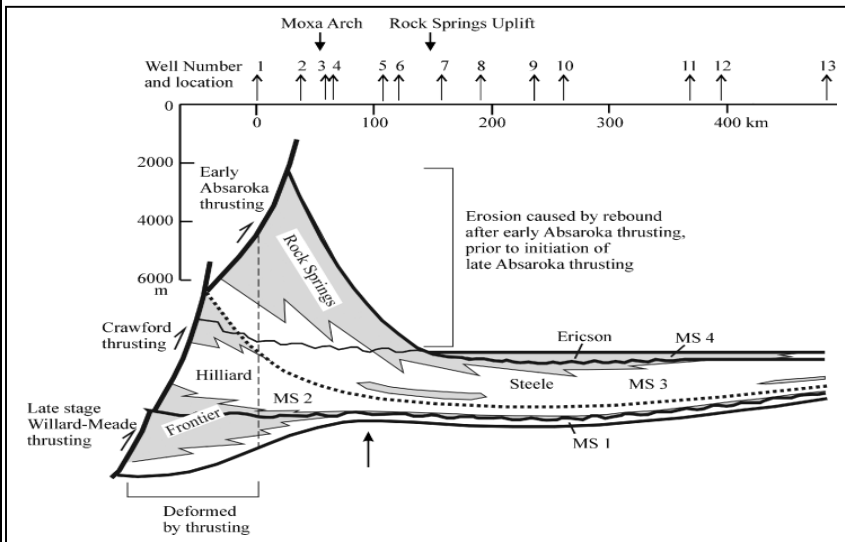




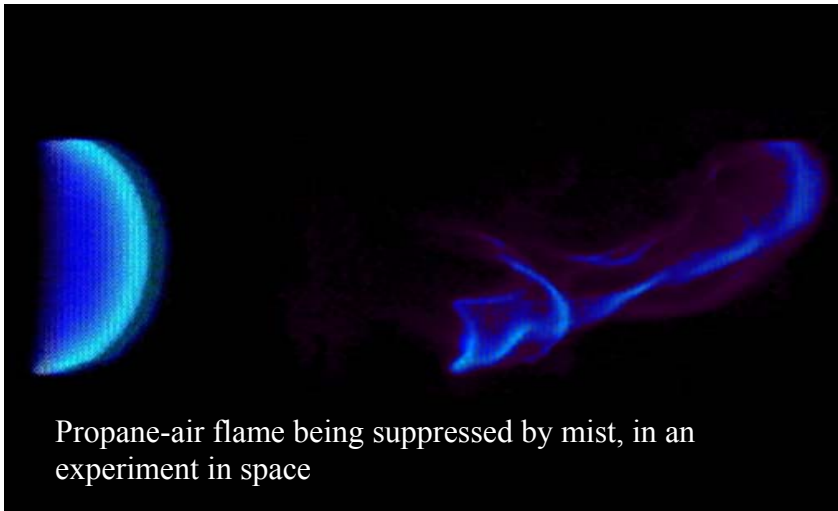
# Colorado Scientific Society

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



## Late Cretaceous subsidence in Wyoming

By Dag Nummedal,  
Colorado School of Mines



Propane-air flame being suppressed by mist, in an experiment in space

## The *MIST* experiment on the space shuttle *Columbia*: fighting fire in microgravity

By Angel Abbud-Madrid,  
Colorado School of Mines

**Thursday, February 16, 2006**  
**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**

---

### **Late Cretaceous Subsidence in Wyoming**

By Dag Nummedal, Colorado Energy Research Institute, Colorado School of Mines

The Farallon plate convergence with the western margin of North America during the late Cretaceous directly controlled rates and patterns of subsidence across the Rocky Mountains and Great Plains, through three linked mechanisms: 1) dynamic subsidence related to mantle convection above the subsiding slab – this subsidence mechanism operated on a wavelength of a few 1000s of miles and was in-phase along strike across most region, 2) flexural subsidence in the retroarc foreland basin landward of the Sevier orogenic belt – operating on a wavelength of less than 200 miles and probably asynchronous along strike, 3) dynamic subsidence or uplift related to plate convergence rate and subduction angle – in control of the temporal distribution of basement involved (Laramie) tectonism.

Quantitative modeling of subsidence induced by Sevier-belt flexure allows this component to be subtracted from the total subsidence across the region. One such detailed

separation exercise has been performed across southern Wyoming, demonstrating that the Sevier-belt flexure influenced only the western parts of the Greater Green River basin, and that late Cretaceous subsidence from there eastward to Iowa was dominantly a product of dynamic subsidence. 3D modeling of the flexural forebulge in response to Sevier and Wind River thrusting demonstrates that this tectonic feature migrated southeastward in response to shortening on the Wyoming-Idaho salient of the Sevier thrust and the Wind River thrust, but rarely extended much farther east than the (tectonically younger) Rock Springs uplift.

This quantitative subsidence reconstruction reveals that most of the late Cretaceous Western Interior Seaway lay well to the east of the Sevier foreland basin; a finding that also is supported by mapping the forebulge as a zone of thin strata throughout the region.

## **Abstract**

---

### **The *MIST* experiment on the space shuttle *Columbia*: fighting fire in microgravity**

By Dr. Angel Abbud-Madrid, Associate Director of the Center for Commercial Applications of Combustion in Space (CCACS), Colorado School of Mines

Increasing interest in fine water mists as fire suppressants has been driven by the search for an environmentally friendly replacement of harmful chemical fire-suppression agents and by the need to protect both water- and weight-sensitive areas with low requirements for total water flow. In addition, with NASA's renewed emphasis on spacecraft fire safety in orbital and planetary manned missions, water mist has also been identified as one of the best candidates for putting out fires in space. Since a weightless environment allows the fundamental

study of the flame/mist interaction by eliminating the distorting effects of buoyancy, the Water-Mist Fire Suppression Experiment (*Mist*) was flown on the STS-107 mission of the Space Shuttle *Columbia* on January, 2003 to take advantage of this unique environment.

The experiment was designed, fabricated, assembled, and tested at the Center for Commercial Applications of Combustion in Space (CCACS), a NASA Research Partnership Center located at the Colorado School of Mines (CSM) in Golden, CO.

*Mist* was then integrated into the Combustion Module-2 (CM-2) at the NASA Glenn Research Center from where it was later transported and placed in the payload bay of the Space Shuttle.

The objective of *Mist* was to study the effects of droplet size and water concentration on the burning velocity of a propagating, premixed propane-air flame inside a cylindrical tube. Changes of the flame speed and shape were used as the measure of flame suppression efficacy. Thirty-two tests were conducted with four different fuel-air mixtures, two droplet sizes, and a variety of water loadings. All tests were conducted during microgravity periods ( $10^{-6}$  g) and over 90% of the information gathered in orbit was downlinked to Earth in the form of sensor and video-image data prior to the tragic end of the STS-107 mission. In

addition, sensor data from a complete test point were recovered from a flash memory unit found among the debris of the Orbiter several months after the accident.

This talk will describe the project objectives, the development of the experiment at CSM, the operation of the experiment from the NASA JSC Mission Control Center in Houston in January 2003, the results obtained from the mission, and the impact of the research project on the design of the next generation of fire suppression systems on Earth and in space.

## **Colorado Scientific Society President's Note—February 2006**

By Chuck Kluth

### Profiles

A lot is in the news lately about profiles. I usually don't bring it up since mine is not very picturesque. But our society needs to think about its profile and ways to make it higher. As several of the last presidents have pointed out, the Colorado Scientific Society is facing a crisis. We don't seem to be attracting enough new members to offset the number of retired USGS folks who have been the main force in the Society through the years. I have some ideas for raising our profile and, hopefully, acquainting people with what a fun intellectual bargain CSS represents. We need to attract the new folks at the USGS but also those in the growing oil industry as well as other government and private

agencies. We'll be discussing several ideas at the Council meeting in February. But I can't imagine that I have thought of all of the good ideas to raise the profile and let people know who we are and what we do. So I invite you to send your ideas to me and I'll make sure any serious ones get discussed at the Council meeting. I've already heard from a few of you, and the ideas are good ones. I need the membership to help us out on this one. So if you have an idea for raising our profile, let me know. At the same time, I will continue to work on my profile, hopefully in the opposite direction.

## **CSS Research Grant Report**

By Jim Cappa

Colorado Scientific Society research funds supported work by Nate Gilbertson, *3D Geologic Modeling and Fracture Interpretation of the Tensleep Sandstone, Alcova Anticline, Wyoming*. In the original proposal to the CSS Research Grant

Committee, funds were requested to aid in the field work at Alcova Anticline required for this project. \$1000 was granted and spent in the following manner:

--\$892 – May/June 2004: 2 weeks of field work at Alcova Anticline (transportation, camping fees and food)

--\$108(of \$403) – September 2004: 1 week of field work at Alcova Anticline (transportation, camping and food)

Work on this project was expected to be completed by December, 2005. The preliminary results were presented as a poster at the 2005 AAPG Annual Convention in Calgary, and are as follows:

--The new geologic map of Alcova Anticline is based upon GPS-controlled formation tops and faults.

--A set of 14 balanced serial cross sections establishes the nature of the structure and provides control for a 3D geologic model.

--Lidar data interpretation of fracture planes at Alcova Anticline resulted in interpretations consistent with those measured in the field at Alcova as well as for analogous Laramide age Tensleep structures.

--This study demonstrates the value of Lidar data for fracture characterization in outcrop. Fracture orientations, spacing, and height can be quantified by observing planar features in Lidar-based digital elevation models. Such data provide the essential input for 3D geologic and reservoir flow models

**Abstract:** Alcova Anticline is a Laramide-age structure on the southeast margin of the Wind River

basin, central Wyoming. The Pennsylvanian Tensleep Sandstone, a prolific oil-producing reservoir in the Rocky Mountains, occurs at the core of the exposed anticline. The North Platte River cuts across the axis of the anticline, resulting in two near-vertical walls of Tensleep Sandstone, approximately 500 m wide, 100 m tall, and separated by 140 m. High-resolution (1-2 cm) Lidar scans of the two walls were acquired to study the frequency and orientation of fractures in the structure. The Lidar survey at Alcova was designed to collect sufficient data points to resolve fracture planes  $\geq 1 \text{ m}^2$  in area. Additionally, high-resolution photomosaics were draped over the data set. The Lidar dataset has been processed using various decimation approaches. Fracture planes have been detected using automated and handpicking approaches.

One goal of the study is to populate a 3D geologic model with a fracture network, based on outcrop work. The 3D geologic model, which is built from serial cross sections, is constrained by GPS measurements of key formation contacts in the study area. Extracted fracture data from the Lidar dataset determine the parameters used to seed the fracture generating model. A further goal of this study is to provide input into a reservoir model of Teapot Dome anticline, an analogous Tensleep reservoir and a proposed CO<sub>2</sub> sequestration site.

## WANTED

Science-minded volunteers to help at area science fairs. These are beneficial events for the schools and students, all of whom will very much appreciate the help of anyone who can volunteer to do this.

**April 13** Valverde Elementary 2030 W. Alameda Ave.

**April 20** McMeen Elementary 1000 S. Holly

**April 26** Valverde Elementary 2030 W. Alameda

**May 4** Steele Elementary 320 S. Marion Parkway

**May 6** DPS District Fair Place Middle School, 7125 Cherry Creek N. Drive

Contact Debbie Turner, Community Resources, Inc., 303-782-0975 or [Debbie\\_Turner@dpsk12.com](mailto:Debbie_Turner@dpsk12.com)

**Feb. 9** 6-8:30 p.m. Ralston Elementary School (Lookout Mountain area, at the Genesee exit on I-70), Dinner will be served prior to judging! Contact Connie Walker, [conniewalk@aol.com](mailto:conniewalk@aol.com), or 303-526-0954.

**Feb. 27** The Denver Metro Regional Science Fair, 1-6 p.m., at the Denver Museum of Nature and Science. An online site for prospective judges to register is [www2.uchsc.edu/ahec/science](http://www2.uchsc.edu/ahec/science). With questions or to volunteer your help, please contact James O. Stevens, [science.fair@uchsc.edu](mailto:science.fair@uchsc.edu), 303-315-2680 or Pete Modreski, [pmodreski@usgs.gov](mailto:pmodreski@usgs.gov), 303-202-4766

# 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 Chuck Kluth, CSM, 303- 904-2939, [kluth@earthlink.net](mailto:kluth@earthlink.net)



**SM SEG Student Chapter**, Feb 10-11, Short course—Diamonds, by Dr. Karin Hoal, CSM Geology Museum, 13<sup>th</sup> and Maple, 8:30-4:30. Cost, \$345, students, \$30, includes course notes, lunch, breaks. For information, [www.mines.edu/Academic/geology/seg/index](http://www.mines.edu/Academic/geology/seg/index) or [epesce@mines.edu](mailto:epesce@mines.edu).

**Denver Mining Club** meets every Monday (except when noted) at Country Buffet near Bowles and Wadsworth (at 8100 W. Crestline Ave.) 11:30-1:00. Feb 6, Bart Suchomel, Principal, Western Mining Services. Understanding and Managing Risk and Reward in Global Mineral Exploration. Feb 13, Bill Boberg, VP/U.S. Projects, Ur-Energy Co. Uranium - Renewed Life in Wyoming. Feb 27, Victoria Egorova, Financial Analyst. The Financial Transparency of the Mining Industry - The International Perspective <http://china-resources.net>.

**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, luncheon at noon, program at 12:30. 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. Feb 6, John Black, President, Antares Minerals, "The Haquira SX-EW deposit, Las Bambas District, south-central Peru." 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. Call Eleice Wickham at 303-573-2781 for res. <http://dwls.spwla.org>.

**Rocky Mountain Association of Geologists (RMAG)** Social at 11:30, lunch at noon, talk at 12:30. Reservations are taken at 303-623-5396 until 10:30 am, Wed. before the lunch. Cancellations are taken until 11 am on Wed. at 303-573-8621. Lunch--\$20 at the door. Talk only (no res)—\$3. Location: Denver Petroleum Club, Anaconda Tower, 555-17th St, 37th floor. Mar 10, 12<sup>th</sup> Annual 3-D seismic symposium. <http://www.rmag.org>

**Rocky Mountain SEPM** Reception at 11:30, lunch at noon, speaker at 12:30. Reservations, Dave Uhl:303-389-5092 before noon of preceding Friday. \$15.00 lunch, \$3 talk only. Wynkoop Brewing Company, 1634 18<sup>th</sup> St., Denver. [David.uhl@EnCana.com](mailto:David.uhl@EnCana.com).

**Co-AIPG** 11:30-social, noon-1:30-lunch and speaker. Cost-\$25. University Club, 1673 Sherman St, Denver. Reservations: Tom Cavanaugh, 303-458-5550, [tcavanaugh@ascg.com](mailto:tcavanaugh@ascg.com).

**University of Colorado at Boulder, Geological Sciences Colloquium** Wednesdays, 4:00-5:30, Rm. 180.Refreshments at 3:30 on the 3rd floor. Feb 8, Dr. Scott Lehman, INSTAAR, "Calibration of the 14C timescale and reconstructed 14C activity for the last 50,000 years." Feb 15, Dr. Kurt Feigl, "What can we learn about rheology from the geodetic measurements of post-seismic deformation in fault zones? Examples from California, Turkey, Iceland." 303-492-8141. Web page: <http://www.colorado.edu/GeolSci>.

**Friends of Dinosaur Ridge.** Web page: <http://www.dinoridge.org>. Admission is free, but donations are welcome. For more information contact the FODR Visitor Center at (303) 697-3466.

**Colorado School of Mines, Van Tuyl Lectures** Fri, from 3:00-4:00 in Berthoud Hall, Room 108. Feb 8, James Syvitski, INSTAAR, Boulder, CO "Construction of a community surface dynamic modeling system". Feb 15, Maya Elrick, University of New Mexico, Albuquerque, NM, "Paleozoic paleoclimate investigations using oxygen isotopes from apatitic marine Conodonts". <http://www.mines.edu/academic/geology>.

**USGS Geologic Division Colloquium.** Thursdays, 1:30, Foord Room, Building 20, Denver Federal Center.. Contact: Pete Modreski, USGS, 303-202-4766, 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: Chuck Kluth, CSM, 303- 904-2939, [kluth@earthlink.net](mailto:kluth@earthlink.net)  
President-Elect: Bill Nesse, UNC  
Treasurer: Don Sweetkind, USGS, 303-236-1828, [dsweetkind@usgs.gov](mailto:dsweetkind@usgs.gov)  
Secretary: Lisa Fisher, CSM, 303-567-2403, [lfisher@mines.edu](mailto:lfisher@mines.edu)  
Past President: Vince Matthews, CGS, 303-866-3028, [vince.matthews@state.co.us](mailto:vince.matthews@state.co.us)

## COUNCILORS

2006-2009: John Keller, CGS, 303-866-3458, [john.keller@state.co.us](mailto:john.keller@state.co.us)  
2006-2009: Scott Minor, USGS, [sminor@usgs.gov](mailto:sminor@usgs.gov)  
2003-2007: Matt Morgan, CGS, 303-866-2066, [matt.morgan@state.co.us](mailto:matt.morgan@state.co.us)  
2004-2007: Celia Greenman, CGS, 303-866-2811, [celia.greenman@state.co.us](mailto:celia.greenman@state.co.us)  
2004-2007: Sue Hirschfeld, Cons., 720-565-9302, [eqdoc@ix.netcom.com](mailto:eqdoc@ix.netcom.com)  
2004-2007: Lee Shropshire, UNC, 970-352-8778, [leeshrop@att.net](mailto:leeshrop@att.net)

## COMMITTEE CHAIRPERSONS

Best Paper Award: Carl Kellogg  
Database Manager: Cory Conrad, 303-629-8788, [cconrad@knightpiesold.com](mailto:cconrad@knightpiesold.com)  
Field Trips: Emmett Evanoff, UCB, 303-492-8069, [evanoff@colorado.edu](mailto:evanoff@colorado.edu)  
Graphics: Karen Morgan, CGS, 303-866-3529, [karen.morgan@state.co.us](mailto:karen.morgan@state.co.us)  
History: Marjorie E. MacLachlan, USGS-retired, 303-986-7192, [jcmemaclachlan@aol.com](mailto:jcmemaclachlan@aol.com)  
Membership:  
Memorial Funds: Emmett Evanoff, 303-444-2644, [emmettevanoff@earthlink.net](mailto:emmettevanoff@earthlink.net)  
Newsletter Editor: Celia Greenman, CGS, 303- 866-2811, [celia.greenman@state.co.us](mailto:celia.greenman@state.co.us)  
Outreach: Sue Hirschfeld, 720-565-9302, [eqdoc@ix.netcom.com](mailto:eqdoc@ix.netcom.com)  
Program: Vince Matthews, CGS, 303-866-3028, [vince.matthews@state.co.us](mailto:vince.matthews@state.co.us)  
Publicity: Mearl Webb, 303-810-1296, [mf\\_webb@msn.com](mailto:mf_webb@msn.com)  
Science Fair: Chuck Weisenberg, 303-238-8806, [cweinsbrg@aol.com](mailto:cweinsbrg@aol.com)  
Webmaster: John M. Ghist, 303-875-9671 [jmghistcss@msn.com](mailto:jmghistcss@msn.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!*