Newsletter of the Society **September 2016**

Colorado Scientific Society

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

September Meeting – Student Paper Night
Thursday, September 15, 2016, 5:45-9:00 p.m.
Arbor House, Maple Grove Park (Applewood area)
14600 W 32nd Ave., Golden CO 80401

A happy hour social (5:45-7:00) will be followed by student talks (6 students, 15 minute slots). "BYOB" is allowed at our venue, so this will be a true happy hour social!. CSS will provide light snacks (not all that light, really—we'll have chips, crackers, cheese, veggies, sub sandwiches). We would like to thank Golden City Brewery for their generous donation of a pony keg of one of their brew products. Join us at 5:45 for the happy hour and enjoy a brew while supplies last. Soft drinks will be provided by CSS, and feel free to bring your own wine or other beverage of choice if you care to.

Our annual Student Paper Night is a CSS tradition. From abstracts submitted to us, a committee has selected 6 papers for an oral presentation. Each talk will be 12 minutes with an additional 3 minutes for questions. Students who were not selected as a speaker were invited to participate in the student poster session- posters from previous presentations at meetings were encouraged as well as new posters. Graduate students, undergraduates, and recent (2016) graduates were all invited to participate. We will have 9 poster presentations on display, which can be viewed during the social hour time.

Best of all- the CSS members will vote for their favorite talk. Please come out to vote!!! The "Best in Show" winner will be treated to a $250 grand prize!! All other speakers will be given a small award to cover gas/ transportation.

CSS members, please come out and support our students! This is a wonderful opportunity to share your experience in the work force, mentor students, and check out some of the cutting-edge research going on in our own backyard! We would love to incorporate students into CSS activities- so your participation at this event is critical!

Oral Presentations

William Armstrong, PhD candidate, CU Boulder
Chinks in the armor: using satellite imagery to quantify ice cliff contributions to melt on debris-covered glaciers

Marisa Boraas-Connors, 2nd year MS student, CSU
Paleoenvironmental insights from the $^{187}Os/^{188}Os_i$ parameter of the Re-Os geochronometer with an example from the Late Jurassic Agardhfjellet Formation, Svalbard, Norway.

Sarah Crump, PhD candidate, CU Boulder
Envisioning a warmer Arctic: Holocene paleovegetation reconstructions from ancient DNA preserved in lake sediments on Baffin Island, Arctic Canada

Sarah Evans, PhD candidate, CU Boulder
Analysis of groundwater flow in mountainous, headwater catchments with permafrost

Jamie Glass, senior undergraduate student, CU Boulder
Latest Jurassic to Early Cretaceous cooling of the Bartle Frere Pluton, North Queensland Australia, revealed by (U-Th)/He analysis of Apatite and Zircon.

Evan Jones, PhD candidate, CSM
The Size of the California Paleoriver and its Termination in the Wasatch Fluvial Fan System: Implications for the Eary Eocene Paleogeography of the Western Colorado Plateau

Poster Papers
Matthew Bauer and Michael Harty, 2nd year MS students, CSM
Induced seismicity in the Denver Basin prompts updated basement fault configuration model

Melissa Bernardino, PhD Candidate, CU Boulder
Understanding upper mantle deformation beneath the Sierra Nevada, CA using shear-wave anisotropy tomography

Cailey Condit, PhD Candidate, CU Boulder
The role of hornblende in deep crustal seismic anisotropy: an investigation of the importance of deformation mechanisms

Michael Genecov, 3rd year PhD student, CSM
Middle Thompson Creek isolated sandbody: Its place in the Piceance Basin stratigraphy

Rachel Glade, 3rd year PhD student, CU Boulder
Blocks control hillslope evolution in layered landscapes

Kelly Kochanski, 2nd year PhD student, CU Boulder
Ice accumulation and the apparent seasonal variation of GPS stations in Alaska.

Adam Nielson, 2nd year MS student, CSU
Using synthetic forward seismic models of channelized deep-water slope deposits to inform stratigraphic interpretation, Tres Pasos Formation, Magallanes Basin, Chile

Simon Pendleton, PhD candidate, CU Boulder
Initial insights into the Quaternary evolution of the Laurentide Ice Sheet on southeastern Baffin Island

Eric Winchell, PhD candidate, CU Boulder
Exploring the landscape evolution of the subalpine meadow-forest system driven by the geomorphic work performed by the Northern Pocket Gopher

Abstracts of the oral presentations follow, below.

Chinks in the armor: using satellite imagery to quantify ice cliff contributions to melt on debris-covered glaciers

Authors: William Armstrong, Leif Anderson, Robert Anderson

Glaciers mantled with a thin cover of rock debris are hypothesized to be less sensitive to climate change due to their insulating "blanket" of debris cover. Such glaciers are found worldwide, but especially in Alaska and the Himalaya, and may become more prevalent with climate warming and bare ice melts. Debris-covered glaciers commonly feature bare ice cliffs, which are zones of rapid ice melting, effectively acting as "chinks" in the insulating "armor" of debris. If a glacier features a sufficient quantity of bare ice cliffs, rapid melt at these locations could offset melt reduction due to debris cover, causing debris-covered glaciers to be just as sensitive to climate warming as bare ice glaciers. We present a novel method to automatically quantify bare ice area on debris-covered glaciers from high resolution (0.5 m pixel) satellite imagery. Using an optimized parameter set, we accurately identify between 45-58% of ice cliff area. Including false positives, and assuming their incidence rate is uniform across the glacier, our automated estimates of ice cliff area are 69-79% of manually digitized ice cliff area. We thus underpredict the areal extent of ice cliffs and provide a conservative estimate of the magnitude of ice melt associated with these features. We find ice cliffs constitute 8.8-9.6% of the ~25 km^2 debris-covered terminus of Kennicott Glacier, Alaska. Ice cliff areal concentration peaks at 13% at 550 m elevation, which corresponds to the down-glacier limit of "active ice" before the glacier's "dead" tongue. At this elevation, bare ice melts at ~5-7 cm day-1, which, when applied over the 0.15 km^2 of ice cliff area in this elevation band, equates to ~7,500-10,500 m^3 of melt that would have not occurred under continuous debris cover. These findings have implication for the stability and future evolution of debris-covered glaciers.

Paleoenvironmental insights from the 187Os/188Osi parameter of the Re-Os geochronometer with an example from the Late Jurassic Agardhfjellet Formation, Svalbard, Norway.

Name: Marisa Boraas-Connors, Hannah, J. L., Markey, R., and Stein, H. J.

Over the past decade, the rhenium-osmium (Re-Os) geochronometer has been proven to yield accurate and precise ages for black shales. In addition, the initial $^{187}Os/^{188}Os$ ratio (Os_i) parameter of the isochron can yield information about paleoenvironmental conditions at the time of deposition, especially when tied to additional chemical data.

Organic matter in marine sediment provides a reducing environment that draws down Re and Os from the overlying water column. Os sequestered in black shales records short-term changes in the proportions of various Os inputs due to its geologically brief ocean residence time of ~28 ka (Stein and Hannah, 2015, Springer). The $^{187}Os/^{188}Os$ ratio in seawater represents a balance of sources. Chemically primitive sources, such as the mantle, hydrothermal, and cosmogenic input, lower the $^{187}Os/^{188}Os$ ratio of seawater (e.g. present day cosmogenic $^{187}Os/^{188}Os \approx 0.127$). Weathering of chemically mature sources such as evolved crustal material will raise the $^{187}Os/^{188}Os$ ratio of seawater (e.g. average continental crust $^{187}Os/^{188}Os \approx 1.4$). As long as the Re-Os system is not affected by diagenesis, the Os_i in black shales are representative of the $^{187}Os/^{188}Os$ ratio in seawater at the time of deposition.

Drill core from the Late Jurassic Agardhfjellet Formation (AF) was collected near Longyearbyen, Svalbard for Re-Os geochronometry. The AF consists of black shales and siltstones with intermittent siderite/glauconite horizons deposited in a tectonically-quiet, shallow marine shelf. The Os_i from the Re-Os isochrons increase systematically over ~12 Ma from 0.402 ± 0.007 in the Oxfordian to 0.67 ± .05 in the Lower Volgian, also seen in the correlative Hekkingen Formation of the Barents Sea (Markey et al, submitted) indicating a regional trend. This reflects possible increases in continental weathering. This is corroborated by a decrease in $\delta 13C_{org}$ from -25.25 ‰ to -26.95 ‰ of the same interval, a trend that has been identified in $\delta 13C_{org}$ and $\delta 13C_{carb}$ from correlative Boreal and Tethyan intervals. Other workers have interpreted this as increasing precipitation and chemical weathering in an increasingly hot and humid climate (Weissert and Mohr, 1996; Koevoets et al, 2016). The AF shows how the Os_i can be used in conjunction with additional chemical data to infer paleoenvironmental changes over time.

Envisioning a warmer Arctic: Holocene paleovegetation reconstructions from ancient DNA preserved in lake sediments on Baffin Island, Arctic Canada

Authors: Sarah E. Crump, Gifford H. Miller, Michael Bunce

One expected consequence of a rapidly warming Arctic is a poleward expansion of high-latitude plants. An increase in woody vegetation at high latitudes will both reduce surface albedo and increase atmospheric water vapor, further amplifying warming. In order to accurately capture this positive feedback in future climate projections, it is necessary to constrain the expected ecological response to a warming Arctic. Tracking past changes in vegetation in response to temperature fluctuations, particularly during past warm times, has the potential to provide critical insights into the ecological response to temperature changes and the mode of plant colonization following ice retreat. Here we present the first lacustrine sedimentary ancient DNA (*sed*aDNA) record from the Eastern Canadian Arctic, in which we use universal plant primers trnL and rbcL to target vascular plant sequences. DNA was extracted from a 1.5-m core from Qauppat Lake (QPT), a small moraine-impounded lake in the Frobisher Bay region of southern Baffin Island, Arctic Canada. Amplifiable DNA was obtained from subsamples down to 140 cm depth, providing a continuous record of vegetation spanning much of the Holocene. Preliminary results reveal a wide range of taxa known to occur in the Arctic, indicating that the DNA analyzed was indeed endogenous, and contamination issues were minimal. *Betula glandulosa* (dwarf birch), a shrub currently near its northern limit at this site, appears in the record at 85 cm depth and remains present to the surface, indicating that the establishment of a temperature-sensitive woody plant is well-constrained with this approach. When paired with other paleoclimate proxies from the same core, particularly paleotemperature proxies, *sed*aDNA has the potential to significantly advance our understanding of the complex relationship between climate and vegetation.

Analysis of groundwater flow in mountainous, headwater catchments with permafrost

Authors: Sarah Evans, Shemin Ge, and Sihai Liang

Headwater catchments have a direct impact on the water resources of downstream lowland regions as they supply freshwater in the form of discharging groundwater. Often, these mountainous catchments contain expansive permafrost that may alter the natural topographically-controlled groundwater flow system. As permafrost could degrade with climate change, it is critical to understand the effect of permafrost on groundwater flow in headwater catchments. This study characterizes groundwater flow in mountainous headwater catchments and evaluates the effect of permafrost on groundwater movement using a three-dimensional, finite element, hydrogeologic model. The model is applied to a representative headwater catchment on the northern Qinghai-Tibet Plateau, China.

Results from the model simulations indicate that groundwater contributes significantly to streams in the form of baseflow and the majority of groundwater flow is from the shallow aquifer above the permafrost, disrupting the typical topographically-controlled flow pattern observed in most permafrost-free headwater catchments. Under a warming scenario where mean annual temperature is increased by 2 °C, the areal extent of permafrost in the catchment decreases by 28%. With this reduction in permafrost extent, groundwater contribution to streamflow may increase three-fold. These findings suggest that, in headwater catchments, permafrost has a large influence on groundwater flow and stream discharge. Increased annual temperatures will increase groundwater discharge to streams, which has implications for ecosystem health and the long-term availability of water resources to downstream regions.

Latest Jurassic to Early Cretaceous cooling of the Bartle Frere Pluton, North Queensland Australia, revealed by (U-Th)/He analysis of Apatite and Zircon.

Authors: Jamie A. Glass, Lon D. Abbott, Rebecca M. Flowers, James R. Metcalf

We employed the apatite (U-Th)/He (AHe) and zircon (ZHe) low temperature thermochronometers to explore the exhumation history of the North Queensland segment of Australia's Great Escarpment. The goal of this work was to better decipher the evolution of this rifted margin and how it compares with that of better-studied segments of this same escarpment. Previous workers have attributed escarpment development to Cretaceous-Paleogene rifting during opening of the Tasman and Coral seas. Our 1500m vertical transect up the

escarpment sampled the I-type Bartle Frere pluton of the ca. 280 Ma Bellenden Ker Batholith is exposed from the base to the top of Mount Bartle Frere.

A previous apatite fission track (AFT) study determined that the escarpment base cooled through ~110 °C at 142.3 ±9.9Ma. Our preliminary ZHe analysis of the same outcrop reveals that it passed through ~180 °C at ca. 155 Ma. These data indicate that an episode of relatively rapid exhumation occurred during the latest Jurassic to earliest Cretaceous, which brought the pluton up from approximately 6 km to 3.5 km depth (assuming a 30 °C/km geothermal gradient).

Samples throughout the entire transect yielded AHe dates ranging from 72 Ma to 182 Ma, with no apparent elevation-date relationship. These data suggest that the pluton continued to cool during the Cretaceous to below ~65 °C, indicating unroofing to less than ~2 km depth. The data scatter makes it difficult to resolve the details of this later stage of cooling, however the fact that we obtain Cretaceous AHe ages across the entire 1500 m vertical transect suggests that the Great Escarpment in North Queensland has existed at approximately its current location and height since at least the Late Cretaceous. Based solely on AFT results from low elevation samples, previous workers concluded, by contrast, that this segment of the Great Escarpment developed after the Cretaceous. Our Cretaceous age for this segment is similar to the age determined by other AHe workers for the segment in southern New South Wales.

The Size of the California Paleoriver and its Termination in the Wasatch Fluvial Fan System: Implications for the Early Eocene Paleogeography of the Western Colorado Plateau

Authors: Evan Jones *and Piret Plink-Björklund; Colorado School of Mines*

The interpretation of the provenance Wasatch Formation exposed in the Roan Cliffs along the Southern Margin of the Uinta Basin, UT has evolved over time and remains somewhat enigmatic. The Wasatch Fm. is immature compositionally (feldspathic litharenite) suggesting a relatively proximal source (i.e. the nearby basement-involved San Rafael Swell and Uncompahgre Uplifts; Dickinson et al., 1986), but more than half of the detrital zircons sampled from the unit are younger than 250 Ma suggesting a connection to plutonic rocks of that age in the Cordilleran Magmatic Arc and Mogollon Rim in Southeastern California and Northwestern Arizona (Dickinson et al., 2012). This study uses a source-to-sink approach to calculate the scale of the river that deposited the Wasatch Fm. and stratigraphic and sedimentological analysis to constrain the type of river system and the prevailing hydrological conditions during deposition.

In the study area the Wasatch Fm. analysis of measured stratigraphic sections and photopanels reveal net-to-gross changes and paleocurrent patterns consistent with a radially dispersive fluvial fan system. In the axial portions of this fluvial system channel deposits are 20+ meters thick and are organized into downstream accreting barforms dominated by upper flow regime and high deposition rate sedimentary structures. Paleosols are commonly developed along accretion surfaces, and long terrestrial bioturbation traces (up to 5m) are present below bar accretions surfaces. Both of these observations necessitate prolonged period of channel abandonment after bar deposition. It is our interpretation that the prevailing hydrologic regime in the river system that deposited the Wasatch Fm. was ephemeral to very flashy. To both the west and east of the interpreted axis of the system maximum channel thickness, degree of vertical and lateral channel amalgamation, and the percentage of sandy channel fill deposits relative to floodplain and paleosol deposits decrease. Paleocurrent directions measured across the roan cliffs display a radially dispersive pattern. Integrating all of these observations we interpret the Wasatch Fm. as a fluvial fan system, and using a quantitative methodology developed by Owen et al. (2015) we project the location of the apex of the fan system to its origin in Southern Utah.

Calculated flow rates necessary to deposit the size of channels with flow conditions observed in the axial region of the Wasatch fluvial fan are approximately 20,000 m^3/sec. In a dataset of gauging station data in more than 400 modern rivers analyzed in this study, the minimum catchment size that produced bankfull discharge rates of 20,000 m3/sec was 197,000 km^2. Using an empirical regression between the magnitude of bankfull

discharge and drainage basin area developed from all 400+ rivers in this study we predict that the catchment size of the river that deposited the Wasatch fluvial fan was approximately 350,000 km^2. This prediction supports the hypothesis of Dickinson et al. (2012) that the river system that deposited the Wasatch Fm., the California Paleoriver, had catchments as far as the Mogollon Highlands of Arizona and Mojave terrain of Southeastern California. This prediction constrains the provenance of the Wasatch Fm., and also supports a dominantly north-flowing drainage system in the Western Colorado Plateau during the Early Eocene.

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CSS at the Geological Society of America Annual Meeting, Sept. 25-28:

CSS will once again have a booth in the Exhibit Hall at the meeting! **If you can help spend a few hours at the booth to talk to people about CSS**, please contact Lisa Fisher, lisa.fisher@alumni.mines.edu . Exhibit hall hours will be 2-7 p.m. Sunday 9/25, 10-6:30 Monday and Tuesday, and 10-2 Wednesday. Volunteers at the booth, or others who might like to visit the Exhibit Hall, can obtain a complimentary pass courtesy of CSS; again, please contact Lisa. CSS is also sponsoring a technical session and a poster session at the meeting. I do not seem to have the full information on this at hand at this time [-*ed.*], so we'll be sending all our members an email with more details, between now and the meeting.

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We are sorry to learn that CSS member, past president, and former State Geologist **Vince Matthews** is leaving Colorado! A letter from Vince:

Friends and Colleagues,

This is to let you know that Susan and I are moving to lower elevation in October. Of course, when you live in the highest city in the nation (10,152 feet above sea level), it is a bit of an oxymoron to say you are moving to lower elevation. But, our new home in the town of Pleasant Valley, Wisconsin is 'only' 1,000 feet above sea level. We will be nine miles south of Eau Claire.

I first came to Colorado in 1971 to teach at the University of Colorado which was a wonderful experience. In the ensuing thirty years spent in Colorado (had to leave for fifteen years to chase the elusive paycheck), I had more fabulous experiences than I could have imagined were possible-- culminating in the best job in the world: State Geologist of Colorado and Director of the Colorado Geological Survey. Along the way, I have had the opportunity to work (in one way or another) with an incredible array of outstanding colleagues, and just plain good people. Only yesterday, I was up at 13,000 feet on Pennsylvania Mountain learning from James Hagadorn who expressed the sentiment that I strongly hold, to wit: Colorado has amazingly diverse and fascinating geology!

Our last three years in Leadville have greatly exceeded my expectations. The community has wonderfully talented people who have been very welcoming to us. Watching the sun rise every morning on the two highest peaks in the entire Rocky Mountains has been a great way to start the day.

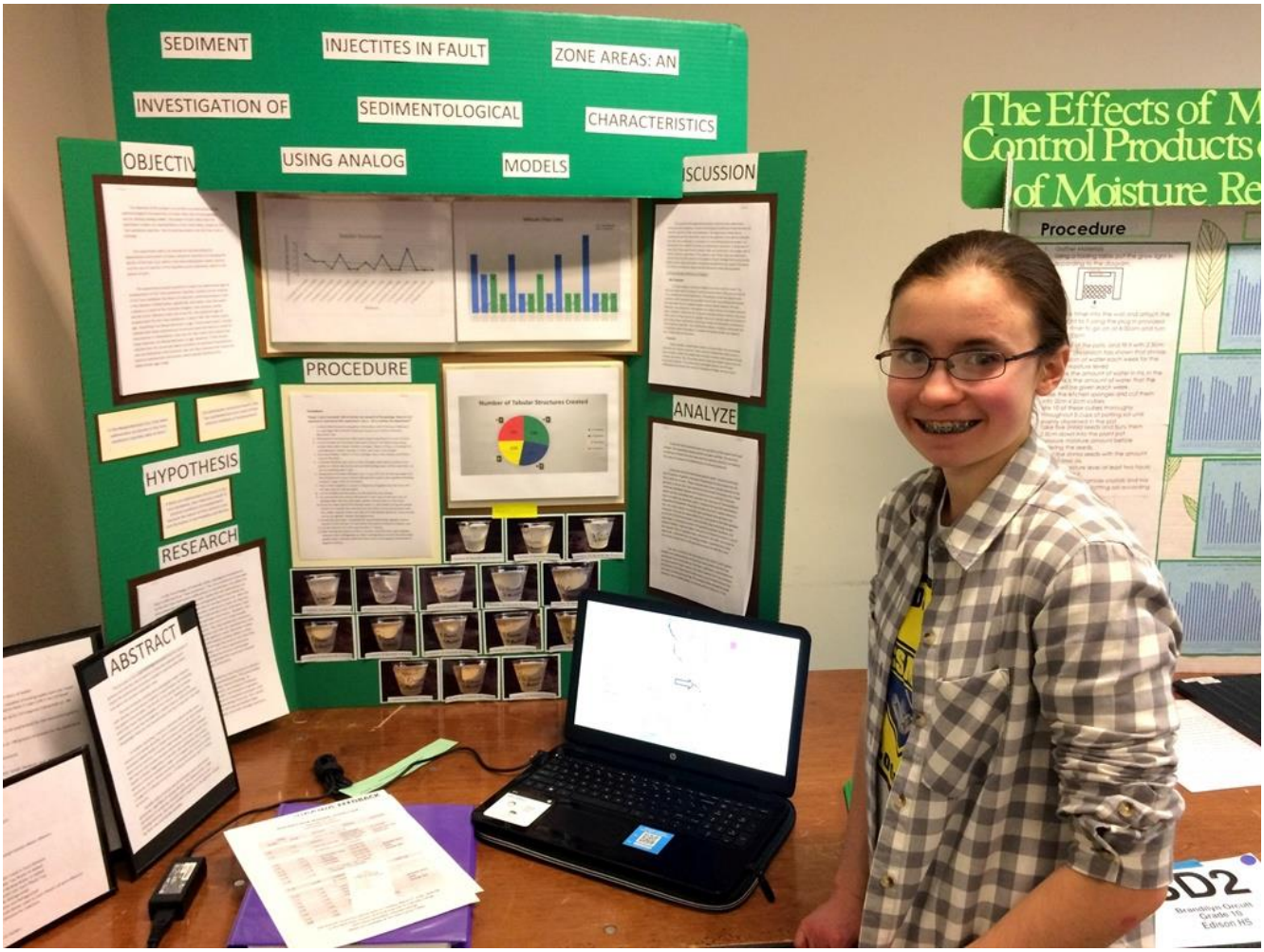
I am already exploring the geology of our new home. We will be on Cambrian sandstone in the Western Uplands. Come see us and we might show you 'The Great Unconformity" (the Grand Canyon has nothing on Wisconsin, in fact, there the Great Unconformity is about a billion-year-less gap than in Wisconsin).

Vince
New Address: E4770 Pinewood Circle; Eleva WI 54738 (Email and phone remain the same).

Colorado Scientific Society Student Member Wins Big at State Science Fair

By Steven Wade Veatch

Jenna Salvat, a ninth grade student at Coronado High School, brought home several awards from the recent Colorado Science and Engineering Fair held at the College of Natural Sciences Education and Outreach Center at Colorado State University in Fort Collins on April 9, 2016.



Her entry, "Sandstone Injectites in Fault Zone Areas: Sedimentological Characteristics Using Analog Models," won second place in the Senior Division Earth and Space Sciences at the Colorado Science and Engineering Fair. Jenna's work was honored by other organizations, including the Colorado Mineral Society, the Rocky Mountain Association of Geologists, and the Colorado Section of the American Institute of Professional Geologists. Jenna also received the Naval Science Award and the NASA Earth Science System Award. Her hard work has paid off in spades.

Before moving to the state finals, her project won first place in the regional Science Fair held at the University of Colorado at Colorado Springs on February 27, 2016. Jenna will now travel with her project to the Intel International Science and Engineering Fair (ISEF) to be held in Phoenix, May 8-13, 2016. The ISEF is the leading pre-college scientific and engineering research event that is held each May. In Phoenix more than 1500 students from 70 countries will compete for scholarships, tuition grants, internships, and other prizes.

Jenna began her work last summer with two sponsors: Christine Siddoway, a professor of geology at Colorado College and geoscience researcher Steven Wade Veatch. Jenna's project centered on analyzing sandstone

injected into Pikes Peak Granite. Jenna looked at the simulated rate of injection of liquefied sediment into igneous rock under variable densities and how that would impact the formation of sedimentary structures. "My project helps to understand the numerous and complex sedimentary structures at exposure sites in the Pikes Peak region that were created in response to the agitation caused by fault zone earthquakes," Jenna said.
The science fair teaches students how to explore a topic of their own interest, using real scientific inquiry, and then learn how to present their findings. Jenna's science fair project began on a field trip to the sandstone she is investigating through the Pebble Pups, a special program for youth in the Pikes Peak region to learn about the geosciences. Since then Jenna has put in countless of hours into the project. She would like to be a geoscientist. "I enjoy the process of science and working at the frontier of discovery," she said.
Jenna is a member of the Pikes Peak Pebble Pups and is an Earth Science Scholar in that program. The Pebble Pup program operates under the Colorado Springs Mineralogical Society. Jenna is also a member of the Colorado Scientific Society.

Editor's note. Jenna is one of several Colorado Springs area students who have participated in the "Pebble Pups" educational group mentored by Steve Veatch (also a CSS member). Steve has encouraged several of the young people to become student members of the CSS. Jenna did participate in, but did not win a further award, the Intel International Science and Engineering Fair, in May. We congratulate Jenna for her good project and for her interest in science, and in the CSS. Photograph of Jenna and her project was supplied by Steve Veatch.

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CSS Permian-Triassic field trip cancelled. As those among our members who had expressed interest in the trip learned, the field trip to examine the Permian-Triassic Lykins Formation of eastern Colorado, to have been led by Dr. James Hagadorn in August, was cancelled for the time being. We hope to offer this trip again, perhaps in the spring 2017, as do we also hope to reschedule James' West Slope trip to the Colorado Devonian in the Flat Tops area.

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Upcoming CSS meetings & field trips:
September 15, Student Presentation Night — at Arbor House in Maple Grove Park, Golden
October 20— Climate Change, Part I and II: Part I, A Geologist's View, by William W. Little, Professor of Geology, Brigham Young University-Idaho, Rexburg, Idaho; and **Part II, Models, Data, Predictions, or "*Why Climate Models are Like Sausages*"**, Thomas R. Fisher, CEO, Escalante Mines Inc. Evergreen, Colorado. At our regular meeting place, Shepherd of the Hills Presbyterian Church, 11500 W. 20th Ave., Lakewood CO.
November 17— Joe Sertich, Curator of Vertebrate Paleontology, Denver Museum of Nature & Science; **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.

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

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Calendar of upcoming events

Sept. 10-18, Denver Coliseum Mineral, Fossil, and Gem Show, 10-6 daily, 4600 Humboldt St., Denver CO. Free admission. See http://www.coliseumshow.com/ .

Sept. 11-18, Colorado Mineral and Fossil Show, 10-6 daily except 10-5 Sun. 9/18. Ramada Plaza - Denver Central, 4849 Bannock St., Denver, CO. Free admission, and free shuttle to the Denver Mart. See http://www.mzexpos.com/denver .

Wed. – Sat., Sept. 14-17, Denver Fine Mineral Show, at Marriott Denver West, 10-6 Wed.-Fri., 10-5 Sat., 1717 Denver West Blvd., Golden CO. Free admission. See http://www.finemineralshow.com/ .

Wed., Sept. 14, 6:00-9:00 p.m., **Open House at the Colorado School of Mines Geology Museum.** All are invited; refreshments and viewing of new exhibits prepared for the coming year. A chance to meet museum curators, mineral collectors, and dealers who are in town for the Denver Gem and Mineral Show.

Thurs, Sept. 15, 5:45-9:00 p.m., Colorado Scientific Society, Student Presentation Night, at Arbor House, in Maple Grove Park, 14600 W. 32nd Ave., Golden (Applewood area). All are welcome to attend, no admission charge, free refreshments. A selected group of graduate students from area universities will give presentations about their geology/earth science thesis research topics, and all attending will be able to vote for "the best presentation". For details see http://www.coloscisoc.org/ .

Sept. 16-18, 49th annual Denver Gem and Mineral Show, Denver Mart, Denver, CO. **Minerals of Africa** is the 2016 show theme. 9-6 Fri., 10-6 Sat., 10-5 Sun. See http://www.denvermineralshow.com/ or https://www.facebook.com/Denver-Gem-And-Mineral-Show-154290574610235/?fref=ts

Fri., Sept. 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., Sept. 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., **Colorado Scientific Society October meeting, Climate Change, Part I and II,** by William W. Little & Thom Fisher. Shepherd of the Hills Presbyterian Church, 11500 W. 20th Ave., Lakewood CO. Social time beginning at 6:30; meeting & program at 7:00. All are welcome to attend; see www.coloscisoc.org.

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, Colorado Scientific Society November meeting, Terrestrial ecosystems during the Mesozoic, by Joe Sertich, DMNS. Shepherd of the Hills Presbyterian Church, 11500 W. 20th Ave., Lakewood CO.

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

Special museum exhibits:
The "**Critical Materials"** exhibit continues at the Colorado School of Mines Geology Museum. It highlights critical materials and rare-earth elements - including the minerals these 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. 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, which is open daily, 9-4 Mon.-Sat., 1-4 Sun., no admission charge; see http://www.mines.edu/Geology_Museum .

Unearthed: Ancient Life in the Boulder Valley, on exhibit at the University of Colorado Museum of Natural History (Henderson Building; in the Anthropology Hall), CU campus, Boulder. Featuring 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." The museum is open daily, no admission charge. See https://cumuseum.colorado.edu/ .

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/department-seminars
Van Tuyl Lecture Series, Colorado School of Mines, (Tuesdays, 4 p.m.): http://inside.mines.edu/GE_Lecture-Series
Denver Mining Club (Mondays, 11:30), see http://www.denverminingclub.org/
Denver Region Exploration Geologists Society (DREGS; 1st 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, 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/ .

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
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