office for the remainder of their 3-year terms.

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Calendar of Coming Events

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.

Wed., Dec. 16, 7:00-8:30 p.m., "**Non-Dinosaurs, the Mammals"** at the Dinosaur Ridge Visitor Center. "A free evening lecture, by Erin LaCount, on those wonderful, warm-blooded ancestors of ours! Learn about the mammals that coexisted with the largest animals to walk the earth and see which ones survived the extinction event at the end of the Cretaceous to evolve into some of the most impressive living things to date." Recommended for adults only (12 years and older). *[Rescheduled from an originally planned date of Dec. 30]*

Thurs., Dec. 17, Colo. Sci. Soc. Annual Meeting, Presidential Address, and Potluck Dinner. Shepherd of the Hills Presbyterian Church, 11500 W. 20th Ave., Lakewood.

Special exhibit continuing to the end of December 2015:
Steps in Stone: Walking Through Time, at the University of Colorado Museum of Natural History, CU campus, Boulder. **"**The 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/ .

The "**2nd Eugene Foord Symposium on Pegmatites**" will 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. All will be welcome to attend. 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.

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://warnercnr.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
Denver Mining Club (Mondays, noon), see http://www.denverminingclub.org/
Denver Region Exploration Geologists Society (DREGS; 1st Monday, 7 p.m.), http://www.dregs.org/index.html
Rocky Mountain Map Society (RMMS; Denver Public Library, Gates Room, 3rd Tuesday, 5:30 p.m.), http://rmmaps.org/
Western Interior Paleontology Society (WIPS; Denver Museum of Nature & Science, 1st Monday, 7 p.m.), http://westernpaleo.org/ .

CSS Meeting Dates for 2016 ***(normally the 3rd Thursday of the month; subject to change if need arises)***

January 21
February 18
March 17
April 21
May19
September 15
October 20
November 17
December 15

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, gijack08@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, cweisnbrg@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, or see our website at http://www.coloscisoc.org/membership/dues.html.

Now is the time to renew your membership for 2016! Thank you!

Colorado Scientific Society

Application and Membership Update
Dues and Funds Contributions

Date_____

New Member _____ Renewing Member _____

_____
(email address) (Telephone)

_____
(Last Name) (First Name) (Initial)

_____
(Address)

The success of most Society activities depends on volunteer help. Please circle any activities for which you can provide assistance. We will pass your name on to the appropriate Committee Chairperson.

Field Trips	History	Outreach
Fund Raising	Newsletter	Program/Talks

Annual Dues (January – December)

Regular Members $20 _____
Corresponding Members $10 _____
Student Members $5 _____

Memorial Funds: These funds support research grants to graduate students in the Earth Sciences throughout the nation. *Please note if contribution is made in the memory of an individual.*

Ogden Tweto Memorial Fund _____
Steven Oriel Memorial Fund _____
Edwin Eckel Memorial Fund _____
Bill Pierce-Heart Mountain Fund _____
George Snyder Memorial Fund _____
Chuck Pillmore Memorial Fund _____

Endowment Fund:

This fund is used to support the Society's monthly meetings and newsletter, field trips, family night, annual Emmons Lecture, invited speaker honorarium, and special activities. _____

TOTAL CONTRIBUTIONS (DUES AND FUNDS): _____

Please make your checks payable to the: *Colorado Scientific Society* Send this form & your check to: **Colorado Scientific Society** **P.O. Box 150495** **Lakewood, CO 80215-0495**	Or register and pay on-line using PayPal at: http://www.coloscisoc.org/membership/duespaypal.htm