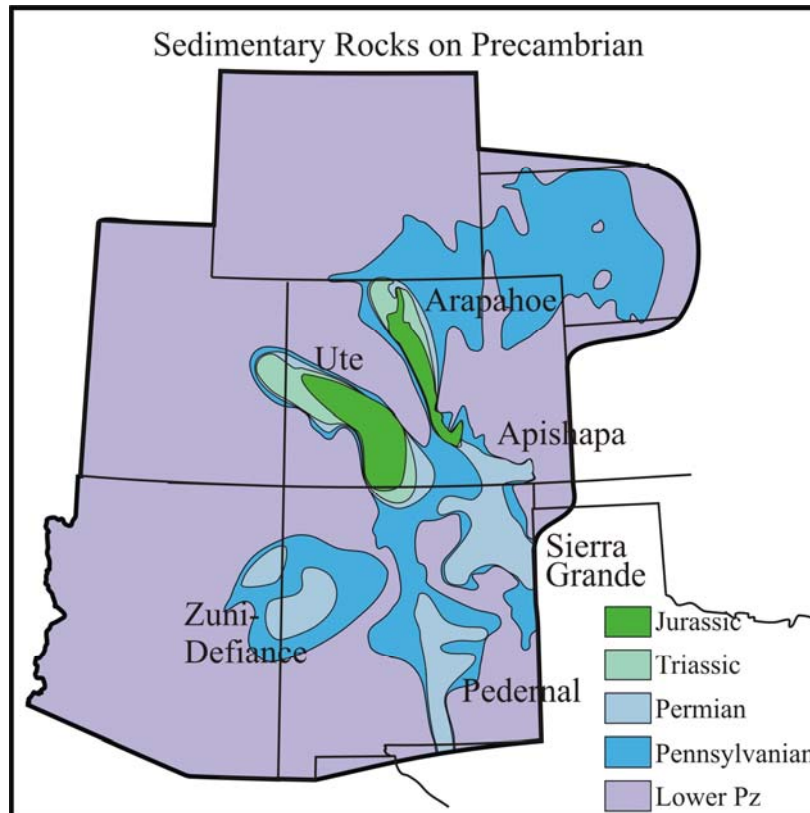




Colorado Scientific Society

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

Colorado Scientific Society Presidential Address



Late Paleozoic Uplifts in Colorado, Utah, Wyoming New Mexico, and Adjacent Areas

Dr. William Nesse, University of Northern Colorado

Thursday, December 20, 2007

American Mountaineering Center

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

Abstract

The late Paleozoic uplifts in Colorado, Utah, Wyoming, New Mexico, and adjacent areas

By William D. Nesse, Department of Earth Sciences, University of Northern Colorado

The location of “Ancestral Rockies” uplifts that developed in the Pennsylvanian is defined by the distribution of sedimentary cover on Precambrian Basement as documented by geologic mapping and oil well data. Areas of major Pennsylvanian uplift which shed clastic debris into adjacent basins are approximated by areas where Permian and younger sediments rest on basement. Areas with preserved Mississippian and older sediments must be in adjacent basins. Areas with Pennsylvanian sediments on basement are marginal to the uplifts and are either areas of pre-Pennsylvanian non-deposition or erosion, or areas where Pennsylvanian uplift was sufficient to erode early Paleozoic rocks before being buried by sediments derived from the uplifts.

The use of the terms *Ancestral Rocky Mountains*, *Ancestral Front Range*, and *Ancestral Uncompaghere* is rooted (Lee, 1918, Ver Wiebe, 1930) in the incorrect presumption that Laramide and Pennsylvanian uplifts are coincident and represent areas of continuous topographic and structural relief from the Paleozoic to the present. Continued use of Laramide/Modern structural terms for Pennsylvanian features is inappropriate and confusing. It is suggested that the terms *Arapahoe uplift* and *Ute uplift* replace *Ancestral Front Range* and *Ancestral Uncompaghere*, respectively. The term *Anasazi uplifts* is suggested as an alternative to *Ancestral Rocky Mountains*.

Based on the criteria outlined above, the Arapahoe, Apishapa, Ute, Sierra Grande, Pedernal, and Zuni/Defiance uplifts can be documented. The Arapahoe and Apishapa Uplifts extend NNW from SE of Pueblo diagonally across the modern Front Range, Middle and North Parks, and Park Range and a short distance into Wyoming. The Ute uplift forms a dog-leg shape in SW Colorado and adjacent areas in New Mexico and Utah. The oldest sediments to extend continuously across the Arapahoe and Ute uplifts are Jurassic. The Sierra Grande and Pedernal uplifts are irregular shaped

areas in NE and south central New Mexico respectively. The Zuni/Defiance uplift is a roughly circular area with two segments straddling the New Mexico-Arizona border. Permian sediments rest on basement nearly continuously on the Sierra Grande, Pedernal, and Zuni/Defiance uplifts.

A number of features have been identified in the literature as Pennsylvanian uplifts, but which are either platform areas within basins, or did not exist. Platforms are areas where the water depth shoaled so that deposition was restricted. Mallory's (1966) Pathfinder uplift in Wyoming is a distal portion of the gentle north flank of the Arapahoe uplift. It is a platform area and includes areas where both early Paleozoic and Pennsylvanian sediments rest on basement and is not a major structural feature. An area in western Wyoming is often shown as an uplift, but this too, is a platform area with nearly continuous coverage of Pennsylvanian sediments resting on lower Paleozoic sediments. The Piute/Emery platform area in central Utah has been re-defined based on the available oil well data to be an area which lacks Pennsylvanian sediments but where older sediment is preserved. The Florida Island and Roosevelt areas in southwest and eastern New Mexico, respectively, are small platform areas, but not significant uplifts. The “Ancestral Sawatch Range,” presumed to have once occupied the site of the modern Sawatch Range, did not exist. Mississippian and older sediments are preserved around the flanks and on top of the Sawatch Range indicating that the area was within the Pennsylvanian Central Colorado Trough depositional basin in the Pennsylvanian.

Depositional basins adjacent to the uplifts received up to 20,000 feet of clastic and evaporite sediments. These include the Eagle Basin/Central Colorado Trough, Paradox Basin, Dalhart Basin, Rowe-Mora/Taos Basin, Tukumcari Basin, and Orogrande basin. The Pennsylvanian basin in eastern Colorado is usually incorrectly referred to as the Denver Basin, but the Denver Basin is a

Laramide construct. It is suggested that this basin, which extends to the SE to join with the Anadarko Basin, be referred to as the Pueblo Basin. The Central Colorado Trough is often shown in the literature extending continuously into New Mexico and connecting with the Rowe-Mora basin. Data from this study, combined with a reinterpretation of isopach data presented by McKee and Crosby (1975), show that the Cimarron Arch separates the Rowe-Mora basin from the basin in Colorado. Further, it appears that the Central Colorado Trough was divided into two segments. The northern portion is often referred to as the Eagle Basin. It is suggested that the southern portion, roughly

centered on the modern Sangre de Cristo Range, be referred to as the Cuchara Basin.

Data from this study and reinterpretation of the Pennsylvanian isopach data from McKee and Crosby (1975) establish the presence of a more-or-less continuous Pennsylvanian structural arch that includes the Florida platform, Zuni Defiance uplift, and Piute/Emery platform, extending from southern New Mexico, across northeast Arizona and into west central Utah. This structural arch served as the western or southwestern boundary for the Orogrande, Rowe-Mora, and Paradox basins.

President's Notes, December 2007

By Bill Nesse

In last month's missive, I encouraged everyone to contribute to one or more of the memorial funds that the Society maintains for the purpose of supporting student research. This month I would like to address the issue of how we manage those funds. For the past year the Council has been discussing the options available to us for the effective management of the funds, which total roughly a quarter million dollars. The initial impetus for studying this issue was when our broker wanted to institute a variety of new fees whose impact would have been to significantly reduce the amount of funds available for research grants. While we were able to avoid those fees for the immediate future, the Council thought it was appropriate to look at other alternatives.

As things currently stand, the funds are held with a broker and invested in bonds and certificates of deposit. While an investment committee consisting of the Treasurer and a number of Past Presidents is supposed to supervise the investments, as a practical matter, the Treasurer makes investment decisions in consultation with the broker. This arrangement has significant problems:

- Lack of diversification.
- High fees and transaction costs
- Extra work for Treasurer

Expectation that Treasurer have sophisticated investment expertise

In addition, while any one of us might be happy to manage our own money and take our lumps if we make poor decisions, it is quite another thing to have the responsibility to manage other people's funds. While Don Sweetkind has done an excellent job, I think the current arrangement imposes on him (or any Treasurer) an unreasonable responsibility to manage a large amount of money.

For these reasons the Council has been investigating placing the funds with an investment management firm such as Vanguard or Fidelity. While all of the Council's questions have not been answered, it appears that making this move will address the problems that we have identified. We would have much greater diversification, lower fees and transaction costs, and professional management. The role of the investment committee and Council would be to establish investment goals, risk tolerance, and related issues to guide us in establishing the best mix of investments to make.

The current investment policy has emphasized the preservation of capital, with all investments being the purchase of individual bonds. While this practice is often seen as having little risk, in reality

that is not the case. First, because we hold only a handful of bonds, we lack diversification. While all are investment-grade bonds, there is always the risk of default. Second, the value of bonds fluctuates in response to changing interest rates. Holding the bonds to maturity minimizes this risk but does not eliminate it. Third, and most important, is that the real value of bonds is constantly eroded by inflation. Because we pay out essentially all of the interest received from the bonds, we are assuring that the real value of the capital is constantly declining. Protecting against the ravages of

inflation involves assuming risk in the form of the fluctuating prices of common stock.

The level of risk that we are willing to accept is a matter that must be established after careful consideration and discussion, but I think that we need to assume some risk to assure that we have a healthy and growing program of support for student research now and well into the future. As the Council reviews our investment policy, we welcome the input that the members may have.

Annual membership dues

By Don Sweetkind

Membership dues for the coming year (2008) are now due. Membership in the Colorado Scientific Society is for one calendar year. The Membership fee comes due in December of each year. Annual dues payments are \$20 for regular members; \$10 for corresponding members (outside the Colorado Front Range area), and \$5 for students. Dues are payable by check mailed to the Society mailing address shown on the renewal form; you may use a credit card to pay dues directly (via PayPal) on the Colorado Scientific Society web site (www.coloscisoc.org). A membership renewal form is included with this edition of the newsletter; the form is also available as a Word document or PDF on the Society web site. As you pay your dues, please consider making an additional contribution to

one of our Memorial Funds (which support our student research grants program) or the Endowment Fund (which we use to defray operating costs). Contributors will receive an acknowledgement receipt for tax-reporting purposes. Please remember that your entire contribution goes towards generating interest for the grants and that your contribution is 100% tax deductible since the Society is a non-profit Section 501 (c)(3) organization. If you are uncertain of your member status or feel that our records are incorrect, contact Colorado Scientific Society Treasurer Don Sweetkind by phone at 303-236-1828 or by e-mail at dsweetkind@usgs.gov. We sincerely appreciate your interest in the Colorado Scientific Society and hope you will renew your membership.



DUES & FUNDS CONTRIBUTIONS COLORADO SCIENTIFIC SOCIETY

(Last Name) (First Name) (Initial) (current email, if available)

DUES: Dues are for the calendar year (January-December)

Regular Members (\$20, CO Front Range)	
Corresponding Members (\$10)	
Student Members (\$5, enrolled in college)	

MEMORIAL FUNDS: These funds support earth-science research grants to graduate students throughout the nation. If your contribution is not specified, it will be distributed equally among the funds:

(A) Ogden Tweto Memorial Fund	
(B) Steven Oriel Memorial Fund	
(C) Edwin Eckel Memorial Fund	
(D) Bill Pierce-Heart Mountain Fund	
(E) George Snyder Memorial Fund	
(F) Chuck Pillmore Memorial Fund	
This contribution is made in the memory of:	

ENDOWMENT FUND: This fund is used to support the Society's monthly

meetings and newsletter, field trips, family night, annual Emmons Lecture, and special activities.	
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TOTAL CONTRIBUTIONS (DUES AND FUNDS): _____

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Emmons Lecture—January 8, 2008, Green Center, CSM

Please note that the Emmons lecture in January will be on a **Tuesday night, the second week in January at 8:00 p.m.** The speaker will be Dr. Steven Squyres, who will speak on

Science Results from the Mars Exploration Rover Mission

The two Mars exploration rovers, Spirit and Opportunity, touched down on Mars in January 2004 and have been conducting extensive observations with the Athena science payload. Together the two rovers have traversed ~16 km. Spirit, located on the floor of Gusev crater, has investigated basaltic plains, as well as older materials in the Columbia Hills. The rocks of the Columbia Hills are largely clastic in nature and range from breccias to finely laminated deposits that have undergone significant aqueous alteration. They appear to be largely a mixture of altered impact ejecta and explosive volcanic materials. Recently, Spirit has discovered silica-rich deposits that may have formed in a hot spring or fumarole environment. Opportunity has carried out the first outcrop-scale investigation of ancient sedimentary rocks on Mars. The rocks are sandstones formed by wind and water erosion and re-deposition of fine grained siliciclastics and sulfate-rich evaporites. The stratigraphic section observed to date is dominated by eolian bedforms, with subaqueous current ripples exposed locally near the top of the section. While liquid water was present at Meridiani below and occasionally at the surface, the ancient environmental conditions recorded there are dominantly arid, acidic and oxidizing, and would have posed some significant challenges to life.

Steven W. Squyres is Goldwin Smith Professor of Astronomy at Cornell University, and is the Principal Investigator for the science payload on the Mars Exploration Rover Project. He received his Ph.D. from Cornell in 1981 and spent five years as a postdoctoral associate and research scientist at NASA's Ames Research Center before returning to Cornell as a faculty member. His main areas of scientific interest have been Mars and the moons of the outer planets. Research for which he is best known includes study of the history and distribution of water on Mars and of the possible existence and habitability of a liquid water ocean on Europa.

Dr. Squyres has participated in many of NASA's planetary exploration missions, including the Voyager mission to Jupiter and Saturn, the Magellan mission to Venus, and the Near Earth Asteroid Rendezvous mission. Along with his current work on MER, he is also a co-investigator on the 2003 Mars Express, 2005 Mars Reconnaissance Orbiter and 2009 Mars Science Laboratory missions, a member of the Gamma-Ray Spectrometer Flight Investigation Team for the Mars Odyssey mission, and a member of the imaging team for the Cassini mission to Saturn.

Dr. Squyres has served as Chair of the NASA Space Science Advisory Committee and as a member of the NASA Advisory Council. His awards include the American Astronomical Society's Harold C. Urey Prize, the Space Science Award of the American Institute of Aeronautics and Astronautics, the American Astronautical Society's Carl Sagan Award, the National Space Society's Wernher von Braun Award, and the Benjamin Franklin Medal of the Franklin Institute. He is a fellow of the American Academy of Arts and Sciences.



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 Bill Nesse, UNC, at 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. Dec 3, Peter Bojtos, Vaaldiam Resources, "Diamond mining in Brazil." Dec 10, Holiday story time, individual anecdotes. Dec 17, Auction of mining memorabilia, books, rocks, supplies. <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 10, Eric Nelson, CSM, "Drill-hole design for dilational ore shoot targets in fault-filled veins". 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, 17th & California. Dec 7, Mike Peacock, distinguished lecturer, "Athabasca oil sands, from regional to project scale, a case history." 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. Dec 5, Christine Siddoway, Colorado College, "Competing hypotheses for the formation of the Cretaceous west Antarctic rift system: assessing the role of melt in the crust." 303-492-8141. Web page: <http://www.colorado.edu/GeolSci>.

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

Friends of Dinosaur Ridge. Morrison Town Hall, 7:00p.m. Web page: <http://www.dinoridge.org>. Admission is free, but donations are welcome. Dec 16, 9:00-4:00, field trip to Bailey, in the footsteps of Arthur Lakes, led by John Ghist. For more information contact the FODR Visitor Center at (303) 697-3466 or cloverknoll@comcast.net.

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, 6:30-8:00, Dec 4, Mitch Morrissey, Denver DA, "DNA, from crime scene to courtroom!" Free, except for beer. <http://www.cafescolorado.org>

University of Northern Colorado Short Course, ESCI 575, Mar 8-9, "Earth materials in human and animal health", instructor Ulli Limpitlaw, 1 hr graduate credit, \$219. ulli.limpitlaw@unco.edu

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

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