



# Colorado Scientific Society

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

## *February Presentations:*

### **“Fault Zone Architecture and Permeability Structure”**

**Jonathan S. Caine**

**U.S. Geological Survey Postdoctoral Fellow**

*And*

### **“Jupiter’s Satellite Io: The Volcanic Moon”**

**John Reiss**

**President of John Reiss, Jr., and Associates, and**

**JPL-NASA Ambassador for Colorado**

**Thursday, February 17, 2000**

**American Mountaineering Center**

**710 10<sup>th</sup> Street (NE corner with Washington)**

**Golden, Colorado**

**Social Half-hour: 7:00 p.m.**

**Meeting Time: 7:30 p.m.**



## Message from the President

I am pleased to announce that the new year for the Colorado Scientific Society started off well with last month's Emmons Lecture given by Douglas Burbank (Penn. State University). Doug presented a thought-provoking analysis of relations between tectonics, climate, and landscape development in the Himalayas. As an added bonus, members were treated to a splendid view of the lunar eclipse as it approached its maximum immediately after the lecture.

Last month marked the successful inauguration of electronic distribution of the newsletter via the portable document format (PDF). About 40 members received their newsletter in this fashion. Electronic distribution of the newsletter is fast and saves reproduction time and mailing costs for paper copies. Special thanks go to Randy Schumann, Bob Bucknam, Scott Lundstrom, and Mike Machette who worked to take this next step in keeping the Society abreast with developing technology. If you have not yet returned your annual dues form from the December letter (hint!), you may choose this option. Otherwise, please contact me at [mHUDSON@USGS.GOV](mailto:mHUDSON@USGS.GOV) if you wish to receive the newsletter electronically. However, if you prefer receiving the paper copy of the newsletter via the mail, be assured that this will remain an option.

Eric Nelson has once again assembling an interesting program for the upcoming year. I hope to see you at the meeting on February 17 to hear John Reiss and Jonathan Caine.

Mark R. Hudson

## Just a Reminder

### **Please remember to mail your membership dues and renewal application.**

Membership dues help support monthly meetings, field trips, family night, student night, the annual Emmons lecture and the production of this newsletter. About half of our 400 current members have made their 2000 dues payments--Have you? If your newsletter mailing label says 2000 in the upper right corner, you are our good graces. If it says 1999, you are in arrears. Dues are a modest \$5-15 depending on status (student, corresponding, or regular). Prompt payment of outstanding dues would be greatly appreciated.



# Fault Zone Architecture and Permeability Structure

## Abstract of presentation by Jonathan Caine:

Fault zones in the upper crust are typically composed of complex fracture networks and discrete zones of comminuted and geochemically altered fault rocks. Their three-dimensional architecture, as well as their response to *in situ* stress, can significantly impact the patterns and rates of fluid flow in and around them. A series of numerical simulations of fluid flow in a set of three-dimensional discrete fracture network models aids in identifying the primary controlling parameters of fault-related fluid flow. Conceptual models for fault-related permeability structures in many geologic settings are derived from field investigations, laboratory permeability measurements, and *in situ* flow tests. Brittle fault zones often comprise a complex arrangement of distinct structural and hydraulic components: a fault core (where strain is accommodated) and a damage zone (subsidiary structures related to growth). Fluid flow in individual fault zone components and full outcrop scale model domains are simulated using a finite element routine. Two idealized end-member fault zones are used to shed light on the myriad combinations of fault core and damage zone structures found in nature and how they control whether a fault zone will act as a fluid flow conduit, barrier, or combined conduit-barrier system. The simulations are done in idealized, but geologically realistic, fault zone architectural models based on fracture data collected along exposures of the Stillwater Fault Zone in Dixie Valley, Nevada and geometric data from a series of normal fault zones in east Greenland. The models are also constrained by an Andersonian model for mechanically compatible fracture networks associated with normal faulting.

Permeability contrasts between components and permeability anisotropy within components are identified as the major controlling factors in fault-related fluid flow. Additionally, the structural and hydraulic variations in these components are also major controls of flow at the scale of the full model domains (20m by 20m by 20m). The model results demonstrate that small changes in the architecture and hydraulic parameters of individual fault zone components can have very large impacts, up to five orders of magnitude, on the permeability structure of the full model domains. Changes in fault zone architecture can cause major changes in permeability structure that, in turn, significantly impact the magnitude and patterns of fluid flux and solute transport both within and near the fault zone. Future modeling efforts will include the impact of *in situ* stress on fault-related fluid flow in the discrete fracture network models.

\* Excerpted from: Caine, J. S. and Forster, C. B., 1999, Fault zone architecture and fluid flow: Insights from field data and numerical modeling, *in* Haneberg et al., eds., *Faults and subsurface fluid flow in the shallow crust*, AGU Geophysical Monograph Series 113, p. 101–127 AND Caine, J. S., 1999, *The architecture and permeability structure of brittle fault zones*, Ph.D. Dissertation, University of Utah, Salt Lake City.

*Jonathan is a U.S. Geological Survey Postdoctoral Fellow, he received his Ph.D. from the University of Utah in March, 1999.*



# Jupiter's Satellite Io: The Volcanic Moon

## Presentation by John Reiss:

Io is Jupiter's third largest moon and is slightly larger than earth's moon. Io's surface is radically different from any other body in the solar system. It is seemingly the most volcanically active body of the solar system and has an amazing variety of terrains: calderas up to several kilometers deep, lakes of molten sulfur, mountains which are apparently not volcanoes, extensive flows hundreds of kilometers long consisting of some low viscosity fluid ( sulfur or silicate rock? ) and volcanic vents. This presentation will cover the details of the latest discoveries on Io by the Galileo spacecraft; the Hubble telescope and other earth based telescopes. (The slides, as provided by NASA scientists, are remarkable)

- ◆ *John (a Colorado resident for 23 years) is president of the John Reiss, Jr. and Associates, Inc, environmental and geotechnical engineering consulting firm. John is also an amateur astronomer, and the JPL-NASA Ambassador for Colorado. He is a geological engineering graduate from the Missouri School of Mines, Rolla, Missouri, where he received a B.S. in 1971.*

## Research Grants Available

The Colorado Scientific Society invites graduate students to apply for research grants to be awarded in April 2000. Applicants must be enrolled in a Masters or Ph.D. program at an accredited college or university. Eight to ten grants ranging from \$500 to \$1200 each will be awarded for field-oriented research on the geology, geochemistry, and geophysics of the Rocky Mountain region. In addition, grants as large as \$1000 are awarded for engineering geology research (with no restriction on the geographic area of interest), and one or more grants for as much as \$1750 (total) are offered for studies of the Heart Mountain fault in northwestern Wyoming. Interested students can obtain application forms and grant information directly from the Society web site at: <http://home.rmi.net/~css/> or by mail from Chuck Pillmore, Chair of the Memorial Funds Committee, Colorado Scientific Society, P.O. Box 150495, Lakewood, CO 80215-0495. **Deadline for applications is April 7, 2000.**



## Please Update Your E-mail Address

Be sure that the Society has your current e-mail address if you want e-mail notification of meetings and other society activities. Probably the easiest way to ensure that our records are up-to-date is to fill in the e-mail address line on this year's dues payment form. If you have already paid this year's dues and did not show your current e-mail address, please send updated information to [bucknam@usgs.gov](mailto:bucknam@usgs.gov) (put CSS E-mail on the subject line).

## Presentation at March CSS Meeting

Jim White, of CU Boulder, will be giving a talk at next month's meeting. The title of his presentation is "New Developments in Carbon Cycle and Climate Change."

## *Rivers: The Song of Life* Exhibition

Foothills Art Center, 809 15<sup>th</sup> St., Golden is presenting a major exhibition:

### *RIVERS: THE SONG OF LIFE*

*January 15, to March 12, 2000*

Five interrelated exhibits will celebrate the beauty and historical significance of rivers of the world, including displays on scientific and historical aspects; the art of fishing; photography of rivers and river life since the 19<sup>th</sup> century; and paintings and sculptures by 18 top artists from Colorado and throughout the U.S. Admission is free. Hours are 10 am – 5 pm Monday-Saturday: 1-5 pm Sunday.

Contact Carol Dickinson, Director for more information (303-279-3922) or [fac@foothillsartcenter.org](mailto:fac@foothillsartcenter.org).

Slide-Talks associated with this exhibition, and co-sponsored by the Colorado School of Mines take place at 7:00 pm, Green Center, CSM, and are free:

**Monday, February 21, at 12 noon** **Bob Weimer**, Emeritus Professor of Geology, Colorado School of Mines presents "*Rivers: Types, Exploration, Trade*" This is a brown bag lunch talk, bring your lunch – cookies and coffee provided.

## Museums

**Friends of Dinosaur Ridge** For information call 697-DINO. Visitors' Center is located at 16831 West Alameda Parkway (north side of Alameda, just west of the C-470 overpass). Open 9 a.m. to 4 p.m. weekdays and weekends. Fireside chats are held at the Red Rocks Elementary School Cafe, in Morrison starting at 7 p.m.



# Earth Science Meetings and Talks

**The Friends of Dinosaur Ridge and the Morrison Natural History Museum** present a free fireside chat lecture: “The Geologic History of the Denver Basin” by Dr. Bob Reynolds, research associate with the Denver Museum of Natural History. The talk will be given Thursday February 24, 2000, at 7 PM at the Red Rocks Elementary School at the west end of Morrison. (Phone (303) 697-DINO)

**Colorado Scientific Society's** regular meetings are held the third Thursday of the month (unless otherwise advertised). Social time begins at 7:00 p.m. and presentations start at 7:30 p.m. For information, contact Mark Hudson at (303) 236-7446 or [mhudson@usgs.gov](mailto:mhudson@usgs.gov).

**Denver International Petroleum Society (DIPS)** meets the 2<sup>nd</sup> Friday of each month at the Wynkoop Brewing Co., 18<sup>th</sup> 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. For information contact Jim Piper, (303) 932-0134, or the website <http://www.dregs.org>.

**Colorado School of Mines Lectures** For Heiland Lectures at 4:00 p.m. on Fridays, contact Michelle Szobody (303) 273-3451. For information on Van Tuyl Lectures, call the Dept. of Geology at (303) 273-3800.

**Colorado State University Geology Lectures** Mondays, 4:10 p.m. in room 109 or 316 of the Natural Resources Building. Call the Dept. of Earth Resources at (970) 491-5661 for further details.

**University of Colorado at Boulder, Geological Sciences Colloquium**  
Wednesdays, 4:00-5:30 p.m., Rm. 180. For schedule, contact Kathy Madsen 303-492-8141.

## **U. S. Geological Survey, Geologic Division Colloquium**

February 17: Margaret Hiza: “The geochemistry and geochronology of the Eocene Absaroka volcanic province: New perspectives on the magmatic and tectonic history of the Cordillera”

February 24: Chris Potter: “Structural interpretation, Brooks Range Foothills and Arctic coastal plain, Northern Alaska”

March 2: Thom Fisher: “Neuro-fuzzy 3-D modeling of fluvial meander belts- Prediction of sedimentary geometries and rock properties in the geologic subsurface”

March 9: Scott Minor: “Structural characteristics and cementation patterns of fault zones in the Albuquerque Basin, New Mexico: Implications for groundwater flow models”

Bldg 20, Denver Federal Center, Thursdays, 1:30-2:30 p.m., Foord Conference Room.  
For a more complete schedule, contact Margaret Hiza: (303) 236-0075.



# COLORADO SCIENTIFIC SOCIETY

## 2000 DUES AND MEMORIAL FUND CONTRIBUTIONS

\_\_\_\_\_  
 (Last Name)                      (First Name)                      (Initial)                      (Telephone)

Check if new address information

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**I WOULD LIKE TO RECEIVE THE NEWSLETTER BY EMAIL AS A PDF FILE (IN LIEU OF A PAPER COPY) AND SAVE THE SOCIETY TIME, MONEY, AND A FEW TREES.**

**DUES:** Dues are for the calendar year and help support the monthly meetings and newsletter, field trips, family night, student night, and the annual Emmons Lecture.

Regular Members (\$15) ..... \_\_\_\_\_  
 Corresponding Members (\$10)..... \_\_\_\_\_  
 Student Members (\$5) ..... \_\_\_\_\_

**MEMORIAL FUNDS:** Supports earth-science research grants to graduate students.  
 If not specified as to the fund, contribution will be distributed equally:

(A) Ogden Tweto Memorial Fund ..... \_\_\_\_\_  
 (B) Steven Oriel Memorial Fund ..... \_\_\_\_\_  
 (C) Edwin Eckel Memorial Fund ..... \_\_\_\_\_  
 (D) Bill Pierce-Heart Mountain Fund ..... \_\_\_\_\_  
 (E) George Synder Memorial Fund ..... \_\_\_\_\_

This contribution in memory of \_\_\_\_\_

**ENDOWMENT FUND:** Funds are used to support the Society's operations and special activities:..... \_\_\_\_\_

**TOTAL CONTRIBUTION (DUES AND FUNDS):** ..... \_\_\_\_\_

Please make your dues and/or contribution checks payable to the Colorado Scientific Society and specify the Fund(s) to which you are contributing.

All Colorado Scientific Society activities depend on volunteer help. Please mark those activities that you can help with. We will pass your name on to the appropriate Committee Chairperson.

Audio Visual   Fund Raising   Newsletter   Science Fair   Geologic Signs   History   Sci. Program  
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\_\_\_\_\_

**Send this form & your check to:**

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







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Lakewood, CO 80215-0495

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**\*\* NOTE: Please help us with publicity by posting copies of the Newsletter on bulletin boards.**

