



# Colorado Scientific Society

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

## **May Meeting – Thursday, May 19, 2016, 7:00 p.m.**

**Shepherd of the Hills Presbyterian Church, 11500 W. 20<sup>th</sup> Ave., Lakewood CO**  
**Social time beginning at 6:30; meeting & program at 7:00**

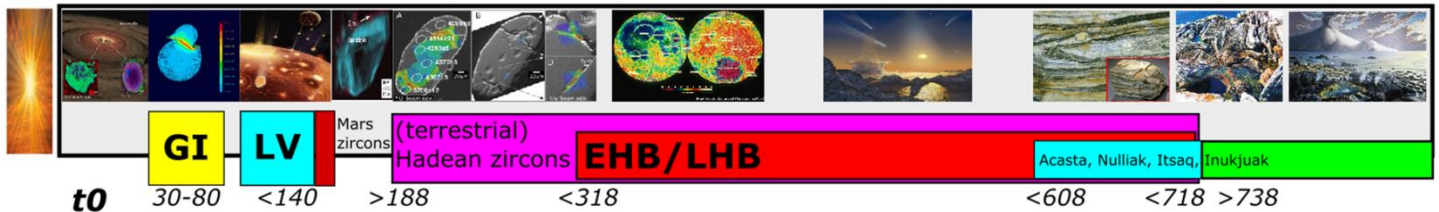
## **Older than the hills: The ca. 3920-3960 Ma Acasta Gneiss (Northwest Territories, Canada)**

Stephen Mojzsis, Professor of Geology, and Director, Collaborative for Research in Origins (CRiO), Department of Geological Sciences, University of Colorado, Boulder



The starting point for my presentation is the notion that conditions at the surface and interior of the Hadean Earth before about 3.9 billion years ago - which nurtured life's origin - were different from those at present, but for reasons that are as yet poorly understood. The young Sun was dimmer, Earth's mantle hotter, its atmosphere anoxic, and bombardment by asteroids and comets frequent, but it is unknown how such differences influenced the way the "Early Earth" functioned. By some accounts, the late Hadean (ca. 4.25-4.0 Gyr ago) may have witnessed the emergence of the biosphere from the ruins of planetary-scale bombardment. Hence, with regards to actually defining what early terrestrial environments existed that could have led to biological systems, it is mystifying that a number of fundamental aspects of the primordial Earth environment are still under debate, such as: (i) what were the thermal consequences of late accretion events like the late heavy bombardment (LHB) to the earliest biosphere?; (ii) was emergent (a.k.a. "dry land" or subaerial) land present that helped facilitate

prebiotic chemical reactions that led to the origin of life?; (iii) what was the mantle's redox state; and (vi) what was the composition of the first crust? Paradoxically, an acute inconsistency exists between observations of the natural world and the various prebiotic experimental models put forth with well-meaning assumptions about "plausible prebiotic conditions". Such a conflict between observation and experiment can best be overcome by geology. I will show how the oldest rocks and minerals are being used to shed unprecedented light on the conditions wherein life emerged on Earth. (*an expanded technical abstract appears on page 3*)



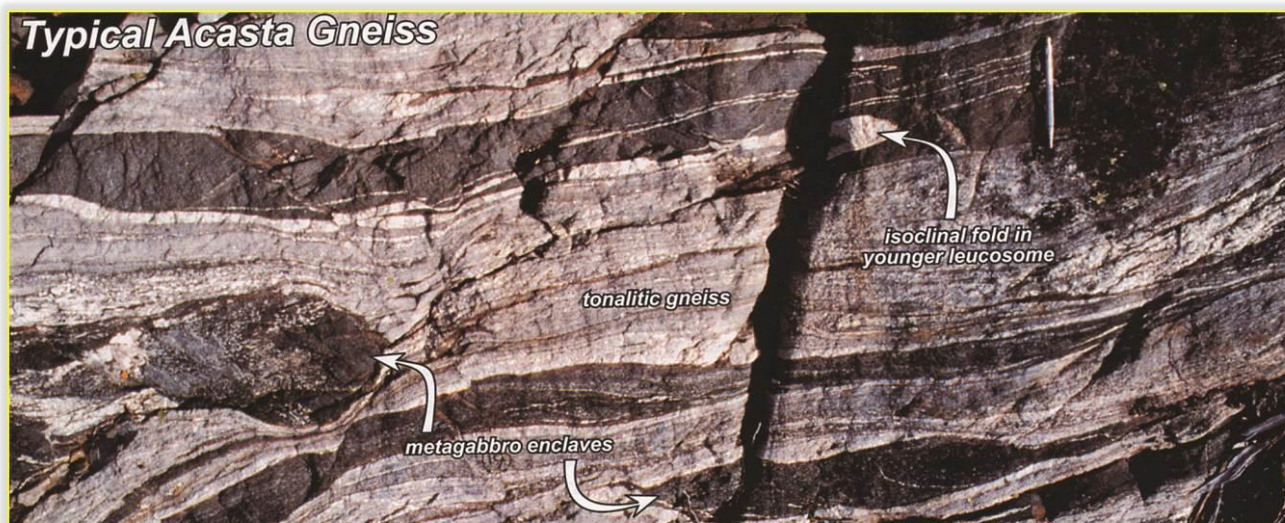
A simplified timeline of early events in our solar system. Numbers refer to millions of years after “t0”, which corresponds to the origin of our solar system at approximately 4.568 billion years ago.

**Legend:** **GI:** “Giant Impact” otherwise known as the “Moon-forming event”; **LV:** “Late Veneer”, a later large impact addition to Earth’s mass; **EHB/LHB:** “Early heavy bombardment/Late Heavy Bombardment” of comets and asteroids. “Acasta”, “Nulliak”, “Itsaq” and “Inukjuak” refer to geological localities of Earth’s oldest rocks.



Steve Mojzsis is Professor of Geology at the Department of Geological Sciences, University of Colorado at Boulder where he directs the Collaborative for Research in Origins (CRiO) funded by the John Templeton Foundation-Fame Origins program. He is also a Distinguished Visiting Professor at the Hungarian Academy of Sciences in Budapest, and has held visiting academic positions in

France at the Université Claude Bernard Lyon 1, and the Centre de Recherches Pétrographiques et Géochimiques (CRPG) in Nancy, and in Japan at the Earth-Life Science Institute (ELSI) at the Tokyo Institute of Technology. His research seeks to understand the physical and chemical conditions on planets that lead to emergence of a biosphere.

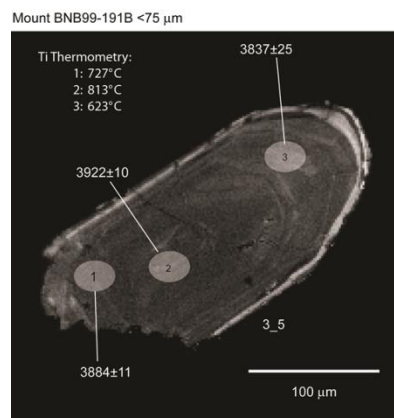
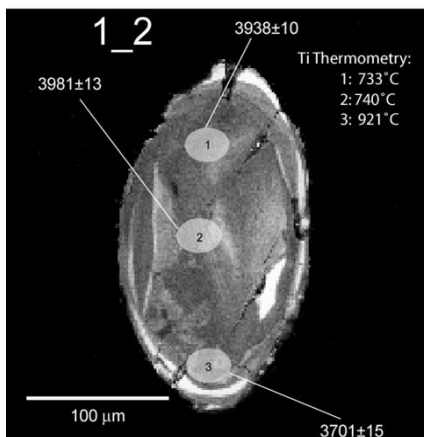
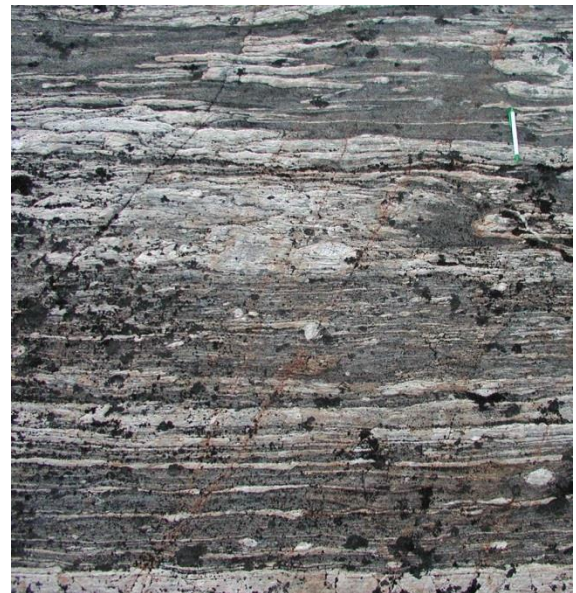




**Detailed Abstract: Multi-faceted component geochronology and geochemistry of the ca. 3920-3960 Ma Acasta Gneiss:** The oldest compiled U-Pb zircon ages for the Acasta Gneiss Complex (AGC) in the Northwest Territories of Canada, span about 4050-3850 Ma; yet older ca. 4200 Ma xenocrystic U-Pb zircon ages have also been reported for this terrane. The AGC expresses at least 25 km<sup>2</sup> of outcrop, but only a small subset has been documented in the detail required to investigate a complex history. To better understand this history, ion microprobe <sup>235,238</sup>U-<sup>207,206</sup>Pb zircon geochronology was combined with whole-rock (WR) and zircon rare earth element compositions ([REE]<sub>zirc</sub>), Ti-in-zircon thermometry (Ti<sup>xln</sup>), Lu-Hf and <sup>147</sup>Sm-<sup>143</sup>Nd vs. <sup>146</sup>Sm-<sup>142</sup>Nd geochronology on a sub-divided ~60 cm<sup>2</sup> slab of Acasta banded gneiss comprising five separate lithologic components. Results were compared to other variably deformed AGC granitoid- and plagioclase-hornblende gneisses collected from mapped (1:50 scale) outcrops. Micro-sampling, in much the same way meteorites are investigated, shows that different gneissic components host distinctive [Th/U]<sub>zirc</sub> vs. Ti<sup>xln</sup> and [REE]<sub>zirc</sub> correlative with zircon age populations, WR compositions, Lu-Hf, W- and <sup>146</sup>Sm-<sup>142</sup>Nd isotope systematics, but not with conventional <sup>147</sup>Sm-<sup>143</sup>Nd geochronology. The Lu-Hf isotope whole-rock measurements show that some AGC gneisses were disturbed by metamorphic garnet growth and/or migmatization and mineral segregation, and others preserved their Lu-Hf isotope systematics relatively intact. The oldest gneisses have a mean Lu-Hf regression age of 3945 ± 91 Ma which is in good agreement with the U-Pb zircon geochronology. Lattice-strain theory used to model  $D_{WR}^{zircon}$  [REE] reconciles the U-Pb zircon geochronology only for the ca. 3920-3960 Ma age component, which also preserves strong positive Eu anomalies. Some components also preserve what has been interpreted as “pre-Late Veneer” mantle viz. tungsten isotopes. I will discuss these results in the context of searches for the oldest terrestrial rocks in general, and the early dynamical evolution of the crust in particular.



Acasta Gneiss Complex (AGC)



*Representative zircons from AGC tonalitic gneisses*





**President's message, from Peter Barkmann, May, 2016:**

### **Watching the big dig!**

Geology is all around us. We geologists at the Colorado School of Mines have a rare and privileged opportunity. The City of Golden and Colorado Department of Transportation are tearing up the intersection of 6th Avenue and 19th Street to build an overpass. Ultimately, this will be a much-needed connection between town, and Mines main campus, and the Lookout Mountain Road, and Mines Park housing. I don't think any Mines students have been flattened on 6th Avenue yet, but it is a matter of time. Also, the Metro

area has visions of 6th Avenue being part of the Northwest Beltway; 6th Avenue will get a lot busier and faster.

So, we get to watch as they tear into the foot wall of the Golden fault! We entertained wishful thinking that they would actually hit the fault, but alas, it looks like Scott's Morrison Quad map is pretty damn good, placing the buried fault just to the west of 6th Avenue. It is probably closer to the Moly Building, and ironically, the home of the Colorado Geological Survey!

Currently, work is progressing on building the on/off ramps to 6th Avenue onto which traffic will be diverted off of 6th so they can make the big dig to lower 6th. As many of you know, the fins of sandstone exposed along 6th Avenue on the east side are Laramie Formation, which puts the more recessive Fox Hills Sandstone closer to 6th Avenue. What we have seen with the current excavations have indeed been Pierre Shale, somewhat silty with a trace of sand, and alluvial fan deposits. For your pleasure I have attached two photos of the cuts.

The northern cut, on the west side of 6th Avenue, exposed what I would call transitional upper Pierre Shale. I am tempted to call it Fox Hills Sandstone, but the exposures have been fleeting! It is tan and very silty and overturned, AZ 156 dipping 73 degrees to the west. Not surprising. Some of it looks bioturbated making it hard to pick good bedding planes. It is also highly jointed. The southern cut exposed a beautiful cut and fill feature of poorly sorted, boulder-rich alluvium with an interesting Fe-Mn oxide layer at the interface. The boulders in the younger fill were deeply weathered



so that the excavator sliced them cleanly like soft potatoes in a casserole (bad analogy, I know). Above: South-bound off ramp on NW side of 19th St- 6th Ave intersection. Photo looking north-northwest shows bedding planes dipping steeply to the west, probably overturned Pierre Shale. Possible bentonite bed with Fe oxide stains.

Above: South-bound off ramp on NW side of 19th St- 6th Ave intersection. Photo looking north-northwest shows bedding planes dipping steeply to the west, probably overturned Pierre Shale. Possible bentonite bed with Fe oxide stains.

Left: South-bound on ramp on southwest corner of 19th St./ 6th Ave intersection. Photo looking west at cut-and-fill feature in weathered fan deposits. Black line is a layer of Fe-Mn oxide at the contact, probably a groundwater mixing interface.

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Sadly for us, the walls were quickly shotcreted over, hiding the story within. Work goes on. We will continue to watch the progress, and if the opportunity arises to gather folks on site to see what else appears, we will get the word out. Baculites have been kicked up and more may surface. Now we know where we are in the section, we know what to look for. One word of warning and advice to those who might be tempted to go take a look, wear proper footwear, hardhats and safety vests. Work is done by 4:00 most days, so go after that. On another note, we have one more monthly meeting before the summer break. After that our next meeting is Student Night in September. These young geologists are the future of the Colorado Scientific Society. Please make every effort to come hear them speak and see their posters. Melissa Foster has found a great venue for this special meeting. The Arbor House in the Applewood area is a very nice open facility that will provide a great space to showcase our young geologists' fine work! Expect calls from Council members to remind you, we look forward to a good turnout. --- Peter Barkmann

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***Upcoming CSS meetings & field trips:***

**May 19—Stephen Mojzsis**, Department of Geological Sciences, University of Colorado, Boulder; title TBA; Dr. Mojzsis' research involves ancient biospheres and the Hadean/Archean Earth

**June 18** – one-day field trip with Martin Lockley to examine new discoveries around Dinosaur Ridge

**June 25**—one-day field trip to the Proterozoic Tava Sandstone near Woodland Park, with Christine Siddoway

**August 27-28** – field trip with James Hagadorn, DMNS, Devonian strata & extinctions in western Colorado

**September 15 (Student Presentation Night)** — at a new location, Arbor House in Maple Grove Park, Golden

**October 20— Climate Change, Part I and II:** Part I, A Geologist's View (tentative title), by William W. Little, Professor of Geology, Brigham Young University-Idaho, Rexburg, Idaho; and Part II, Climate Models, Data, Predictions, and Model Uncertainty (tentative title), Thomas R. Fisher, CEO, Escalante Mines Inc. Evergreen, Colorado.

**November 17— Joe Sertich**, Curator of Vertebrate Paleontology, Denver Museum of Nature & Science; Title TBA; Dr. Sertich's research involves global changes and the evolution of terrestrial ecosystems during the Mesozoic

**December 15**—Potluck dinner, Annual Meeting, and President's Address

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**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>.

***Please renew your membership for 2016 if you've not already done so!***

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***Colorado Scientific Society, P.O. Box 150495, Lakewood CO 80215-0495***

***<http://www.coloscisoc.org>***



## **CSS Field Trip #1, Saturday June 18, 2016:**

### **New discoveries of dinosaur tracks & markings at Dinosaur Ridge, Morrison CO**

Leader: Dr. Martin Lockley

Several of Martin's new discoveries here have been in the news; he'll show them to us for creative discussion and debate! If interested, please contact Cal Ruleman, [cruleman@usgs.gov](mailto:cruleman@usgs.gov), 303-236-7804, or 303-859-0911, or Pete Modreski, [pmodreski@usgs.gov](mailto:pmodreski@usgs.gov), 303-202-4766, and you'll be sent exact meeting place & time info.

## **CSS Field Trip, Saturday June 25, 2016:**

### **Basement hosted sandstone dikes of the Colorado Front Range: structural and other field relations, and contemplation of origins**

Leaders: Christine Smith Siddoway, Colorado College; and Scott Lundstrom, possibly others

New research in the southern Front Range reveals a Neoproterozoic ancestry for some of the range-bounding faults, due to their association with basement-hosted sandstone dikes that indicate Neoproterozoic age [1], based on detrital zircon (DZ) sedimentary provenance that includes characteristic components from the Grenville Orogen. Informally named Tava sandstone, DZ data indicate that the sandstone dikes and other large associated fault-bounded bodies formed during the Cryogenian Period, and as such the Tava sandstone provides a 'waypoint' in the vast span of time between emplacement of the Pikes Peak Granite at ~1.1 Ga and the deposition of Cambrian Sawatch Sandstone upon the Great Unconformity. In other words, it offers access to exploration of paleoenvironments that previously have been inconceivable.

Sandstone injectites are formed by liquefaction, remobilization and intrusion of sand into fractures within host rock, that in most circumstances involves upward injection from buried sands into overlying sediments/sedimentary rocks in active sedimentary basins. Hence the occurrence in Colorado of detrital, nonmetamorphosed injectites within crystalline basement is distinctive, and may require different geological circumstances for downward injection. The sedimentary injectites likely are a product of 'natural fracking' of the sort that may have been achieved by large magnitude earthquakes, transient subglacial hydraulic conditions of large ice sheets, or regional scale mass wasting (rock slab failure) — possibilities that we hope to explore with CSS members who participate in the field trip.

Exposures of Tava sandstone along the Ute Pass Fault system may be found from Penrose, CO in the south, northwestward to Pine, CO, but this trip will focus on accessible sites near Buffalo Creek, and then proceed to Crystola and Manitou Springs where large associated sandstone bodies can be examined. The road-side stops require no hiking, but the Crystola and Manitou Springs stops (the latter only if there is time) involve hikes upslope, over rough terrain.

[1] Siddoway, C.S. and Gehrels, G.E. (2014) Basement-hosted sandstone dikes of Colorado: a vestige of the Neoproterozoic revealed through detrital zircon provenance analysis: *Lithosphere* 6(6): 403–408 doi:10.1130/L390.1

Registration deadline for the trip will be **June 10**. Travel will be by rented vans (cost still to be determined), and departure will be Saturday, June 25th, at 7:30 am from the Park N Ride on west side of Denver Federal Center, off Union Blvd. at W. 2<sup>nd</sup> Place. Please register by contacting Cal Ruleman at [cruleman@usgs.gov](mailto:cruleman@usgs.gov), 303-236-7804, or 303-859-0911.



## CSS Field Trip #3, Saturday-Sunday, August 27-28, 2016

### Devonian strata & extinctions in western Colorado

Leader: Dr. James Hagadorn, Denver Museum of Nature and Science

The main part of this weekend field trip will be on Saturday, August 27; additional stops may be made on Sunday the 28<sup>th</sup> before returning to Denver. More details will be sent to all CSS members during the summer.

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## 2016 Distribution of Colorado Scientific Society Memorial Funds for Student Research

With help from past and present members of the CSS Officers and Council materials for soliciting applications for the Memorials funds were prepared in January and uploaded to the CSS website in early February. An e-mail blast was sent to an updated list of geoscience student mentors on February 9. The final application deadline was set as midnight, MT, April 15. A total of 27 applications were received (by e-mail), the first arriving on March 1, and twenty arriving on April 14 or 15. The e-mail blast brought in a nation-wide distribution of applications from students for projects in the Rocky Mountains region. Applications and appraisals from student mentors were distributed to the Evaluation Committee (Paul Morgan, Chair, Lisa Fisher, Melissa Foster, and Peter Barkmann) during the week of April 18, together with a matrix on which to score the applications on objectives (10 pts), importance (10 pts), plan (15 pts), budget (5 pts) and supervisor appraisal (10 pts), for a possible total of 50 points. The Evaluation Committee met on May 2 with a compilation of their individual evaluations and a ranking of their aggregate scores. The committee discussed each application. Over half of the applications were thought to be worthy of funding but funds limited awards to the following twelve applications, listed in alphabetical order of the student's last name:

Name	Student year	Award	Tweeto	Ortel	Eckel	Pierce	Snyder	School	Project Title
Ryan Creitz	MS 1	\$990		X				New Mexico State University	Stratigraphic history and provenance of Eocene synorogenic strata in southern New Mexico: implications of basin formation and sediment dispersal during the final stages of the Laramide orogeny
Andrew Harp	PhD 2	\$440			X			University at Buffalo, NY	Determining the propagation direction and an eruption's influence on magma flow direction within silicic dikes, Summer Coon Volcano, CO, USA
Kelly Kochanski	PhD 1	\$900			X			University of Colorado, Boulder	Sastrugi formation in the Rocky Mountains
Erin Lathrop	MS 1	\$1,000					X	Utah State University	Capturing changes in the Mesoproterozoic carbon cycle: C-isotope stratigraphy of the ~1254 Ma Bass Formation, Grand Canyon Supergroup, AZ
Caitlin Leslie	PhD 3	\$1,000	X					Baylor University	Paleoenvironment and Paleoclimate Reconstruction of the Lower Paleocene Nacimiento Formation, San Juan Basin, New Mexico

John Ethan Malone	UG Jr	\$1,140	X	X	X	X	X	Augustana College	Does the Florence Pass Shear Zone in the Big Horn Mountains of North-Central Wyoming exist?
James Daniel Pike	MS 1	\$1,000	X					Texas Tech University	Surface hierarchy characterization and wind parameters from a lower Permian coastal dune field, Ingleside Formation, Manitou Springs, Colorado
Anthony Pivarunas	PhD 1	\$800					X	University of Florida	Project Title: Paleomagnetism and Geochronology of the McClure Mountain igneous complex
Maxwell Pommer	PhD 2	\$1,000		X				Colorado School of Mines	Biotic and chemical controls on sedimentation, sequence stratigraphy, and diagenesis in the Phosphoria Rock Complex (Permian), Rocky Mountain region, USA
Sean Ross Scott	PhD 3+	\$730				X		University of Wyoming	Non-traditional stable isotope systematics of Yellowstone Hotsprings
Patrick Whalen	MS 2	\$1,000	X					University of Kentucky	Evaluating Pyroclastic Sedimentary Rocks: Examples from the Oligocene of Central Colorado
Ryan Wilhelmi	PhD 1	\$1,000					X	University of Florida	Protolith, Provenance, Cooling History and Deposition Age of Basement Rocks in the Blacktail Mountains Montana

One undergraduate student applications was included in the awards (Malone) and funds for this award were taken from each of the Memorial Funds.

During the week of May 2 all applicants were notified whether their applications were successful or unsuccessful. Where appropriate, unsuccessful applicants were given an indication where their application lost points. Successful applicants were asked to agree to the CSS policies and procedures for Memorial Fund awards before they were informed of the amounts of their awards and before the Treasurer was authorized to cut award checks. In general the Evaluation Committee was pleased with the quality of the applications but recommended that the application form should be revised before the 2017 applications.

Paul Morgan  
Chair, Evaluation Committee



## **CSS-cosponsored technical sessions at 2016 GSA Annual Meeting, Denver, Oct. 25-28**

CSS is sponsoring three topical sessions at GSA for the 2016 Annual Meeting in Denver. Please join us to make these sessions a success. Consider submitting a paper, encouraging your colleagues to submit, and we also are encouraging students to participate. Submission deadline is July 12, let's get momentum going for soliciting papers!

### **T205. The Colorado Scientific Society III: From the Mountains to the Plains—New Concepts and Discoveries in Colorado and the Rocky Mountain Region**

[Lisa Rae Fisher](#), Libby Prueher

*Colorado Scientific Society; Colorado Geological Survey; GSA Quaternary Geology and Geomorphology Division; GSA Structural Geology and Tectonics Division*

Colorado and the surrounding Rocky Mountain region is a geology wonderland. The region is rich in geologic history, yet there is always something new. Join us for presentations and discussion to find out what's happening.

### **T216. Cenozoic Evolution of the Southern Rocky Mountains and Northern Rio Grande Rift: Exploring Linkages between Geologic History, Processes, and Landscape Change**

[Scott A. Minor](#), Ren A. Thompson

*GSA Structural Geology and Tectonics Division; GSA Quaternary Geology and Geomorphology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Sedimentary Geology Division; SEPM (Society for Sedimentary Geology)*

The southern Rocky Mountains-Rio Grande rift has experienced diverse tectonism, magmatism, surface processes, and landscape change in the Cenozoic. Presentations are sought on research in this region exploring linkages between these processes at multiple scales.

### **T44. The Holistic Approach to Landscape Evolution: Incorporating Chronometric Data into the Geologic History of a Region.**

[Melissa A. Foster](#), Dylan J. Ward, Claire E. Lukens

*GSA Quaternary Geology and Geomorphology Division; GSA Sedimentary Geology Division; SEPM (Society for Sedimentary Geology); Colorado Scientific Society*

Geochronometers are powerful tools used to quantify rates of landscape evolution, but careful consideration must be given to geologic context and applicable timescales. We encourage contributions that interpret geochronometer results within broader geologic history.

## *April's Where is this Rock?*

Our first member to respond to this was Thom Fisher, who wrote, “Local area railroad buffs will recognize this as a monument to Billy Westall, engineer on the South Park and Pacific Railroad. Westall was killed in a train wreck in 1898 near Pine when the train hit a pile of debris. The initials “A.O.U.W.” and shield with the anchor belong to the “Ancient Order of United Workmen” a sort of union.”

Which is correct. I first came across this monument, at the time, quite hidden behind overgrown shrubs—when driving along the North Fork of the South Platte River, between Foxton and the confluence of the North and South Forks at “South Platte” some years ago (on my way to explore pegmatites). At the time, it took me quite a bit of searching and inquiring to learn what it was—just that single name “Westall” was a mystery then. A story about it appeared in “Historically Jeffco” in 2012, <https://historicallyjeffco.files.wordpress.com/2012/11/98westall.pdf>, “The Story of Billy Westall and the Westall Monument”. As you can see from my picture, the monument was very much leaning and seemed in danger of toppling into the nearby river. I was surprised and pleased to read in a recent edition of the Denver Post – YourHub, [http://www.denverpost.com/southjeffco/ci\\_29671638/jeffcos-westall-monument-highlighted](http://www.denverpost.com/southjeffco/ci_29671638/jeffcos-westall-monument-highlighted), “Jeffco's Westall Monument highlighted; Monument's story still garners interest more than 115 years after historic train accident”, By Joe Vaccarelli, YourHub Reporter, 03/24/2016, that thanks to a student group from West Jefferson High School, the monument has been moved 40 or 50 feet to an upright, more secure, and more visible spot along the road, with a picnic table and interpretive signs (I haven't seen these yet). The stone appears to be Pikes Peak Granite, and the dark engraved oval in the center is a gabbroic rock—exact source of either not known.



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## *Where is this Rock? – May*



Let me try something a bit different this time. These two pictures were both taken at the same mining site (though as you may surmise, at somewhat different elevations—separated by some 2000 vertical feet, in fact). This time, I'll admit that the site is *not* in Colorado, and that these are not my pictures this time... though it is in the U.S. If you have a guess, write to [pmodreski@usgs.gov](mailto:pmodreski@usgs.gov).



## *Calendar of upcoming events*

**Sun., May 22**, monthly meeting of the Florissant Scientific Society, meeting this day at the **Pueblo Weisbrod Aircraft Museum** (east of Pueblo at I-25 exit 101). Cort Hayden speaking

The May meeting will be at the Pueblo Weisbrod Aircraft Museum. “Museum hours are 10:00 to 4:00. At noon, we will converge on the meeting room behind the front desk for the talk and lunch. Lunch will be provided. Presentation will be by Howard “Cork” Hayden, author of “A Primer on CO<sub>2</sub> and Climate, and Bass Ackwards: How Climate Alarmists Confuse Cause with Effect”. For more information or directions contact Beth Simmons, [cloverknoll@comcast.net](mailto:cloverknoll@comcast.net), or see <http://www.fss-co.org/>.

**Tues., May 24**, 11:00, USGS Rocky Mountain Science Seminar, **Improving constraints on lower crust composition and structure using seismic anisotropy**, by Sarah Brownlee, Wayne State Univ. Denver Federal Center, Building 25 auditorium; visitors are welcome; use entrance E-14.

**Thurs., June 2**, 7:00 p.m., “**Ancient Wyoming with Kirk Johnson**”, special lecture at the Denver Museum of Nature and Science. “Our former chief curator, Kirk Johnson, returns to share his newest book that brings another ancient world to life. Johnson, now Sant Director of the Smithsonian National Museum of Natural History, and Jan Vriesen, world-renowned painter and muralist, joined forces to create Ancient Wyoming. Ever wondered what the ground below you was like millions of years ago? Merging paleontology, geology, and artistry, Ancient Wyoming breathes life into scenes of Wyoming’s changing landscape of vast oceans, lush rainforests, and mountain prairies and provides fascinating details on the flora and fauna of the past 300 million years. Johnson and Vriesen also collaborated on the Ancient Denvers mural project and book. Following the program, join us for a reception and see two of the original Ancient Wyoming murals, pulled especially from our collections for this event. Phipps Theater. For reservations go to <http://www.dmns.org/calendar> ; cost, \$12 member, \$15 nonmember.

Coming up during the summer and fall:

**Fri.-Sun., June 3-5**, **53<sup>rd</sup> annual Pikes Peak Gem, Mineral, and Jewelry Show**, sponsored by the Colorado Springs Mineralogical Society; at a new (indoor!) location, the Mortgage Solutions Financial Expo Center, “a community partnership between the University of Colorado—Colorado Springs (UCCS) and the Housing & Building Association of Colorado Springs (HBA)”, 3650 N. Nevada Ave., Colorado Springs. 10 a.m. – 5 p.m. Fri. & Sat., 10 – 4 Sun. See [www.csms-web.org](http://www.csms-web.org).

**Sat., June 18**, **CSS Field Trip, New discoveries of dinosaur tracks & markings at Dinosaur Ridge, Morrison CO**, led by Martin Lockley.

**Sat., June 25**, **CSS Field Trip, Basement hosted sandstone dikes of the Colorado Front Range: structural and other field relations, and contemplation of origin**, led by Christine Smith Siddoway.

**Sun., June 26**, “**Vince Matthews will lead a field trip to the Laramide fold structures along the northeastern flank of the Front Range uplift**”. This geology field trip will take place through the informal geology group, the Florissant Scientific Society; see <http://www.fss-co.org/page3.html> for details about this and the group’s other planned meetings and field trips, or contact Beth Simmons, at [cloverknoll@comcast.net](mailto:cloverknoll@comcast.net). All interested persons are welcome to attend. The trip will leave at 7:30 a.m. from a Park-and-Ride along I-25 at the north end of Denver, and return at 6:30 p.m.

**July 15-19**, the “**2<sup>nd</sup> Eugene E. Foord Symposium on Pegmatites, Golden Colorado**” will take place on the CSM campus. There will be a welcoming reception, two days of oral and poster presentations, and two days of field trips to Colorado pegmatite localities. See full registration information at <http://www.colorado.edu/symposium/pegmatite/> Pegmatite researchers from around the country and internationally are expected to attend, as well as local presenters. All interested persons are invited to attend; talks will cover a mixture of scientific research and general descriptive topics. Registration cost is \$100 (field trips included), full-time students \$50.



**July 28-31, Petroleum History Institute, Annual Symposium, “Casper, Wyoming, the Oil City”.** For more information see [www.petroleumhistory.org](http://www.petroleumhistory.org) .

**Fri., Aug. 26, 3:00 p.m.,** Earth Sciences Colloquium at the Denver Museum of Nature & Science, **Hot and high times in the western U.S., 80 Ma to Present**, by Katie Snell, CU Boulder. In VIP Room. All are welcome, museum admission is not required.

**Sat.-Sun., Aug. 27-28, CSS Field Trip, Devonian strata & extinctions in western Colorado**, led by James Hagadorn.

**Thurs, Sept. 15, CSS Student Presentation Night**, at Arbor House, Maple Grove Park, Golden (Applewood)

**Sep. 16-18, 49<sup>th</sup> annual Denver Gem and Mineral Show**, Denver Mart, Denver, CO. **Minerals of Africa** is the 2016 show theme. See <https://www.facebook.com/Denver-Gem-And-Mineral-Show-154290574610235/?fref=ts>

**Fri., Sep. 23, 3:00 p.m.,** Earth Sciences Colloquium at the Denver Museum of Nature & Science, **Jurassic-Cretaceous paleogeographic evolution of the Western Interior Seaway** , by Ron Blakey, Colorado Plateau Geosystems. In Ricketson Auditorium. All are welcome, museum admission is not required.

**Mon., Sep. 29, 3:00 p.m.,** Earth Sciences Colloquium at the Denver Museum of Nature & Science, **Deciphering the Rocky Mountains**, by Beth McMillan, University of Arkansas-Little Rock . In VIP Room. All are welcome, museum admission is not required.

**Thurs., Oct. 20, 7:00 p.m., CSS meeting, Climate Change, Part I and II**, by William W. Little & Thom Fisher.

**Oct. 25-28, Geological Society of American Annual Meeting, Denver, CO** (plus pre- and post-meeting field trips). See <http://community.geosociety.org/gsa2016/home> . Abstracts deadline is July 12.

**Thurs., Nov. 17, CSS meeting, Terrestrial ecosystems during the Mesozoic**, by Joe Sertich, DMNS.

**Thurs., Dec. 15, CSS Potluck dinner, Annual Meeting, and President’s Address**

***Special exhibits in 2016:***

**"Critical Materials"** is a new in The Colorado School of Mines Geology Museum. The exhibit highlights critical materials and rare-earth elements - including the minerals the elements can be derived from - essential to the development of advanced technology and energy. The exhibit is a joint project of the Critical Materials Institute at the School of Mines and the Colorado School of Mines Geology Museum. Mandi Hutchinson, graduate student at CSM, played a major role in planning and design of the exhibit. The exhibit focuses on the elements Li, Y, Te, Nd, Eu, Tb, Dy, their minerals, and their uses in technology. You’ll find the exhibit downstairs in the museum, near the Gift Shop.

**Unearthed: Ancient Life in the Boulder Valley**, at the at the University of Colorado Museum of Natural History (Henderson Building; in the Anthropology Hall), CU campus, Boulder, “This new exhibit features a collection of 80+ stone tools known as The Mahaffy Cache that was found in a Boulder backyard in 2007. The artifacts were studied by CU Boulder Professor of Archaeology Doug Bamforth, Ph.D. He dates the tools to 13,000 years ago at the end of the last ice age. The exhibit includes interactive elements and video, as well as replicas of the tools that visitors can pick up and hold.” Open daily, no admission charge.

**Western Museum of Mining & Industry, Colorado Springs:** their latest temporary exhibit opened in February, **“Cheyenne Mountain at 50: Military Icon, Engineering Marvel”**. See <http://www.wmmi.org> ./ “Until mid-June 2016”.

*For more lecture series during the year see: (the several university lecture series will resume in September)*

**Colorado Café Scientifique in Denver**, monthly lectures on science topics held either at Blake Street Station or Brooklyn's, Denver; open to the public, no charge other than refreshments you may choose to purchase; see <http://cafescicolorado.org/>.

**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/departments-seminars>

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

**Denver Mining Club** (Mondays, 11:30), 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>

**Florissant Scientific Society** (FSS); meets monthly in various Front Range locations for a lecture or field trip; meeting locations vary, normally on Sundays at noon; all interested persons are welcome to attend the meetings and trips; see <http://www.fss-co.org/> for details and schedules.

**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/>.

### **2016 CSS Elected Officers**

President.....Peter Barkmann, 303-384-2642, barkmann@mines.edu  
President Elect.....Marith Reheis, 303-277-1843, marith16@gmail.com  
Past President.....Paul Morgan, 303-384-2648, morgan@mines.edu  
Secretary.....Lisa Fisher, 303-215-0480, lisa.fisher@alumni.mines.edu  
Treasurer.....Don Sweetkind, 303-236-1828, dsweetkind@usgs.gov

### **Councilors**

2014-2016: Celia Greenman, celia.greenman@earthlink.net  
2014-2016: Chris Morrison, chris-morrison@comcast.net  
2015-2017: Bruce Geller, bgeller@mines.edu, 303-273-3823  
2015-2017 Pete Modreski, pmodreski@usgs.com, 303-202-4766  
2016-2018: Linda Barton Cronoble, lbarton1611@gmail.com, 720-338-1237  
2016-2018: Melissa Foster, melissa.ann.foster@gmail.com, 707-498-2484

### **Committee Chairpersons**

Database Manager: Don Sweetkind, 303-236-1828, dsweetkind@usgs.gov  
Field Trip Chair: Cal Ruleman, 303-236-7804, cruleman@usgs.gov  
GSA Meeting Co-chairs, Lisa Fisher & Libby Prueher  
History Chair: Beth Simmons, cloverknoll@comcast.net  
Hospitality Chair: Linda Barton Cronoble, 720-338-1237, lbarton1611@gmail.com  
Membership Chair: open  
Newsletter Editor: Pete Modreski, 303-202-4766, pmodreski@aol.com or pmodreski@usgs.gov  
Outreach Chair: open  
Past Presidents' Best Paper Award, Marith Reheis, 303-277-1843, marith16@gmail.com  
Program Chair: Thom Fisher, thom.fisher@esclantemines.com, 303-674-1233  
Publicity Chair: open  
State Science Fair: Chuck Weisenberg, 303-238-8806, cweisnbrg@msn.com  
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