



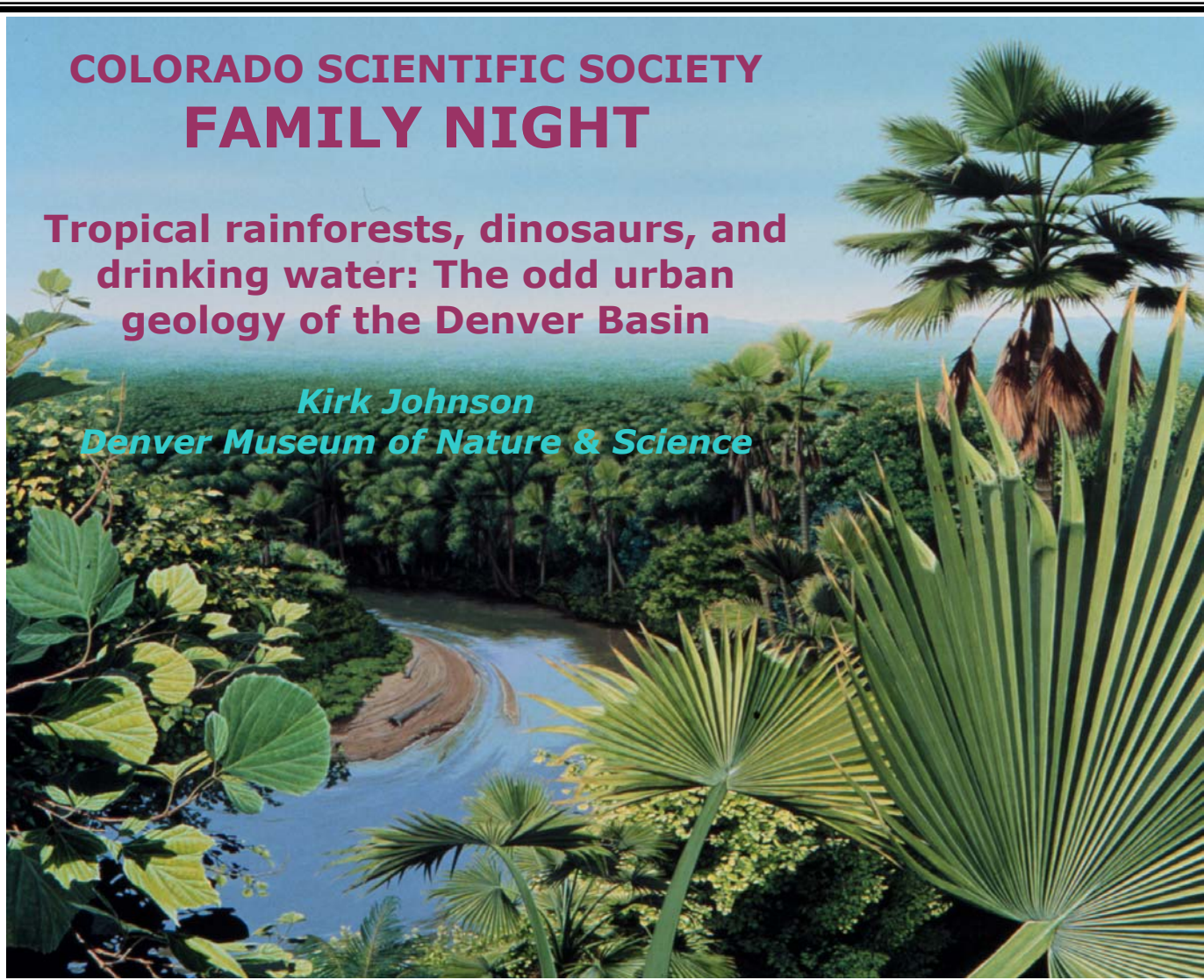
## ***Colorado Scientific Society***

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

### **COLORADO SCIENTIFIC SOCIETY FAMILY NIGHT**

**Tropical rainforests, dinosaurs, and  
drinking water: The odd urban  
geology of the Denver Basin**

***Kirk Johnson  
Denver Museum of Nature & Science***



**Friday, April 18, 2003**

**Geology Museum, Berthoud Hall, corner of 16<sup>th</sup> and Maple  
Colorado School of Mines, Golden  
Dinner – 6:30 pm. Meeting time – 7:30 pm.**

## **Abstract**

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# **Tropical rainforests, dinosaurs, and drinking water: The odd urban geology of the Denver Basin**

By Dr. Kirk Johnson, Curator of Paleontology and Head of the Department of Earth Sciences at the Denver Museum of Nature & Science

The city of Denver lies above nearly 12,000 feet of horizontal sedimentary rocks. Many of these layers are exposed around the margins of the Denver Basin, a geologic depression that formed around 68 million years ago in response to the uplift of the Colorado Front Range. Sediments shed from the uplifting Rockies during the Late Cretaceous and early Paleogene form the top 2,000 to 3,000 feet of the Denver Basin sequence, and these rocks lie immediately beneath the cities of Denver and Colorado Springs.

Rapid urban growth in the 1990s caused thousands of excavations that yielded hundreds of new, but ephemeral, fossil sites. Several of these discoveries received extensive media coverage because they occurred in public sites like the Denver International Airport, Coors Field, and the margins of local interstate highways. Most of the discoveries were mundane but a few have been spectacular. The most notable include a partial *Tyrannosaurus rex* skeleton at a suburban house site in Littleton and a 64 million-year-old tropical rainforest along the side of Interstate 25 in Castle Rock. This *T. rex* skeleton is the only one from Colorado, and the rainforest is arguably the oldest one known to date, on Earth.

Research on these sites is shedding light on the nature of the landscapes that formed during the Laramide orogeny and their relationship to the Cretaceous-Tertiary boundary extinctions and the origin of modern biomes. Groundwater is an important and limited resource for the growing population of the semiarid region and the Denver Basin bedrock aquifers are found in the same synorogenic strata that contain fossils of dinosaurs and rainforests. Using data from a network of two cored wells and hundreds of logged wells and surface observations, we are able to place both the fossil sites and the aquifers in a temporally calibrated stratigraphic framework that is based on an understanding that the basin was filling as the mountains were uplifting. The Denver Basin Project links primary research on geology and paleontology with assessments of the groundwater resource and delivers the results to not only the scientific community but also to the 3.5 million residents of the Front Range Urban Corridor.



## **Colorado Scientific Society, April 2003 President's Note**

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### **Jim Cappa**

As I write this letter American military forces are engaged throughout Iraq, American lives have been lost, and the Iraqi government has captured American soldiers. We all may have different feelings about this war with Iraq and this column is not going to be used as a pulpit for either view. However, as most of our members are earth scientists I thought we should be aware of the role of geology in military affairs.

During World War II, the Japanese launched balloons from Japan to be carried across the sea by the prevailing westerly winds to North America. These balloons carried incendiary bombs, which were timed to be released over the United States and Canada causing forest fires and other destruction, creating panic amongst the citizens, and thereby diverting American attention from the war in the Pacific against Japan. These balloons caused little actual damage. The only known deaths were a result of a balloon that landed in a forest in Oregon with its bomb load intact. A family with young children out on a picnic came upon the bombs and inadvertently set them off, causing the only known casualties from this remote bombing effort by Japan.

What's all this got to do with geology, you may ask? The balloons carried ballast bags loaded with sand and gravel. Based upon the unique mineralogy and lithology of the sand and gravel, forensic geologists working for the United States military used existing geological maps of the Japanese islands to pinpoint areas where the sand originated and, possibly, where the bombs were being manufactured. Several possible locations were identified and were bombed by the Army Air Force in the latter stages of World War II.

During the dying days of the Cold War forensic geologists using remote sensing technologies verified the decommissioning and disarmament of nuclear test sites in the former Soviet Union. More recently, we all remember the 2002 video of Osama bin Laden sitting in front of a rock outcrop in the days after the invasion of Afghanistan and the routing of the Taliban. Forensic geologists analyzed this video and using the character of the rock outcrop determined areas where bin Laden might be hiding.

We don't know role forensic geology is playing in this war, but we can assume that is of some strategic importance. For an interesting article on military geology check out the following web site:  
[http://www.agiweb.org/geotimes/feb02/feature\\_military.html](http://www.agiweb.org/geotimes/feb02/feature_military.html)

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## Status of Colorado Scientific Society Investment Accounts

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**Don Sweetkind, CSS Treasurer**

On Tuesday, March 25, 2003, Eric Nelson (Chairman of Memorial Funds Committee) and I met with the CSS investment brokers. As of 12/31/02, the market value of our Memorial Funds was \$205,822. During 2002, these funds generated \$9,557 of interest income that we can distribute through our student grants program. This figure is below the income generated in 2001 (\$12,622) but is above that generated in 1999 and 2000 (both years about \$8,500). Our interest income likely will decline over the next few years as our higher-interest investments come due or are called in and we must re-invest at lower rates. Basically, it is a tough investment climate in which to try and generate income!

In the absence of high yields, the other way to generate income is to increase the principal value of our funds. I encourage your financial contributions to our Memorial and Endowment Funds. You may also wish to consider reducing your tax bill for 2003 by contributing shares of stocks or mutual funds to the Colorado Scientific Society. Generally speaking, gifts to charities and non-profit organizations are not subject to gift taxes, and the donation is eligible for an income tax deduction.



### *A View Through the Brown Diapir...uuhh, I Mean Diaper*

*by Lisa Ramirez Rukstales*

Imagine. Having a baby *does* change everything. Good thing I decided years ago that I can sleep when I'm dead. As for little Scott Diego, he'll be 8 weeks old by the time you read this, and he still hasn't shown any geologist tendencies. I guess he's still a little young to be putting rocks in his mouth. Most moms would probably discourage this, but if it's okay for me, it should be fine for him. Right? As for me, whenever I go to write "diaper" on the grocery list it comes out "diapir." I keep waiting for hubby to ask, "What kind? Mafic?" And then there's the visiting nurses who come to make sure your preemie is gaining weight and doing fine. How much is he eating? How many diapers per day? What color is the poopie? Sheesh, how can I describe this stuff? Uhhh, "It looks like a cross between 10 Y 7/4 and 10 GY 6/4!" I sometimes wonder if being a scientist and a mommy is more than my internal worry-meter can take. The maternal instinct goes into safety-first hyperdrive from day one. Speaking of which, does anyone know where I can get a miniature hard hat?

# COLORADO SCIENTIFIC SOCIETY FAMILY NIGHT

## Tropical rainforests, dinosaurs, and drinking water: The odd urban geology of the Denver Basin

**When:** Friday, April 18, 2003  
**Where:** CSM Geology Museum, Berthoud Hall, corner of 16<sup>th</sup> and Maple, Golden,  
Colorado  
**Cost:** \$21.00/adult and \$17.00/young adults under 18

Dinner will begin at 6:30 p.m. Our featured speaker, Kirk Johnson, will begin his talk at 7:30 p.m. in Room 108, Berthoud Hall.

Dinner this year will be a Western Style Buffet\* consisting of:

Beef Brisket and Rosemary Chicken  
Wild green salad  
Petite corn and the cob  
Garlic mashed potatoes  
Rolls with butter  
Peach or apple cobbler  
Water, ice tea and coffee are included  
Alcoholic beverages will be available for purchase.

\*If you have any vegetarian requirements, please let us know as soon as possible.

Please RSVP no later than April 11, 2003 to: Jim Cappa at Colorado Geological Survey, 1313 Sherman Street, Room 715, Denver, CO 80203. Please make checks payable to the Colorado Scientific Society.

## Hope to see you there!

Detach and send with payment

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

Number of adults attending: \_\_\_\_\_ young adults: \_\_\_\_\_

Amount enclosed: \$\_\_\_\_\_

## 2002 Contributions to Memorial & Endowment Funds

The Society thanks its members & friends who contributed a total of \$3,213 to our Memorial and Endowment Funds during 2002. As of December 31, 2002, the total value of our Memorial Funds investments was approximately \$205,000 (which includes about \$8,000 in interest reserved for the 2003 awards) and the balance of the Endowment Fund (used to cover Society expenses) was \$14,200.

### Memorial Fund

### Primary research objective

Ogden Tweto (1984): Field-based earth-science research in Colorado and adjacent areas  
 Stephen Oriol (1986): Geologic studies of the Idaho-Wyoming thrust belt and associated topics  
 Edwin Eckel (1990): Engineering geologic studies in the United States  
 William Pierce (1994): Studies of the Heart Mountain fault, Wyoming, & associated problems  
 George Snyder (1998): Studies of Precambrian geology and basement tectonics, Rocky Mountain region.

Since the Memorial Fund Program started in 1984, the Society has awarded student research grants in Earth Sciences with an aggregate value of just over \$100,000. Please remember that your entire contribution goes towards generating interest for the grants and that your contribution is 100% tax deductible, because the Society is a non-profit Section 501 (c)(3) organization.

In the table of contributors below, Memorial or Endowment Fund contributions in the memory of others are shown in brackets, whereas an asterisk indicates those contributing \$100 or more.

|                              |                          |                           |
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| Ball,* Theodore T.           | Hembre, Don              | Doug Carter, Bob Cadigan] |
| Baltz, Elmer H.              | Kinkel, Robert A.,       | Ratté, James C.           |
| Barclay,* C. S. Venable      | [Art Kinkel]             | Rice, Cynthia             |
| Birkeland, Peter W.          | Kirkham, Robert M.       | Robertson, Jacques F.     |
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| Boland, Maeve A.             | Leonard III,* B. F.      | Robinson, Peter           |
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| Camp, Nancy Ann              | McCarthy, Jr., J. Howard | Sims, Paul K.             |
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| [Ogden, Marguerite and Paul] | Moench,* Robert H.       | Smith,* Marjorie C.       |
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| Curtis, Graham R.            | Mytton, James W.         | Tuttle, Michele L.        |
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| Duckworth, Edward G.         | Ohl, Jane P.             | Williams, Paul L.         |
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| Eberle, Mary C.              | Personius, Stephen F.    | Wobus, Reinhard A.        |
| Evanoff, Emmett              | Pierce, Kenneth L.       | Zeller, Howard D.         |
| Freeman, Val L.              | Pillmore,* Charles L.    | Zielinski, Robert A.      |

# 2003 Colorado Scientific Society Field Trip Schedule

## **Emmett Evanoff, Field Trip Coordinator**

The number of field trips available to the members of Colorado Scientific Society is expanding! Three field trips have been scheduled for late spring and early fall, and three other trips are in the planning stage.

The first field trip will be a four-day field trip to the Black Hills and Badlands of South Dakota. This trip will be led by Jack Redden, John Lufkin, Lee Shropshire, and Emmett Evanoff and will examine the Paleozoic and Precambrian rocks of the Black Hills, the Eocene and Oligocene rocks of Badlands National Park, and the Eocene intrusions of the northern Black Hills, including Devils Tower. The trip is scheduled for June 6-9 and will cost \$310.

The second trip will be on Saturday, June 21, and will be a one-day tour of the rocks of the Denver Basin Project, led by Bob Raynolds. This will be a new kind of trip, during which we will meet at a central location, car-pool, and everyone will bring his or her own lunch. There will be a small cost of \$7 for this trip. The third scheduled trip will be to the San Juan Mountains on September 19-22. Peter Lipman, Chuck Chapin, Bill McIntosh, and possibly some others will lead this trip. I have not yet determined a price for this trip, but it will be probably be about \$300.

Three other trips are still in the planning stage. One will be a one-day trip to examine the Pennsylvanian-Permian rocks of the northern Front Range. The other one-day trip will be to visit the Kremmling Giant Ammonite site sometime in the fall (Emmett Evanoff will lead this trip).

Finally, I hope to start a new program for the Colorado Scientific Society. In those Octobers when GSA is not in Denver, CSS will be sponsoring a one-day symposium on some topic of regional geology followed by a one-day field trip. The first symposium will be on the Tectonics of the Front Range, a memorial to Bill Braddock. I am hoping to reserve the lecture hall in the Benson Earth Sciences Building at the University of Colorado in Boulder, tentatively on October 3 and 4. I will include more information on all of these trips in the May newsletter.

If you are interested in attending any or all of the scheduled trips, please fill out the short form given below and send it to me at the address given below. Those who reply will receive early a registration form through the mail. I will be providing the registration form in the May newsletter as well. Hope to see you on the trips!

Emmett Evanoff  
Department of Geological Sciences, 399 UCB  
University of Colorado, Boulder, CO 80309-0399.  
Phone: 303-444-2644, FAX 303-444-2684,  
[emmettevanoff@earthlink.net](mailto:emmettevanoff@earthlink.net)

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### **2003 Colorado Scientific Society Field Trips – Scheduled Trips**

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

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

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

I am interested in attending all of the following field trips (check all that apply):

Black Hills (June 6-9): \_\_\_\_\_ Denver Basin (June 21): \_\_\_\_\_ San Juans (Sept 19-22): \_\_\_\_\_



# Earth Science Meetings and Talks

Newsletter items must be received by the 4th 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, American Mountaineering Center in Golden (unless otherwise advertised). Social time begins at 7:00 p.m. and talks start at 7:30 p.m. For information, contact Jim Cappa at (303) 866-3393, [jim.cappa@state.co.us](mailto:jim.cappa@state.co.us)

**Colorado School of Mines, Van Tuyl Lectures** Fridays from 3:00 to 4:00 p.m. in Berthoud Hall room 108: April 4 - **Ignimbrites and Calderas from the Central and Northern San Juan Mountains: New Tales From Old Tuffs**, Peter Lipman; April 11- **The History of a New Play: Thunder Horse Discovery, Deepwater Gulf of Mexico**, Cindy Yielding, AAPG Distinguished Lecturer; April 18 - **Ground and Surface Water Contributions to Chemical Mass Discharge: Considering the Problem at Field and Basin Scales**, Richelle Allen-King; April 25 - **The Mesozoic and Cenozoic Tectonics of Liaodong Bay, Eastern China; Implications for the History of the Tan Lu Fault Zone**, Chuck Kluth.

Web page: <http://www.mines.edu/academic/geology/calendar/vantuyl.html>

**Denver International Petroleum Society** meets the 2<sup>nd</sup> 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 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. For additional information contact Dick Beach, (303) 986-6535 .

**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. April 7 (at *Green Hall*, Colorado School of Mines) – **Magma, Melt Inclusions, Metals and Ores**, Edwin Roedder, Professor Emeritus, Harvard University. 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 deals with the application of well logs to oil and gas exploration. April 15 - **Facies Based Petrophysics**. Call Elice Wickham at 303-573-2781 for reservations. Web page: <http://dwls.spwla.org>.

Friends of Dinosaur Ridge; 7:00 pm at Red Rocks Elementary School in Morrison, CO. Join now. April 8 - **Dinosaurs Who Survived the Meteorite at the K/T Boundary**, Jim Fassett. Web page: <http://www.dinoridge.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. April 4 - Petroleum Industry Perspective 2003. Web page: <http://www.rmag.org>.

**USGS Central Region Colloquium Series** Lectures held weekly, 1:30-2:30 p.m., Foord Conference Room, Bldg. 20 (entrance W-3), Denver Federal Center, Lakewood, CO. Mar. April 3 and 10 – **TBA**; April 17 - **Paleohydrology of Mars**, Justin Ferris; April 24 - **Aquatic Systems Research on the Yellowstone River**, Terry Waddle and Ken Bovee. For more information call Pete Modreski, 303-202-4766, [pmodreski@usgs.gov](mailto:pmodreski@usgs.gov) or see <http://geology.cr.usgs.gov/crg/colloquia.htm>.

**University of Colorado at Boulder, Geological Sciences Colloquium** Wednesdays, 4:00-5:30 p.m., Benson Earth Sci. Bldg., Rm. 180. Refreshments at 3:30 PM on the 3rd floor. April 2 - **The Initiation of Subduction**, Michael Gurnis; April 16 - **Structural Ore Controls in the Creede Mining District, Colorado**, Stanton Caddey; April 23 - **Good Rocks Gone Bad: The Ubiquity of Chemical Disequilibrium During Metamorphism**, William Carlson; April 30 - **Satellite Measurements of Temporal Variations in the Earth's Gravitational Field**, R. Steven Nerem. For info, call 303-492-8141. Web page: <http://www.colorado.edu/GeolSci>.

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