

Colorado Scientific Society

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

Two talks by
Warren B. Hamilton
Distinguished Senior Scientist
Department of Geophysics,
Colorado School of Mines



**DRIVING MECHANISM AND
3-D CIRCULATION OF PLATE
TECTONICS**

AND

**BEFORE
PLATE TECTONICS—EARTH'S
FIRST 4 BILLION YEARS**

**
NOT Thursday

Wednesday, April 21, 2010

**Colorado School of Mines—Department of Geology and Geological Sciences,
Berthoud Hall, Room 241, Golden, CO**
Social half-hour—6:30 p.m. Meeting time—7:00 p.m.

April Talk Abstracts by Warren Hamilton (see figures on p. 3)

Talk #1: Driving Mechanism and 3-D Circulation of Plate Tectonics

Popular explanations of plate tectonics are not based on knowledge of the behavior of plates but rather on cartoon misconceptions combined with geochemical speculations that the lower mantle is unfractionated and the upper mantle has been progressively depleted by continental growth. From these conjectures, geodynamicists conjure whole-mantle convection, plates driven from below, and deep-mantle subduction and plumes, all of which are refuted by powerful evidence but hang on as zombie science (www.mantleplumes.org/Zombie.html). The Atlantic spreads very slowly and is rimmed by separating continents, whereas the Pacific spreads very rapidly, is rimmed by subduction, and is getting smaller: hinges roll back. Leading edges of overriding plates mostly are unshortened. Spreading ridges are pulled apart, not pushed, no ridges or trenches are “fixed,” and spreading ceases when ridges meet trenches. Plates and subduction are driven by density inversions produced by cooling from the top. Seismological and mineral-physics evidence best accords with the 650 km discontinuity, the base of the upper mantle, as a barrier to material going either up or down. Almost none of this is considered in popular models.

Young subducting oceanic lithosphere becomes marblecaked into the mid-upper mantle beneath overriding plates, but older lithosphere is laid down on the 650 as hinges roll back. Slabs sink steeply—they do not slide down slots—and push all sublithospheric upper mantle back toward fast-spreading ridges (e.g., Pacific). Only subducted lithosphere is transferred to slow-spreading passive oceans for recycling (e.g., Atlantic, and back-arc basins). Subducting plates are driven by their mass toward their only exits from the surface, and overriding plates are sucked toward sinking slabs. Motions are self-organized from the top.

Talk #2: Before Plate Tectonics—Earth’s First 4 Billion Years

From the late Cambrian on, indicators of modern-style plate interactions are abundant in the geologic record—ophiolites, subduction melanges, blueschists, magmatic arcs. There are sniffs of these in the Neoproterozoic, but none in the older Precambrian. Nevertheless, most Precambrian specialists force interpretations into non-actualistic plate-tectonic frameworks.

Archean igneous rocks are strikingly different from modern ones as rock types, lithologic associations, and structural assemblages. The lower crust is everywhere dominated by TTG (tonalite-trondhjemite-granodiorite) gneisses, igneous zircons in which can scatter from 4.4 to 2.5 Ga, which display long histories of extreme mobility. Only TTG has ever been seen depositionally beneath supracrustal greenstone belts, including voluminous mafic and ultramafic lavas. The characteristic structural style of the upper crust is of diapiric and batholithic domes that rose as denser greenstone sank in synforms, while simultaneously the crust underwent stretching and complementary shortening as it rode atop flowing lower crust. These and other features, including isotopics, can be explained by thorough fractionation of the Earth to produce a thick, global mafic/ultramafic protocrust by 4.4 Ga, delamination and recycling of which generated most subsequent Archean magmatism.

Seekers of Archean plate tectonics largely ignore geology, geochronology, and descriptive and phase petrology, and turn to ratios of trace elements taken on faith, from quite different modern rocks, to define ancient tectonic environments. Wild pseudo-plate settings and impossible structures are postulated by armchair spreadsheet manipulators.

Abbreviate the long story of Proterozoic orogens to note that their dominant igneous rocks are bimodal (which rules out popular island-arcs analogies), sedimentary rocks are mostly terrigenous, and there is no evidence for subduction nor proof of ensimatic rocks. Increasing evidence for exposed and contaminating Archean basement permits the inference that Proterozoic orogens typically formed from basins, filled thickly by sediments and volcanics, formed on extensionally thinned Archean lithosphere.

The upper mantle has evolved opposite to popular theory: it was severely depleted very early, and became progressively more enriched during geologic time by delamination and, later, subduction.

Warren Hamilton had a long career with the U.S. Geological Survey, punctuated by visiting professorships. He made field-based structural and petrologic studies in various parts of North America and Antarctica. The latter got him into continental drift when that was widely considered impossible, and enabled him to lead the way into plate-tectonic explanations of Phanerozoic continental geology. His monograph and wall maps on Indonesia and surrounding regions remain the most comprehensive integration of marine geophysics and onshore geology to reach new understanding of a huge active region. He worked with increasingly broad problems of crustal evolution and tectonics, early in USGS regional geology branches, later in a geophysics branch. After retirement, he joined the Department of Geophysics, Colorado School of Mines, where he continues research. His research honors include the Distinguished Service Medal of the Department of the Interior, the Penrose Medal of the Geological Society of America, and membership in the National Academy of Sciences. PDFs of recent papers on the topics he will be presenting are available on his website, www.mines.edu/~whamilto; further work is ongoing.

TALK #1

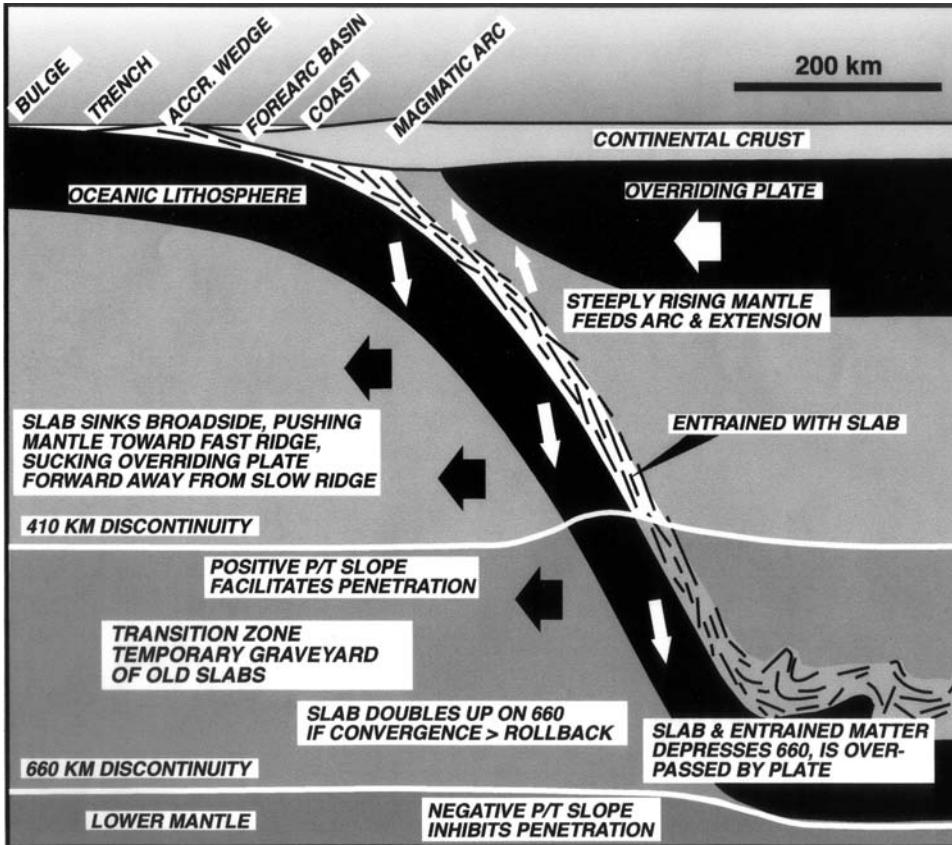
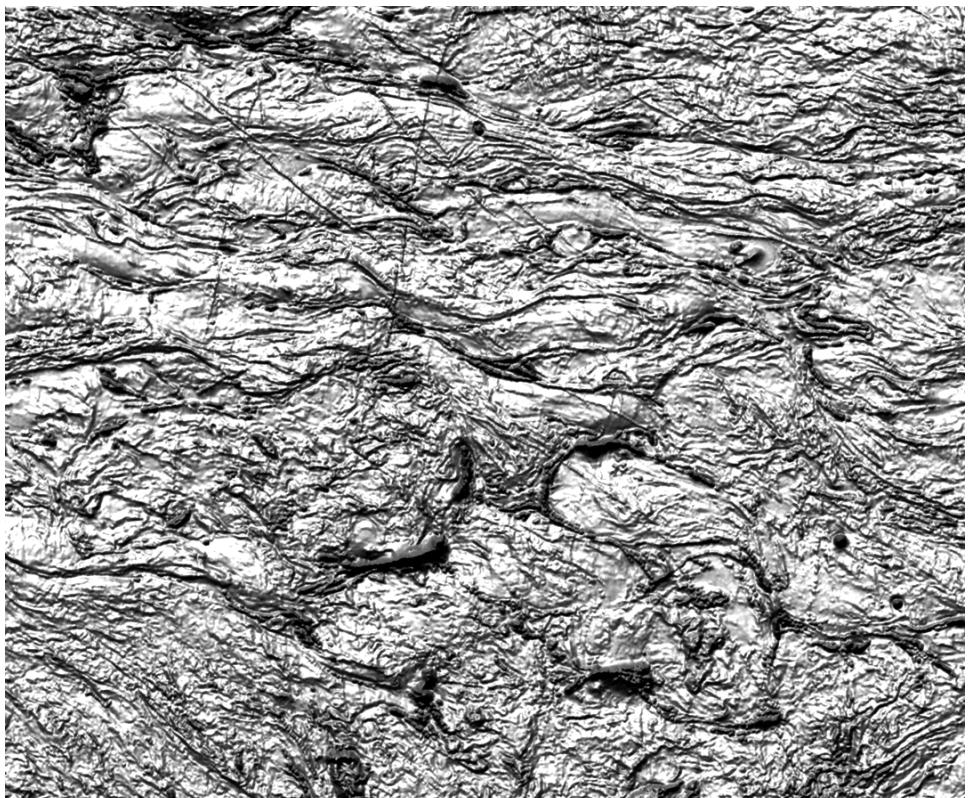


Figure 1: A model for subduction control of plate-tectonic circulation as closed above the discontinuity near 650 km.

Figure 2: Shaded-relief magnetic map of part of northwestern Superior Craton (Archean). Southeast quarter of image includes clear dome-and-keel structure, whereas rest shows more pervasive NNE shortening and WNW stretching of upper crust as it floated on more mobile lower crust. Area 500-km wide; map from Geological Survey of Canada.



TALK #2

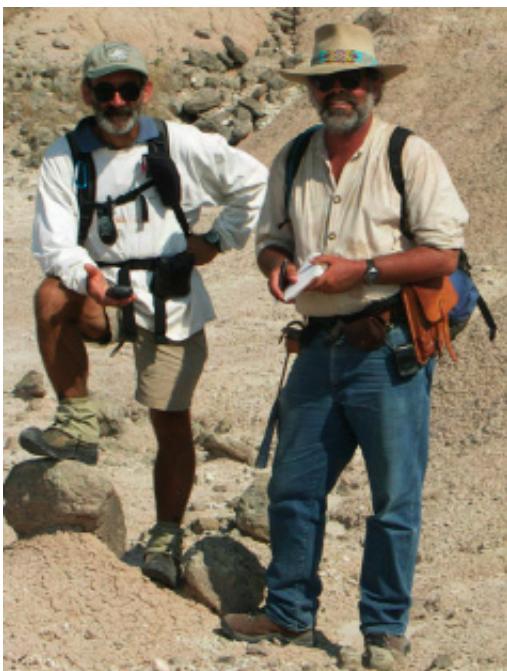
April President's Message from Scott Minor



Our Society has been involved in several exciting (and sad) recent developments that are worth noting. Our recent joint meeting in Denver with the Western Interior Paleontological Society (WIPS) was a total success! Emmett Evanoff gave an excellent first-hand account of his very difficult and harrowing “bad day in the field” last summer in the Dakota badlands, including his challenging rescue by field assistant Terry Hiester. Emmett shared several valuable pieces of advice regarding field safety, for example, always try to report your GPS coordinates to rescuers using the WGS84 datum. Emmett’s talk included a moving memorial tribute to Terry, a past CSS member who sadly succumbed to a long-standing disease just a few weeks ago (please see tribute to Terry below). My deepest condolences are extended to Terry’s family and friends. The CSS/WIPS meeting was well attended by members of both organizations, who seemed to have no problem engaging with each other in the aisles and at the information tables for the two societies. Several WIPS folks expressed interest in joining CSS, and vice versa. I, for one, appreciated the opportunity to learn about the activities, functions, and social nuances of the WIPS organization, and to give a brief introduction of CSS to the audience. WIPS president Paul Belanger was a gracious host and I thank him and his society for allowing us to participate.

One idea that has recently precipitated from our interactions with WIPS and other local earth science societies is to establish an “umbrella” organization from which the various groups can pool resources (e.g., meeting facilities), scientific expertise, etc., and coordinate events such as field trips and special gatherings of mutual interest (e.g., Colorado Day). More on this idea in future newsletters, but for now I invite you to think about the umbrella concept and let me or Council members know if you are in favor of, or opposed to, such an idea. In another development, a newly formed CSS committee has begun work on revamping our Society website. Although the website (www.coloscisoc.org) has been through many minor iterations during the ~10 years that it has been in existence, this new effort is an attempt to give the site an entirely new organization, look, feel, and, perhaps, sound.....yes sound...please come forward if you have any ideas for a CSS signature sound (clanging rock hammer sound not allowed). We hope that the new site will be much more intuitive and functional, as well as aesthetically pleasing. Be on the lookout for our new website, coming soon to a computer near you.

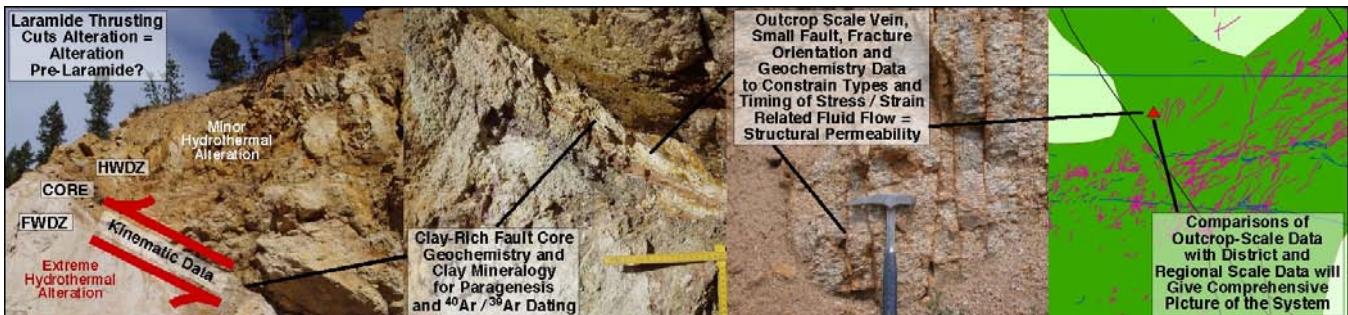
Two important events are just around the corner, one being our April 21st meeting (see front page of the newsletter). This “evening with Warren Hamilton” is guaranteed to deliver two very entertaining and intellectually stimulating talks by one of our very own premier scientists. The following day, April 22nd, is Earth Day. Several local events are being planned on, and near, this day to commemorate its 40th anniversary (www.earthday.net/earthday2010). As folks who value and care about the Earth, I hope that many of you can participate in one or more of these activities and demonstrate your support for the admirable Earth Day causes.



A Talk in Honor and Memory of Terry Hiester

The April 5, 2010, joint CSS-WIPS talk entitled “A Bad Day in the Field” was presented by Emmett Evanoff, in memory of his field partner, Terry Hiester, who got Emmett out of the hole he landed in while traversing the Badlands. The talk was originally going to be presented by both Emmett and Terry, but sadly, Terry passed away on March 24 after a long illness. The talk was dedicated to Terry, whose fast actions and clear thinking made the rescue go quickly and saved Emmett’s life. Terry was a great field assistant and a very good friend.
He is greatly missed.

(Modified from Emmett Evanoff’s write-up for the WIPS newsletter.)



Colorado Scientific Society Spring Field Trip, Saturday, May 22, 2010

Ductile and Brittle Structures, Kinematics, and Hydrothermal Alteration in the Central Colorado Front Range

Trip Leaders: Jonathan Caine (USGS) and Zachary Wessel (Colorado State Univ.)

Scope: The evolution of the Colorado Rocky Mountain Front Range is intimately associated with pervasive brittle deformation, fluid flow, economic mineral deposition, and hydrothermal alteration. Regional to local structural control of the major mining district plays and hydrothermal mineral deposits has long been hypothesized in the Colorado Mineral Belt. However, the controls on strength, permeability, and rheology of various geological structures in relation to mineral deposit formation are poorly documented and understood. As part of ongoing USGS research, structures resulting from protracted brittle deformation in the Front Range are being examined in detail using an integrative approach to better understand this complex system. The field trip objectives are to show participants key localities that exemplify the details of structures, data and conceptual models, and foster dialogue. Some topics to be discussed include 1) the structural geologic history; 2) ductile deformation; 3) evolution and localization of brittle fault zones, polymetallic fault veins, and hydrothermal alteration systems; and 4) hypotheses regarding structural and permeability inheritance in the central Front Range.

Logistics: May 22, 2010. Meet at 8 A.M. at the Cold Springs Park-N-Ride at 6th and Union Ave. The trip will return to the same location by 5:30 P.M. All transportation during the field trip will be provided by rental vans. Participants should bring boots for short hikes, a hard hat if working around road cuts is of concern, sunblock, sunglasses, cameras, and any geology equipment desired. We will visit road cuts, natural outcrops, and quarries in the vicinity of the Central City and Boulder-Tungsten mineral districts and the Idaho Springs-Ralston Shear Zone. Bring a sack lunch and drinks will be provided.

Contact: Cal Ruleman, cruleman@usgs.gov; 303-236-7804

Cost: \$20/person, and students are FREE!

Registration Deadline: FRIDAY, MAY 7, 2010

Make Checks Payable To: Colorado Scientific Society

Mail Checks To: Cal Ruleman, USGS

Box 25046, Denver Federal Center

MS 980

Denver, CO 80225

----- cut here -----

"Ductile and Brittle Structures, Kinematics, and Hydrothermal Alteration in the Central Colorado Front Range" CSS Spring Field Trip sign-up form Saturday, May 22, 2010

Name(s) _____

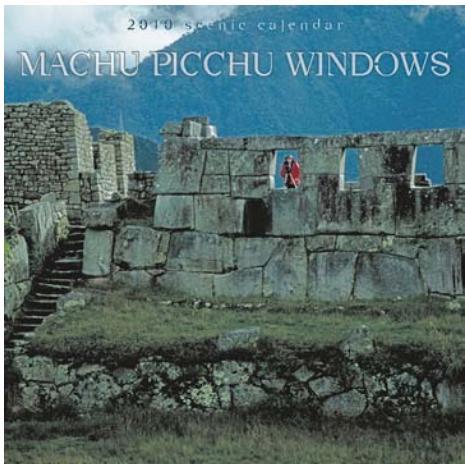
Address: _____

Phone: _____ E-Mail: _____

Number of registrants _____ x \$20 = _____ (enclosed); Number of students (free) _____

Please include this form with your payment.

Write check to: *Colorado Scientific Society*



Boy Scout Day at Dinosaur Ridge

Volunteers still needed!! The scouts need your support!

Boy Scouts will earn their badges in Geology at Dinosaur Ridge on Saturday, May 1, 2010. We expect about 2,000 people to visit in the hopes of learning about geology. We need your assistance to make this day enjoyable for everyone.

All day schedule is 9–3:00 P.M., half day schedules are 9–12:30 and 12:30–3:00 P.M. Please let me know if you will be available.

Contact: Clare Marshall,
dinodiscovery@dinoridge.org, 303.697.3466 ext. 15.

Dinosaur Ridge, 16831 W. Alameda Pkwy., Morrison, CO 80465

CSS MEMBER'S "MACHU PICCHU WINDOWS" EARNS CALENDAR AWARDS

A publication that celebrates the research on Inca hydrology, The 2010 Machu Picchu Windows calendar, won eight national and world awards from the Calendar Marketing Association. The calendar, produced by CSS member, Hydrologist Kenneth Wright, who has studied Inca paleohydrology since 1994, features scenic photography of Peru's Machu Picchu site from the vantage of, or with a view of, Inca windows. The Denver consulting firm Wright Water Engineers has produced a scenic calendar of Machu Picchu annually since 1996. This is the second year the calendar has won eight awards, this time gold awards for best subject and best nonprofit, three silver awards and three bronze awards. Other calendar award winners included Coca Cola, the Utah Office of Tourism, Blue Cross-Blue Shield and the Rand Corporation. Designer Todd Clary Ink of Denver, C & C Offset Printing of China, and iocolor (prepress) of Seattle all contributed to the calendar. For purchasing info., go to: www.wrightwater.com/calendar.html (The "Archaeological Map of Machu Picchu" is also available at this website.)

April 23, 2010 AWRA Colorado Annual Symposium, Uncertainty and the Future of Colorado's

Water Resources, Mt. Vernon Country Club. This year's symposium features talks on the uncertainty in forecasts of conditions that affect Colorado's water resources such as climate, population, and demand; and consider how this uncertainty may affect water users now and in the future. Also, there will be the opportunity to learn how models are being used to quantify potential changes that may occur in water supply or water quality, and the water supply strategies being developed to address those changes. We are pleased to announce that Jim Martin, Executive Director of the Colo. Dept. of Nat'l Resources is our keynote speaker and Denver Mayor John Hickenlooper is our luncheon speaker.

Register on-line today at <http://www.awracolorado.org/> (Early registration BEFORE April 9, 2010). We will hold our first annual silent auction at the symposium to raise money for the Scholarship Fund. Items available include: Rockies tickets, rafting trip, photographs, restaurant gift certificates, fishing trip, and more.

Contact Laurel Stadjuhar (lstadjuhar@bbawater.com) to donate an item for the auction.

(Bruce Wahl sent in the news items below as a follow-up to the 2010 CSS Emmons Lecture by Jim Kennett. Thanks Bruce!)

Vance Haynes and a Team of Arizona Archaeologists Suggest Evidence for Clovis Era Comet Impact Flawed

A team of researchers from the University of Arizona has revisited evidence pointing to a cataclysmic event thought by many scientists to have wiped out the North American megafauna - such as mammoths, saber tooth cats, giant ground sloths and Dire wolves - along with the Clovis hunter-gatherer culture some 13,000 years ago. The team obtained their findings following an unusual, multidisciplinary approach and published them in the Proceedings of the National Academy of Science (PNAS). <http://uanews.org/node/31096>

Younger Dryas Comet Impact Hypothesis - Astronomer Proposes Multiple Impacts from Portions of a Known Comet

A British astronomer has published new evidence that North America was strafed by thousands of fragments from a massive comet about 12,900 years ago, a theory he says is the best explanation yet for why the planet was plunged into a 1,000-year cooling period and dozens of Ice Age mammals went extinct at that time. <http://tinyurl.com/yahx5j3> (Canada.com)

Why Does the Younger Dryas Matter?

What caused the last great stab of cold 13,000 years ago? Almost overnight, it seems, something drove the gradually warming Northern Hemisphere back into the ice age for 1,000 years or more until warming resumed. People researching the behavior of ancient climate have been ruminating over this question for 20 years now, ever since they detected unexpectedly sharp changes in temperatures in a variety of sources -- ice cores, ocean sediments, pollen layers in old dirt.

<http://news.discovery.com/earth/why-the-younger-dryas-matters.html>



Earth Science Meetings and Talks

Newsletter items must be received by the 25th of each month.

Colorado Scientific Society's regular meetings are held the 3rd Thursday of the month at the Colorado School of Mines in Golden (**unless otherwise advertised**). Social time begins at 6:30 p.m. and talks start at 7:00 p.m.

For more information, contact Scott Minor, at 303-236-0303, sminor@usgs.gov

Café Scientifique Wynkoop Brewery, evening science talks at 6:30. Free, except for beer. <http://www.cafescicolo.org>

Colorado School of Mines, Van Tuyl Lectures—April 15, *Dr. Paul Wright, Cardiff University*, “Macro-porosity Development at a Third-order Sequence Boundary—Using Outcrop Analogs of Paleokarst Systems to Develop Quantitative Models of Porosity Distribution.” **April 22,** *Dr. Robert Loucks, Res. Associate Professor, CSM, Geology & Geological Engineering*, “Distinguishing Chemical Characteristics, Geodynamic Settings, and Petrogenesis of Copper-Ore-Forming Arc Magmas.” Berthoud Hall room 241, 4–5 P.M. <http://www.mines.edu/academic/geology>

Denver Mining Club—April 12, *Stacey Leichliter, Exploration Geologist, Anglo Gold Ashanti (Colorado) Corp.*, “Cripple Creek and Victor Gold Mine.” **April 19,** *Todd Hennis, President and CEO, San Juan Corp*, “Where the U.S. Economy Is and Is Going.” **April 26,** *John E. Burghardt, Geologist and Certified Mineral Examiner, U.S. National Park Service*, “The Amazing World of Bats.” **May 3,** *Tony Hammond, Mining Engineer and GIS Analyst*, “The Hunt Brothers, Sunshine Mining and the Attempt to Corner the Silver Market in the Late 1970s.” The DMC meets every Monday at the Littleton Country Buffet near Bowles and Wadsworth (8100 W. Crestline Ave., in the shopping center) 11:30–1:00. Purchase of lunch required. <http://www.denverminingclub.org>

Denver Museum of Nature and Science —“The Science Lounge,” Entertainment, Science, and Cocktails. \$8 member, \$10 non-member, cash bar. For schedule see: <http://www.dmns.org/science-lounge>

Denver Region Exploration Geologists' Society (DREGS) meets in the Mutual Consolidated Water Building, 12700 West 27th Avenue, Lakewood. Social 6:00–7:00 p.m. Presentation at 7:00 p.m. Meetings are normally scheduled for the first Monday of each month. For information contact Jim Piper, (303) 932-0137, or the website <http://www.dregs.org>

Denver Well Logging Society (DWLS)—April 20, *Bob Cluff, Discovery Group*, “Log evaluation of gas shales: a 35-year perspective.” The DWLS meets on the third Tuesday of each month, Sept. through May. Lunch and a technical talk at the Wynkoop Brewery begins at 11:30 a.m., 18th and Wynkoop Sts. in Denver.

To make your reservations for the luncheon, please use the new PayPal page, *no later than noon on the Thursday prior to the lunch*. http://dwls.spwla.org/Luncheon_Reservation.htm

Lookout Mountain Nature Center and Preserve—Sun., Apr. 11, 1:30 p.m., “Colorado’s Changing Climate”: Join Robert Thompson and Laura Strickland from the USGS for a discussion on methods scientists use to unravel the history of climate changes in Colorado over the last 15,000 years and how these changes have affected ecosystems in the Colorado Mountains. Ages 13 to adult. These are free programs but registration is required. Please visit <http://lmnc.jeffco.us> to register.

Rocky Mountain SEPM—Apr. 27, *Christopher R. Fielding, Department of Geosciences, University of Nebraska-Lincoln, NE*, “A Modern Planform, Process and Facies Analog for the Cretaceous Ferron Sandstone of Utah: Applications to Exploration and Reservoir Description.” Reception at 11:30, lunch at noon, speaker at 12:30. Reservations: luncheons@rmssepml.org, or call Steve Stancel 720-929-6536, before noon of preceding Friday. \$20.00 lunch, \$3 talk only. Wynkoop Brewing Company, 1634 18th St., Denver. <http://www.rmssepml.org/luncheons.shtml>

Univ. of Colorado, Boulder, Geol. Sciences Colloquium—April 14, *Gareth Funning, UC Riverside*, “InSAR in California.” **April 21,** *Andres Aslan, Mesa College—Grand Junction*, “Origin of the Colorado River and late Cenozoic history of the Upper Colorado Basin.” **April 28,** *David Greenwood, Brandon University*, “Eocene precipitation: How wet, and where? A proxy-model comparison.” Weds., 4:00 p.m., Benson Earth Sci. Auditorium, Rm. 180. Refreshments at 3:30 p.m. on the 3rd floor. <http://www.colorado.edu/geolsci/>

Western Interior Paleontological Society —Sat., May 22, 2010 *Baculite Mesa (near Pueblo, CO)*, Trip Leader: Malcolm W. Bedell, Jr. This field season marks the 20th anniversary of WIPS’ first trip to the Cretaceous marine outcrops of Baculite Mesa, known, as the name suggests, for fossils of Baculites. Many other invertebrate fossils can be found there including ammonites, gastropods, nautiloids, scaphites, and various pelecypods. Exposures of Pierre Shale as well as Tepee Buttes can be explored. For more details, go to: www.westernpaleo.org

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

<http://www.coloscisoc.org>



OFFICERS

President:	Scott Minor, USGS, 303-236-0303, sminor@usgs.gov	2007–2010: Jeremy McCreary 303-744-0907 jeremy@cliffshade.com
President-Elect:	Lisa Fisher, CSM, 303-478-9427 (c), lfisher@mines.edu	2008–2011: Lee Shropshire, UNC, 970-352-8778, leeshrop@comcast.net
Treasurer:	Don Sweetkind, USGS, 303-236-1828, dsweetkind@usgs.gov	2008–2011: Sue Ellen Hirschfeld, eqdoc@ix.netcom.com
Secretary:	Lisa Fisher, CSM, 303-478-9427 (c), lfisher@mines.edu	2009–2012: Jim Burnell, CGS, 303-866-2611, jim.burnell@state.co.us
Past President:	Don Sweetkind, USGS, 303-236-1828, dsweetkind@usgs.gov	2010–2013: Liz Pesce, epesce@mines.edu

COUNCILORS

COMMITTEE CHAIRPERSONS

Best Paper Award: Don Sweetkind, USGS, 303-236-1828, dsweetkind@usgs.gov

Database Manager: Emily Taylor, 303-236-8253, emtaylor@usgs.gov

Field Trips: Cal Ruleman, USGS, 303-236-7804, cruleman@usgs.gov; Karl Kellogg, kkellogg@usgs.gov

Graphics: Lisa Rukstales, USGS, 303-236-5547, lrukstales@usgs.gov

History: Beth Simmons, cloverknoll@comcast.net

Membership: **volunteer needed!!**

Memorial Funds: Don Sweetkind, USGS, 303-236-1828, dsweetkind@usgs.gov

Newsletter Editor: Lisa Rukstales, USGS, 303-236-5547, lrukstales@usgs.gov

Outreach: Sue Hirschfeld, 720-565-9302, eqdoc@ix.netcom.com

Pillmore Fund: Lee Shropshire, UNC, 970-352-8778, leeshrop@comcast.net

Program: Christine Turner, USGS, 303-236-1561, cturner@usgs.gov

Publicity: Libby Prueher, 720-260-0350, lprueher@umich.edu

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

Webmaster: Table Mountain Web Design, 303-278-2701, bwarden@tablemtn.com



** STOP! Do NOT recycle this until after the talk! Please help us with publicity by posting at least the front page of this Newsletter on a bulletin board. Thank you!