



## *Colorado Scientific Society*

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



**A fault-bounded depositional basin in  
central Colorado**

**Paul Myrow  
*Colorado College***



**From buttes to bowls:  
Repeated inversions in the landscape of the Colorado  
piedmont**

**Matthew L. Morgan (*presenter*)  
*Colorado Geological Survey***

**Thursday, September 16, 2004**

**American Mountaineering Center**

**710 10<sup>th</sup> St. (NE corner with Washington), Golden**

**Social half-hour – 6:30 pm. Meeting time – 7:00 pm.**

## Abstract

---

---

### A fault-bounded depositional basin in central Colorado

By **Paul Myrow**, Geology Department Chair, Colorado College

The Minturn Formation of central Colorado records deposition in an active fault-bounded basin. Minturn strata represent braided rivers, fan deltas, marginal marine settings, and carbonate and siliclastic shallow marine environments. A prominent unit of subaqueously deposited interbedded sandstone and shale has turbidite-like graded beds that contain sole marks such as grooves, prods, and flutes. However, these beds are atypical compared with classic Bouma turbidite sequences.

Detailed process-oriented sedimentological analysis reveals internal sedimentary structures that are consistent with deposition under the influence of both excess weight forces and oscillatory flow. Sedimentary structures characteristic of waves include small- and large-scale hummocky cross-stratification and gutter casts. There is also considerable evidence for deposition under combined flows, including ripples with rounded crests and convex-up foresets. Individual beds thus have characteristics of both turbidites and tempestites and were therefore deposited in combined flows of waves and currents driven by

excess-weight forces. Abundant plant remains and deep sole marks indicate that the flows were highly charged with plant debris.

The paleogeographic context of high topographic relief adjacent to a marine basin suggests that the flows were linked to sediment-charged flood currents that entered the ocean and became hyperpycnal flows (i.e., oceanic floods). These beds are unusual in that they also contain sequences of internal sedimentary structures that record both waning and waxing flow. Such flow is also preserved by reverse-to-normal grading patterns. These patterns may be smooth transitions from fine to coarse to fine, or show a jump in grain size within the bed at the coarsest division.

The pattern of waxing and waning flow is interpreted as a record of the hydrographic response to storm events, namely increasing and decreasing discharge. The hyperpycnal flow was dynamically linked to the hydrograph and those beds with reverse-to-normal grading record all stages of the flow, including the waxing stage that in most density-driven flows is not preserved.

## Abstract

---

---

### From buttes to bowls: Repeated inversions in the landscape of the Colorado piedmont

By **Vincent Matthews**, Colorado Geological Survey, Denver, **Matthew L. Morgan** (presenter), Colorado Geological Survey, Denver, **Jon P. Thorson**, Consulting Geologist, Parker, Colorado, **Francisco Gutierrez**, University of Zaragoza, Zaragoza, Spain, and **Matthew T. Grizzell**, BEK/Terranext, Lakewood, Colo.

Mesas and buttes of the central Colorado Piedmont are composed of at least two distinct rock types that differ in their cohesiveness and ability to withstand

erosion. The lower parts are friable, early to middle Paleogene sandstones of the Dawson Formation. The caprock is composed of one or more resistant

formations: Castle Rock Conglomerate, Wall Mountain Tuff, and Larkspur Conglomerate—all of late Paleogene age. The three resistant units were originally deposited in topographic lows. The lower slopes of the buttes are armored with colluvium composed of fragments of the capping units and commonly form “talus flatirons” or relict faceted slopes.

Once the caprock of a butte or mesa has been removed by erosion, the poorly consolidated Dawson Formation quickly erodes out of the center. This leaves the armored, lower slopes of the former

butte as an erosionally-resistant, circular ridge standing as much as 100 meters above the surrounding topography. This process produces a topographic low where the peak of the butte once stood.

Some buttes have prominent alluvial fans that record the main phase of butte removal and excavation of the central part of the armored slopes. Soil profiles and height above modern streams suggest the oldest preserved gravel deposit is of middle Pleistocene age; the youngest alluvial fans were deposited during the Holocene.

## **Colorado Scientific Society President’s Note—September 2004**

---

*By* **Emmett Evanoff**

Welcome back to the fall session of the Colorado Scientific Society! Upcoming events include the following:

- ♦ Two regular meetings on September 16 and October 21
- ♦ The next CSS Council meeting will be at 4 pm on September 16. Members who have an interest in the Society’s business are welcome to contact me about the Council Meeting at 303-444-2644 or [emmettevanoff@earthlink.net](mailto:emmettevanoff@earthlink.net). The Society still needs a membership chair, a publicity chair, and several new officers in 2005.
- ♦ Student night on November 18
- ♦ The passing of the Society gavel to Vince Matthews with my talk on December 16.
- ♦ The Fall Field Trip to the Black Hills and Badlands on September 23 to 26. Registration for the field trip is still open and there are plenty of spaces available—please refer to the announcement in this newsletter.
- ♦ Colorado Scientific Society is sponsoring events at the Annual Meeting of the Geological Society of America (Denver Convention Center on November 7–10). It will sponsor three theme sessions in the multi-day, Pre-EarthScope Synthesis of the Rocky Mountains topical sessions and three (one-day) field trips.

The summer was a good one with three one day, brown-bag field trips. Karl Karlstrom, Bruce Bryant, and Jack Reed took us on a great trip across the Front Range along I-70 from Golden to Dillon on May 30. It was a great trip despite the high winds on the Dakota Hogback and snow in Dillon. Highlights on the trip included seeing the Williams Fork Thrust over Pierre Shale hornfels and the mineralization along the Colorado Mineral Belt at Idaho Springs.

The second trip was to the Pawnee Buttes area to see the features of the Cenozoic geology of this region. I led this trip that had to be postponed a week to July 27 because of the rainy weather. We saw the ancient valleys and stream channels in the Tertiary rocks, and discussed the origin of the sediments seen in the High Plains.

The last trip was led by Lisa Lytle and Thom Fisher on August 14 to see the Precambrian features between Golden Gate and Coal Creek canyons. This was a great trip that discussed the stratigraphic relations and origins of the Precambrian metamorphic rocks. The highlights included the huge andalusite crystals at Golden Gate State Park, the bedded magnetite deposit on the Schwartzwalder Mine property, and the remarkable stretch-pebble conglomerates and quartzites in Coal Creek Canyon. The weather on

this last trip could not have been better, and there were more flowers out than there were in May!

Thanks to all the leaders and participants of these trips, and of which will be given at the GSA Annual Meeting in November 2004.

## **CSS 2004 Colorado Scientific Society Fall Field Trip—Geology of the Black Hills and Badlands National Park Thursday-Sunday, September 23-26**

By **Emmett Evanoff**, CSS President and field trip coordinator

The 2004 Fall Field Trip is still on to see the geology of the Black Hills and Badlands National Park in South Dakota. The trip will be led by Jack Redden, John Lufkin, and Emmett Evanoff.

The first day will be a drive to Custer and will include a stop at the Hot Springs Mammoth Site. This site has an excellent local museum where the bones of dozens of mammoths are on display in an ancient sinkhole deposit that acted as a natural mammoth trap.

The second day will examine the Precambrian and Paleozoic rocks of the Black Hills and will be led by Jack Redden, a retired USGS geologist who mapped and subdivided the Precambrian rocks of the Black Hills. We hope to visit some of the famous pegmatite mines with giant crystals on this second day and to end in Rapid City in the evening.

The third day we will examine the geology and fossils of Badlands National Park. Emmett Evanoff will be the leader on this day, discussing the stratigraphy and origin of the most fossiliferous parts of the White River Group. The fourth day will include a drive to Devils Tower and then return to Denver.

The \$300 cost for the trip includes transportation, lodging (double occupancy) and lunches. If you wish to have a single room, then the cost will be \$396. Dinners and breakfasts are not

included, but we will be staying in Custer and Rapid City, which have many good restaurants.

If you are interested in attending this field trip, please fill out the following form, make out a check to the Colorado Scientific Society for \$300 per person, and send all to

Emmett Evanoff, Dept. of Geological Sciences,  
399 UCB, University of Colorado,  
Boulder, CO, 80309-0399,

no later than **September 12**. You will receive additional information concerning the trip in the 1<sup>st</sup> week of September, or after you register.

---

---

### **Black Hills–Badlands Field Trip Sept. 23–26 (Thursday—Sunday)**

Name: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Phone: \_\_\_\_\_

E-Mail: \_\_\_\_\_

### **Black Hills–Badlands Field Trip-Sept. 23–26**

	# registrants	Total \$ amount
Room occupancy		
Double: \$300 per person		
Single: \$396 per person		



# Topic Sessions and Field Trips Sponsored by the Colorado Scientific Society at the 2004 Geological Society of America Annual Meeting

By **Emmett Evanoff**, CSS President

The 2004 Annual Meeting of the Geological Society of America will be held in the Denver Convention Center on November 7–10. The Colorado Scientific Society is proud to sponsor three theme sessions and three field trips during the meetings. The theme sessions are as follows:

Session 42, T77.

## **Pre-EarthScope Synthesis of the Rocky Mountains I and II**

Surface Processes, Geodynamics, and the Roles of Neotectonics and Climate in Development of Modern Topography. Eric Kirby, Margaret E. McMillan, Karl E. Karlstrom and Rick Aster, Presiding. Sunday, November 7, 1:30–5:50 pm.

Session 111, T78.

## **Pre-EarthScope Synthesis of the Rocky Mountains III**

New Advances in Laramide Deformation and Tectonics of Rocky Mountain Basement-Involved Structures: In Honor of Don Blackstone Jr. Eric Erslev, David Lageson and Arthur Snoko, Presiding. Monday, November 8, 1:30–5:30 pm.

Session 173, T80.

## **Pre-EarthScope Synthesis of the Rocky Mountains V**

New Insights in Basement Tectonics, Deep Crustal Structure and Precambrian Tectonic Evolution. Michael Williams and Karl E. Karlstrom, Presiding. Tuesday, November 9, 1:30–5:30 pm.

Forty-four presentations will be given at these theme sessions; they will include talks by CSS members Eric Erslev, Karl Karlstrom, and Vince Matthews.

The three field trips sponsored by the Colorado Scientific Society are

Field Trip 8

### **Colorado Front Range—Anatomy of a Laramide Uplift**

Coleaders: Karl Karlstrom, Bruce Bryant, and Jack Reed of the U.S. Geological Survey. Saturday, November 6.

Field Trip 20

### **Cenozoic Geology and Fossils of the Pawnee Buttes Area, Northeast Colorado.**

Leader: Emmett Evanoff, Denver Museum of Nature and Science and the University of Colorado Museum. Thursday, November 11.

Field Trip 24

### **Underground Tour of Henderson Molybdenum Mine**

Leader Eric Nelson, Colorado School of Mines. Thursday, November 11.

There will be an additional 246 sessions and 22 additional field trips at the meeting. For more information, see the GSA Meeting website at [www.geosociety.org/meetings/2004/](http://www.geosociety.org/meetings/2004/) or call the main GSA office at 303-357-2020. The program listing for the Annual Meeting is on the web at <http://gsa.confex.com/gsa/2004AM/finalprogram/>. Preregistration for the full meeting for professional members of GSA is \$295, for professional nonmembers is \$375, for student members is \$90, and for student nonmembers is \$120. Registration fees must be received at GSA before **September 30** to get the preregistration rates. Register online at [www.geosociety.org/meetings/2004/reg.htm/](http://www.geosociety.org/meetings/2004/reg.htm/).

## New USGS Science Information Center

The USGS, National Park Service, Bureau of Land Management, Fish and Wildlife Service, U.S. Forest Service, and Rocky Mountain Nature Association (RMNA) have established an interagency public lands and science information center in Denver, Colo. A grand opening celebration was held on June 16 for "The Map Store @ USGS—Public

Lands & Science Information" at the USGS Rocky Mountain Mapping Center.

RMNA will have responsibility for the operation and management of the new store. The store will replace the retail map sales outlet at the USGS Earth Science Information Center.

## Meeting Challenges with Geologic Maps

ALEXANDRIA, VA - Geologic maps are our most important and complete compilation of information about the planet on which we live, and we cannot understand Earth without them.

Meeting Challenges with Geologic Maps, a richly illustrated, 64-page book recently published by the American Geological Institute, provides an overview of the nature, production and interpretation of geologic maps, along with 16 key examples demonstrating the application of geologic mapping to addressing societal issues.

Intended for educators, policy-makers, and the general public, Meeting Challenges with Geologic Maps is written clearly and concisely and contains many photographs and graphics of natural phenomena and their corresponding representation on a geologic map—fully illustrating the application of geologic maps to problem solving.

Copies of Meeting Challenges with Geologic Maps (ISBN 0-922152-70-5, 64 pages, 1 lb.) are available from AGI.

## The Colorado Geological Survey asks, "Did you know?"

By **Vince Matthews**, Colorado State Geological Survey

Did you know that the Rocky Mountains have fifty-eight peaks over 14,000 feet high, all of them in Colorado? That Colorado has 740 peaks between 13,000 and 14,000 feet high? That Colorado has the highest average elevation of any state (6,800 feet), with more than two vertical miles between its lowest (3,313') and highest (14,433') points? That Grand Mesa is touted as the world's highest flat-topped mountain with 380,000 acres, heights above 10,500 feet, and more than 300 lakes.

How many 14,000+ foot peaks are there in Colorado? The answer depends on whom you ask. The "fourteeners" website claims 53, Colorado Mountain Club claims 54, and the book Colorado's Fourteeners claims 55. The United States Geological Survey has the official responsibility for measuring, mapping and naming topographic

features in the United States. They list, by name, 58 summits in Colorado that have elevations more than 14,000 feet above sea level.

Did you know?....

That the oldest rock in Colorado is a 4.8 billion-year-old meteorite, that the oldest crustal rocks are 2.7 billion years old, that the youngest volcanic rock is only 4,132 years old, and that the deepest rock came from the mantle more than 20 miles deep?

That Colorado is the birthplace of the Rio Grande, Colorado, North and South Platte, Arkansas, San Juan, Dolores, Gunnison, and Yampa rivers?

That Madam Curie won a Nobel Prize using Colorado uranium?



# Earth Science Meetings and Talks



*Newsletter items must be received by the 25th of each month. Items may include special events, open houses, etc...thanks!*

**Colorado Scientific Society's** regular meetings are held the 3rd Thursday of the month at the American Mountaineering Center 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 Emmett Evanoff at (303) 444-2644 or [emmettevanoff@earthlink.net](mailto:emmettevanoff@earthlink.net)

**Denver Mining Club** meets every Monday (except when noted) at Country Buffet near Bowles and Wadsworth (at 8100 W. Crestline Ave.) 11:30 a.m.-1:00 p.m. **Battle in the trenches—mining prohibitions in Colorado counties**, Sept. 13—Stuart Sanderson, President, Colorado Mining Assn. **Identity theft**, Sept. 20—Jefferson County Sheriff's Office. **Geology, mining history, and minerals of the midcontinent Mississippi Valley deposits**, Sept. 27—Ed Raines, VP, Clear Creek County Metal Mining Assn.

**Denver International Petroleum Society** meets the second Friday of each month at the Wynkoop Brewing Co., 18th and Wynkoop Streets. Reception begins at 11:30 a.m., luncheon at 12 p.m., program at 12:30 p.m. Make reservations (required) by leaving message at (303) 623-5396. Reservations accepted after 8 a.m. on Friday until 10:30 a.m. on Wednesday prior to the meeting. Cancellations accepted until 11:00 am Wednesday prior to the meeting. Cost: \$15 for lunches; talk only is available for \$2 (make checks payable to "D.I.P.S."). Contact Keith Murray at (303) 986-8554 for information.

**Denver Region Exploration Geologists' Society (DREGS)** meets in the Mutual Consolidated Water Building, 12700 West 27th Avenue, Lakewood. Social hour 6:00-7:00 p.m. Technical presentation at 7:00 p.m. Meetings are normally scheduled for the first Monday of each month. **Geology, Tectonics and Mineral Occurrences of Central Lapland, Finland: Exploration Potential for Iron-oxide-Copper-Gold (IOCG) Deposits**, Sept. 13—Craig Horlacher, Principal Geologist, Silver Crescent Exploration, Inc. For information contact Jim Piper, (303) 932-0137, or the website <http://www.dregs.org>.

**Denver Well Logging Society (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. Subject matter usually applies well logs to oil and gas exploration. **Jonah field: Controls on overpressure and status of development**, Sept. 21—Dean DuBois, EnCana Oil and Gas. Call Elice Wickham at 303-573-2781 for reservations. Web page: <http://dwls.spwla.org>.

**Rocky Mountain Association of Geologists (RMAG)** Reception at 11:30 a.m., lunch at 12:00 p.m., talk at 12:30 p.m. Reservations are taken by recording at 303-623-5396 until 10:30 a.m., Wed. before the luncheon. Cancellations are taken until 11:00 a.m. on Wed. at 303-573-8621. Luncheon cost is \$20 payable to RMAG at the door. Reservations are not required for talk only—cost is \$3. Meeting location: Denver Petroleum Club, Anaconda Tower, 555-17th St, 37th floor. Web page: <http://www.rmag.org>.

**University of Colorado at Boulder, Geological Sciences Colloquium** Wednesdays, 4:00-5:30 p.m., Rm. 180. Refreshments at 3:30 pm on the 3rd floor. **Providing a context for 20th century warming**, Sept. 15—Gif Miller, INSTARR & U. of Colorado, Boulder. **Osmium economy of the oceans**, Sept. 22—Mukul Sharma, Dartmouth College. For more information, call 303-492-8141. Web page: <http://www.colorado.edu/GeolSci>.

**Friends of Dinosaur Ridge** meets at 7:00 pm at Red Rocks Elementary School in Morrison, Colorado. Join now. Web page: <http://www.dinoridge.org>. TBA, Fall 2004. Admission is free, but donations are welcome. For more information please contact the FODR Visitor Center at (303) 697-3466.

**Colorado School of Mines, Van Tuyl Lectures** Fridays from 3:00PM to 4:00PM in Berthoud Hall room 108. **Reservoir Engineer? I Thought I Was a Geologist?**, Sept. 17—Wayne Ackerman, AAPG Distinguished Lecturer. **Sustainable Management of Surface Water Resources: How to protect the World From Thirst**, Sept. 24—George Annandale, Engineering and Hydrosystems Inc. **Ghawar: Anatomy of a Giant Oil Field**, Oct. 1—Abdulkader M. Afifi, Saudi Aramco, AAPG Distinguished Lecturer. For further information, check <http://www.mines.edu/academic/geology.html>

**USGS Geologic Division Colloquium**. Thursdays, 1:30 p.m., Foord Room, Building 20, Denver Federal Center. For more information contact: Peter J. Modreski, U.S. Geological Survey, Denver, Colorado tel. 303-202-4766, fax 303-202-4767 email [pmodreski@usgs.gov](mailto:pmodreski@usgs.gov)

**For a constantly updated, online geo-calendar, visit the Colorado Geological Survey at**  
<http://geosurvey.state.co.us>

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

<http://www.coloscisoc.org>



## OFFICERS

President: Emmett Evanoff, CU-B, 444 2644 [emmettevanoff@earthlink.net](mailto:emmettevanoff@earthlink.net)  
President-Elect: Vince Matthews, CGS, 866-3028, [vince.matthews@state.co.us](mailto:vince.matthews@state.co.us)  
Treasurer: Don Sweetkind, USGS, 236-1828, [dsweetkind@usgs.gov](mailto:dsweetkind@usgs.gov)  
Secretary: Lisa Finiol, CSM, 567-2403, [lfiniol@mines.edu](mailto:lfiniol@mines.edu)  
Past President: Jim Cappa, CGS, 866 3293, [jim.cappa@state.co.us](mailto:jim.cappa@state.co.us)

## COUNCILORS

2002-2004: Scott Lundstrom, USGS, 236-7944, [slundst@usgs.gov](mailto:slundst@usgs.gov)  
2003-2005: John Lufkin, Cons., 216-1076, [Lufk3@aol.com](mailto:Lufk3@aol.com)  
2003-2005: Chuck Kluth, CSM, 904-2939, [kluth@earthlink.net](mailto:kluth@earthlink.net)  
2004 : Celia Greenman, CGS, 866-2811, [celia.greenman@state.co.us](mailto:celia.greenman@state.co.us)  
2004-2006: Sue Hirschfeld, Cons., 720-565-9302, [eqdoc@ix.netcom.com](mailto:eqdoc@ix.netcom.com)  
2004-2006: Lee Shropshire, UNC, 970-352-8778, [leeshrop@att.net](mailto:leeshrop@att.net)

## COMMITTEE CHAIRPERSONS

Best Paper Award: Mark Hudson, USGS, 236-7446, [mhudson@usgs.gov](mailto:mhudson@usgs.gov)  
Database Manager: Cynthia Rice, USGS, 236-1989, [crice@usgs.gov](mailto:crice@usgs.gov)  
Field Trips: Emmett Evanoff, UCB, 492-8069, [evanoff@colorado.edu](mailto:evanoff@colorado.edu)  
Graphics: Karen Morgan, CGS, 866-3529, [karen.morgan@state.co.us](mailto:karen.morgan@state.co.us)  
History: Marjorie E. MacLachlan, USGS-retired, 986-7192, [jcmemaclachlan@aol.com](mailto:jcmemaclachlan@aol.com)  
Membership:  
Memorial Funds: Eric Nelson, CSM, 273-3811, [enelson@mines.edu](mailto:enelson@mines.edu)  
Newsletter Editor: Mary-Margaret Coates, TECHEdit, 422-8349, [mmcoates@att.net](mailto:mmcoates@att.net)  
Assoc. Editor: Scott Minor, USGS, 236-0303, [sminor@usgs.gov](mailto:sminor@usgs.gov)  
Outreach: Sue Hirschfeld, 720-565-9302, [eqdoc@ix.netcom.com](mailto:eqdoc@ix.netcom.com)  
Program: Vince Matthews, CGS, 866-3028, [vince.matthews@state.co.us](mailto:vince.matthews@state.co.us)  
Publicity: Mearl Webb, 810-1296, [mf\\_webb@msn.com](mailto:mf_webb@msn.com)  
Science Fair: Chuck Weisenberg, 238-8806, [cweisnbrg@aol.com](mailto:cweisnbrg@aol.com)  
Webmaster: Bill Wingle, 303-279-1290, [wwingle@uncert.com](mailto:wwingle@uncert.com)

**\*\* STOP!** Don't 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!*