# 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*
## *(Past) President's Address*

**A New Look at Old Friends—**
**The Paleogeography of the Ancestral Rocky Mountains**
**Chuck Kluth, *Colorado School of Mines***

## Thursday, February 15, 2007

***American Mountaineering Center, 1st floor conference room***
**710 10th St. (NE corner with Washington), Golden**
**Social half-hour – 6:30 p.m. Meeting time – 7:00 p.m.**

# Abstract

## A new look at old friends—The paleogeography of the ancestral Rocky Mountains of Colorado

*By* Chuck Kluth, Director, Center of Research Excellence, Colorado School of Mines

New data, combined with earlier data, indicate that previous interpretations of the geometry and timing of the classical Ancestral Rocky Mountains in the Colorado region are in need of revision. N-S stratigraphy of the Fountain Formation along the present Front Range suggests that the Fountain on lapped a broad NW-SE arch that began to develop in early Pennsylvanian time. Interbedded or subjacent marine rocks are preserved as far north as Lyons and as far south as Perry Park, Colorado. The interbedded marine rocks and the preservation of earlier Paleozoic rocks indicate that the Front Range was separated from a narrow, uplifted block in the Colorado Springs area, the Ute Pass Block. The southwestern margin of the Front Range was faulted and had approximately 6 kilometers of structural relief. In contrast, the NE side of the Front Range is now interpreted to have been a NE dip slope with only minor faulting. The presence of Pennsylvanian marine rocks constrains the Front Range to have had its northern plunge end at approximately the Colorado-Wyoming state line.

The San Luis Highland is interpreted to have been a west dipping fault block with approximately 8 kilometers of structural relief on its eastern side and a gentle west dip-slope on the western side. It is interpreted to have been a separate uplift from the adjacent Uncompaghre Uplift to the west, during at least its early history, and possibly its entire history. The San Luis Highland was uplifted in early Pennsylvanian time and shed coarse sediments eastward and northward into the Central Colorado Trough, and more fine grained sediments westward into the Paradox Basin.

The Uncompaghre Uplift is interpreted to have been uplifted in late Pennsylvanian and early Permian time, after the deposition of the middle Pennsylvanian evaporites. The data show that the geometry of the Uncompaghre front, SE of the Utah/Colorado state line, contrasts to the single large fault in Utah, and is a stack of SW directed thrust faulted basement blocks. Distribution of synorogenic sediments derived from the Uncompaghre Uplift was largely by axial river systems. Loading by the sediments caused the underlying salt to move into salt walls that nucleated on basement faults. These basement faults formed between middle-late Mississippian and middle-early Pennsylvanian time. The basement faults are usually interpreted as normal faults, but there is evidence that at least some of them were reverse faults. The development of accommodation space for each minibasin between salt walls ended when the pre-salt and post-salt sections welded together, as the last of the salt moved from beneath the basin. The locus of deposition then moved to the SW, farther away from the Uncompaghre front, and a younger salt wall and minibasin formed. This process was repeated several times, with the result that the salt walls are progressively younger toward the SW. The coarse alluvial fan material was preserved and prograded away from the mountain front only after the locus of deposition moved to the SW and axial rivers no longer redistributed the erosional debris. The new interpretation of the geometry and timing of the Uncompaghre Uplift suggests that the Paradox salts and the Eagle Valley Evaporites were deposited in a continuous basin that existed across the site of the later Uncompaghre Uplift.

The Central Colorado Trough was a NW-SE basin located between the Ancestral Front Range and the San Luis Highland and Uncompaghre Uplift. The Trough appears to have been complexly faulted, and contained crustal slivers that were uplifted in a complicated pattern within the trough. These blocks and slivers included the Ute Pass, Wet Mountain/Hartsel Uplift, possibly the ancestral Sawatch Uplift, and unknown small uplifts known only from lithologies and paleocurrent data from their synorogenic sedimentary packages. Normal

block faults and thrust faults are located in the Central Colorado Trough, although the details of their relationships to each other are not yet known.

There appears to have been almost no reactivation of Late Paleozoic Ancestral Rocky Mountain structures during the Late Cretaceous/Early Cenozoic Laramide Orogeny. Most of the younger structures cut across the earlier structures. Structures oriented almost normal to the Laramide regional stress, such as the Uncompaghre and San Luis fronts, the Ute Pass and Gore faults, were reactivated with movements that appear to be orders of magnitude less than the late Paleozoic movement. The Laramide Front Range formed in a N-S orientation that is oblique to the NW-SE orientation of the Ancestral Front Range, which might have been at almost right angles to the regional Laramide stress fields.

Formations derived from the Ancestral Rockies, and land use, today.

****Please note that the February meeting will be in a first floor conference room of the Mountaineering Center.** The meeting will include discussion of business items that were postponed due to cancellation of the December meeting.

# President's Note--February 2007

Plans are proceeding for the Society's activities this year. For the Spring Field Trip, Mike Machette will take us to look at ancient Lake Alamosa on June 2-3. The Council also approved a symposium to deal with recent advancements on Colorado volcanism to be held on May 19th and plans are moving along for that. The model will be the Braddock symposium held a few years ago at CU Boulder. Lisa Fisher is finalizing arrangements for Family Night in April and we will announce the venue as soon as we receive confirmation. Emmett Evanoff, Libby Prueher, and Christine Turner have agreed to serve as the Program Committee to schedule another year of interesting talks for the monthly meetings.

The Society operates on the strength of the many individuals who volunteer their time and expertise to get things done. While all deserve thanks, I would like to single out Marjorie MacLachlan. After serving as Historian for years, she has indicated that she must relinquish this responsibility. On behalf of the membership, Council, and myself, I want to extend our thanks for her years of steady service.

If you haven't already done so, please get your membership renewals in the mail. The form can be found on the Society's web page http://www.coloscisoc.org.

# 2007 CSS Field Trips

Put June 2-3 on your calendar for the Society's Spring field trip to visit ancient Lake Alamosa, a Plio-Pleistocene lake that occupied a large part of the San Luis Valley. The trip is led by Michael Machette (USGS-Denver), who won the 2006 Best Paper of the Year Award for his CSS talk on Lake Alamosa. We will examine various lake features, such as spits, bars and lagoon deposits, discuss the timing and ultimate overflow of the lake, peat and tufa deposits, and visit the Quaternary Mesita Volcano. We will also visit the Sangre de Cristo fault zone and its scarps near Fort Garland, which are as young as early Holocene. On the trip down to the Alamosa, we will make a brief stop near Kenosha Pass to arm wave at the eastern margin of South Park, where new mapping by Bob Bohannon and Cal Ruleman (USGS) has revealed some intriguing new features. Cost, including transportation (vans), lunches, and one night lodging, will be kept to a minimum, and camping may be an option to reduce costs even more. Student grants from the Pillmore Fund are available to cover some or all of your expenses. Contact Karl Kellogg (kkellogg@usgs.gov; (303) 236-1305) for additional information.

Also, ***stay tuned*** for information on this Fall's 1-day trip to Florissant, which will be led by National Park Service paleontologist Herb Meyer. Early October looks like the most likely time, which will be finalized very soon. At least one additional single-day field trip is also being planned

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# Class offering

An ore microscopy short course will be given March 20-22, at Colorado School of Mines. The cost is $995, U.S., and $500 for full time students. Contact John Lufkin, instructor, 303-284-2646 or 303-273-3321, luk3comcast.net, space@mines.edu or www.mines.edu/outreach/cont_ed/ore.html.

# Earth Science Meetings and Talks

*Newsletter items must be received by the 25th of each mont*h. 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 Bill Nesse, UNC, 970-330-7183 nesse@ctos.com

**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 5, Judd Sundine and Scott Powell, "A shocking approach: separation of heavy metals, emulsified oil, and other constituents using electricity." Feb 12, Jim Blanning, "The Leadville Limestone: a future bonanza." Feb 26, Bob Jordan, "Intake shaft raised under Lake Huron (MI) by freezing lake's clay bottom." http://china-resources.net.

**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 5, Sandra Perry, Perry Remote Sensing, "Mineral mapping approach using airborne and satellite imaging systems". For information contact Jim Piper, (303) 932-0137, or the website http://www.dregs.org. Also, Distinguished lecture series, *Strategy in the mining and metal industries,* Jose Luis Rebollo, Feb 6, Feb 13, and Mar 6, 4-5:15 p.m., Petroleum Hall, Green Center, CSM.

**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, $15. Subject matter usually deals with the application of well logs to oil and gas exploration. Feb 20, Keith Katahara, Hydro-Gulf, "Shale properties, over-pressure, and smectite-illite transformation." Call Eleice Wickham at 303-573-2781 for reservations. Web page: http://dwls.spwla.org.

**Rocky Mountain Association of Geologists (RMAG)** Reception at 11:30, lunch at noon, talk at 12:30. Reservations by recording at 303-623-5396 until 10:30 a.m., Wed. before the luncheon. Cancellations until 11:00 a.m. on Wed. at 303-573-8621. Luncheon is $20 payable to RMAG at the door. Talk only (no res)—cost is $3. Location: Denver Marriott, 17th & California. Feb 16, Marian Warren, AAPG distinguished lecturer, "Case study from the Cretaceous of Alberta." Web page: 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 18th St., Denver. David.uhl@EnCana.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 7, James Zachos, "A rapid rise in greenhouse gas concentrations 55 mya, a deep sea perspective." Feb 21, Timothy Dixon, "Hurricane Katrina and New Orleans: subsidence." 303-492-8141. Web page: http://www.colorado.edu/GeolSci.

**Colorado State University, Dept of Geosciences,** Rm 320 Natural Resources Bldg, 4:10 pm. Feb 5, Bridget Scanlon, GSA distinguished lecturer, "Impacts of changing land use on subsurface water resources in semi-arid regions." Feb 19, Fred Ogen, "Curious features of the annual runoff hydrograph, in seasonal tropics, upper Rio Chagres River, Panama." 970-491-5661. http://www.cnr.colostate.edu/geo/seminars

**Friends of Dinosaur Ridge**. Morrison Town Hall, 110 Stone St, 7:00 p.m. Web page: http://www.dinoridge.org. Admission is free, but donations are welcome. Feb 28, David Warren, "Fossils of China." For more information contact the FODR Visitor Center at (303) 697-3466 .

**Denver Museum Nature and Science,** Feb 12, 7 p.m. Darwin Day, screening, "Flock of Dodos-Evolution Intelligent Design Circus" Phipps IMAX, $15 non-members.

**Colorado School of Mines, Van Tuyl Lectures** Thursdays from 4-5 p.m. in Berthoud Hall room 108.
http://www.mines.edu/academic/geology.html

**USGS Geologic Division Colloquium.** Thursdays, 1:30 , 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.

**Café Scientifique.** Wynkoop Brewery, 18th & Wynkoop, 6:30 p.m. Feb 20, Kirk Johnson, Denver Museum Nature and Science, "Salvaging suburban science: how the fossils beneath Denver document climate change." No charge, except for beer.
http://cafescicolorado.org/Upcoming

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

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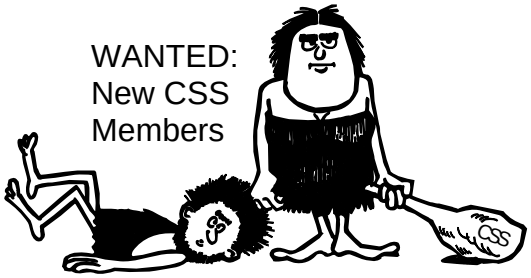


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