



## ***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 President's Address***



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

**Thursday, December 21, 2006**

*American Mountaineering Center*

**710 10<sup>th</sup> St. (NE corner with Washington), Golden**  
**Social half-hour – 6:30 p.m. Meeting time – 7:00 p.m.**

## **Abstract**

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# 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 overlapped 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, to the 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.

## **2007 Emmons Lecture**

The Emmons lecture will be held on January 18 at the Green Center. Dr. Mary Lou Zoback, vice-president of Earthquake Risk Applications for Risk Management Solutions will speak on, “The 1906 San Francisco earthquake and a century of progress in understanding earthquakes and their effects”. **Mark your calendars!**

## **2006 Student Awards**

Three students presented talks at the November meeting. The judges awarded first prize of \$500 to Ian Merkel, of Colorado State University for, “Processes of magma evolution: A Trace Element Study of magmatic epidote”. Second prize of \$250 went to Gloria Lopez, Colorado School of Mines, for, “Regional zoning of alteration and mineralization of Espino iron-oxide copper gold district, coastal Cordillera of northern Chile. Siobhan Fackelman, University of Northern Colorado, received third prize of \$100 for, “Shatter cone occurrences indicate a possible impact structure near Santa Fe, New Mexico.” The students will receive their awards at the January meeting.

## **2007 CSS Officer Nominees**

The nominees for new officers are Tim McIntyre and Jeremy McCreary for councilors, and Matt Morgan for president-elect. A verbal vote will be taken at the meeting. If you wish to be nominated, or you know of other persons who wish to be nominated, please contact Chuck Kluth at [kluths@comcast.net](mailto:kluths@comcast.net) or [ckluth@mines.edu](mailto:ckluth@mines.edu).



# 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 at 303-273-3889 or [ckluth@mines.edu](mailto:ckluth@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. Dec 11, Carl Nelson, Bellhaven Copper and Gold, "Gold and copper exploration in Panama." <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. Dec 11, Miles Silberman and Hans Klob, "The Schellgaden mining district, central Austria, a strata-bound Au-W deposit in the eastern Alps". 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 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, 17<sup>th</sup> & California. Web page: <http://www.rmags.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).

**University of Colorado at Boulder, Geological Sciences Colloquium** Wednesdays, 4:00-5:30, Rm. 180. Refreshments at 3:30 on the 3rd floor. Dec 6, Jim McCalpin, "Neotectonics of the Sangre de Cristo fault, Colorado's most active fault." 303-492-8141. Web page: <http://www.colorado.edu/GeolSci>.

**Colorado State University, Dept of Geosciences**, Rm 320 Natural Resources Bldg, 4:10 pm. 970-491-5661. <http://www.cnr.colostate.edu/geos/seminars>

**Friends of Dinosaur Ridge.** Morrison Town Hall, 7:00p.m. 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** 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](mailto:pmodreski@usgs.gov).

**Café Scientifique.** Wynkoop Brewery, 18<sup>th</sup> & Wynkoop, 6:30 p.m. Dec 12, Dr. Wayne Sheppard, USFS, "What's all the hullabaloo over dying aspen?" 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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## OFFICERS

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## COMMITTEE CHAIRPERSONS

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