



# Colorado Scientific Society

*In pursuit of the promotion of knowledge,  
understanding of science,  
and its application to human needs.*

## **Stratigraphic Cycles and Controls within a Continental Basin-Fill Succession in the Hornelen Basin (Middle Devonian), Western Norway**

**Donna S. Anderson**

Consulting Geologist, Golden, CO

## **Paradise Gained and Lost: A Geologic Tour of Tenerife, the Jewel of the Canary Islands**

**W. Ian Ridley**

USGS, Denver

**Tuesday, September 8, 1998**

**Union Square Theatre in the Sheraton Hotel**

**360 Union Boulevard**

**Lakewood, Colorado**

**Social Hour: 7:00 p.m.**

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

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## **Fall Field Trip Sept. 19-20**



# Speakers' Abstracts

## **STRATIGRAPHIC CYCLES AND CONTROLS WITHIN A CONTINENTAL BASIN-FILL SUCCESSION IN THE HORNELEN BASIN (MIDDLE DEVONIAN), WESTERN NORWAY**

**Donna S. Anderson**  
Consulting Geologist, Golden, CO

The Hornelen Basin (Middle Devonian) of western Norway is the most completely preserved of a series of structurally-linked, rapidly subsiding extensional basins that formed after the Silurian, continent-to-continent collision of the North American and Eurasian plates (Caledonian orogeny). The tectonic style of extension following compression is reminiscent of post-Laramide extension in the Great Basin of the western U.S.A. The syntectonic continental basin-fill succession is also analogous to Tertiary successions of the Great Basin, U.S.A.

In a study area along the north-central margin of the Hornelen Basin, sedimentary rocks consisting of interfingering deposits of the alluvial-fan, lake, and braidplain facies tracts are spectacularly exposed from the faulted basin margin to >4 km basinward. Mapping the organized relationships of coeval and interfingering alluvial-fan, lake, and braidplain facies in the study area shows three, nested (hierarchical) scales of stratigraphic cycles ranging from 4 to 120 m thick. Mapping also shows that the retreat or basinward advance of the alluvial-fan-facies tract is fundamentally linked to the expansion and contraction of the lake and braidplain facies tracts at all cycle scales.

Previous studies of Hornelen Basin strata are the sources of the "classic" and oft-cited tectonically-induced coarsening-upward alluvial-fan cycle. However, this study suggests that climate and an autocyclic mechanism, in addition to tectonics, controlled cyclicity of strata across all facies tracts. High sediment-accumulation rates in the alluvial-fan-facies tract correspond to high tectonic subsidence rates immediately adjacent to the faulted northern basin margin. But within this high subsidence background, climatically controlled lakes formed an important component of accommodation space. The mostly in-phase contraction and expansion of the alluvial-fan and braidplain facies tracts, that are sourced from entirely different geographic areas, also suggests a climatic control on cyclicity. An autocyclic mechanism produced by a huge difference in depositional topography between the alluvial-fan and adjacent braidplain facies tracts forms an important control at all cycle scales. Stratigraphic cycles in the continental strata of the Hornelen Basin are not simply the products of one forcing function. Rather they are products of independent and simultaneously operating controls.

## **PARADISE GAINED AND LOST: A GEOLOGIC TOUR OF TENERIFE, THE JEWEL OF THE CANARY ISLANDS**

**W. Ian Ridley**  
USGS, Denver

Welcome to Tenerife. The majestic volcano Pico del Teide rises to 3718 meters through the cloud banks that shroud the lower flanks of the island of Tenerife, one of the seven major volcanic islands of the Canary Archipelago. Teide sits within a large, semi-arid caldera whose origin has been debated for half a decade, but which, nonetheless, reveals the complex geologic history of the past 3 million years. In contrast, deeply incised, sub-tropical valleys within the western (Teno) and eastern (Anaga) peninsulas illuminate their earliest sub-aerial geologic history. Large landslide depressions on the northern and southern flanks of the island, and ~1800 cubic kilometers of debris on the adjacent seafloor, represent major sector zone collapse that is the dominant mechanism of destruction of the island. This geologic/travelog talk will illustrate the growth and destruction of the island.



# Message from the President

'Twas the night before classes, and all through Fort Collins, not a creature was stirring - unless you count the last-minute professors scurrying to assemble their courses. For students and geoscientists, particularly those with field notions, the end of August brings a far greater punctuation in lifestyle than the end of December. As such, it is a good time to contemplate the last few months and anticipate the coming months.

This summer saw some interesting developments in our understanding of the Rocky Mountains. Specifically, the initial results of the Deep Probe seismic experiment showed just how little we understand the Rocky Mountains. This long-range refraction study extended from the Colorado Plateau west of Albuquerque to northern Alberta. As reported by Henstock and nine other coauthors in the July issue of GSA Today, their profile showed remarkably thick (and seismically fast) crust under the Archean Wyoming Province and low velocity mantle under the thinner crust of the Colorado Plateau. Next year, more details about the underpinnings of the Rocky Mountains should come from the CD - ROM (Continental Dynamics - ROcky Mountain project) collaboration which will combine geologic, petrologic, reflection and refraction profiles of the Jemez Lineament in New Mexico and the Cheyenne Belt, which separates the Archean Wyoming province from the Proterozoic terranes to the south.

Our Fall field trip on September 19-20 will give you a chance to get firmly grounded on the fascinating geology of the Cheyenne Belt. It's coming up soon, so get those forms in to Lee Shropshire! And if a weekend field trip is too much to fit into your schedule, be sure to come to our meeting on September 8 to hear Donna Anderson talk about the Hornelen Basin of Norway and Ian Ridley talk about the Canary Islands.

October's family night promises to be an interesting event. It will be held at that other school's (aka Colorado School of Mines) geological museum on October 13th. Nolan Doesken, the Assistant State Climatologist, will hold forth on the topic "The Incredible Climate of Colorado." After some incredible moments 13 months ago near my house above Spring Creek in Fort Collins, I know I'll come with an open ear and lots of questions for Nolan.

November will bring us a newly revamped student night. In an effort to publicize the society more widely, teams of judges will be going to CSU, CSM and CU to run preliminary student research seminars. Then, one winner from each school will present their research at the November 10th CSS meeting. If you are interested in helping us encourage our state's young geoscientists by judging one of these competitions, please contact me.

It looks like a busy Fall for all, with something for everyone, be it a field trip or one of our diverse meetings. Right now, though, I've got to shift this mountain of field gear and find my ER570 notes for that class tomorrow... Eric Erslev

## George Snyder, 1927-1998

George Snyder, retired USGS geologist, died at home on August 16. He had been in declining health the past few months, but was in good spirits and found joy in bridge and cribbage, dining with friends, and finishing some geologic maps of Wyoming. He began his Survey career working on volcanic rocks in the Aleutian Islands of Alaska. However, George's main geologic interests were rooted in older rocks, especially the Precambrian igneous and metamorphic rocks of Colorado and Wyoming.

George was Colorado Scientific Society President in 1977, and served in many other capacities for the Society. He was a principal advisor for the Memorial Funds Program over the past decade and had been a frequent field trip leader and regular attendee at our monthly meetings.

George is survived by four adult children and was preceded in death by his wife Margaret. A memorial service for George was held on Tuesday, August 25, at 2:00 p.m. at the Christ Congregational Church in Lakewood, followed by a potluck luncheon at the church. The Snyder family asks that contributions be sent to the Colorado Scientific Society Memorial Fund, P.O. Box 150495, Lakewood, CO 80215-0495.

## 1998 Student Night

On Tuesday November 10, the Colorado Scientific Society will host a special night highlighting the geoscience work of students from Front Range colleges and universities. The program will consist of three 15-minute talks and will be held on the campus of CSM. Cash prizes will be given to all students chosen to participate. All participants will also receive complimentary one-year membership in the Society. This student night provides a fine opportunity for students to showcase their research before a knowledgeable yet friendly audience. Students are welcome to repeat talks from the GSA national meeting of October. Interested students can contact Eric Erslev (Department of Earth Resources, Colorado State University, Fort Collins, CO 80523; [erslev@cnr.colostate.edu](mailto:erslev@cnr.colostate.edu); 970-491-6375) to be included in preliminary sessions to be run at CSU, CSM, and CU.



## Museums and News

**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 Morrison Town Hall, 110 Stone Street in Morrison starting at 7 p.m.

**Association for Women Geoscientists** has announced their 1998 Chrysalis Scholarship winners. They are Mary Armstrong, University of Akron; Sister Augusta Collins, Abbey of Regina Laudis; Xanthippe Augerot, Oregon State University; and Debra Prim, Ohio University. All are pursuing graduate studies in the earth sciences. Information about the AWG Chrysalis Scholarships may be obtained by writing to: Chrysalis Scholarships, Association for Women Geoscientists, c/o G & H Production Company, LLC, # 930, 518 17<sup>th</sup> Street, Denver, CO 80202; ph. 303-534-0708, fax 303-623-0708, email: [gandh@idt.net](mailto:gandh@idt.net)

**Denver Gem and Mineral Show and Fossil Expo** Sept. 18-20, Denver Merchandise Mart, 451 E. 58<sup>th</sup>, for more information, call 303-233-2516

**Colorado Mineral and Fossil Show** Sept. 16-20, Holiday Inn, Denver North, 4849 Bannock St.

## Earth Science Meetings and Talks

**Colorado Scientific Society's** regular meetings are held the 2<sup>nd</sup> Tuesday 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 Eric Erslev at (970) 491-6375 or [erslev@cnr.colorado.edu](mailto:erslev@cnr.colorado.edu).

**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 calling Marybeth Davies (303) 573-3909x223. 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 "DIPS"). 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 Cappa, (303) 866-2611. Next meeting will be September 14, 1998.

**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



# Memorial Fund Awards

## \$7,617 awarded for student research

The competition was strong for student research grants from the Colorado Scientific Society's Memorial Funds. The Memorial Funds Committee, consisting of Karl Kellogg (Chair), Greg Holden, Susan Landon, Barney Poole, and Jack Reed, met April 28 to evaluate a total of 32 research proposals for the Tweto, Oriel, Eckel, and Pierce Funds. The proposals were from 22 different universities and represented seven Ph.D. candidates and 25 M.S. candidates. The range of research topics was broad, with a larger number of submittals than on previous years in the fields of water resources, environmental geology, and surficial processes. Consequently, the committee made its decisions with a bit more latitude than in previous years while still keeping to the intent of each fund.

In all, 11 awards totaling \$7,617 were awarded. These included five awards, totaling \$3,545, from the Tweto Fund for research in the central and southern Rocky Mountains, three awards, totaling \$2,100, from the Oriel Fund for research in structural geology in the northern Rocky Mountains, and three awards, totaling \$1,972, from the Eckel Fund for research in engineering geology. The committee feels confident that these 11 funded research grants are of the highest quality and fulfill the intentions of the many donors to the Colorado Scientific Society Memorial Funds.

No proposals suitable for funding from the Pierce Fund, for research on the Heart Mountain detachment fault in Wyoming, were submitted. Consequently, the amount accrued this year for the Pierce Fund (\$1,630) will be rolled back into the fund. Under the agreement by which the fund was established, if no grants are made under the Pierce Fund for three years, then the money after the third year may be distributed to any of the other funds.

### Ogden Tweto Memorial Fund

Janet Bertog, Ph.D. thesis, University of Cincinnati, \$700, High resolution stratigraphic correlation of the Late Cretaceous Pierre Shale using bentonitic beds

Derek Sjostrom, Ph.D. thesis, Dartmouth College, \$600, Geochemistry of ferricretes as an indication of pre-mining water quality and Holocene climate in historically mined areas of the Rocky Mountains

Dippold, Cassandra, M.S. thesis, Kansas State University, \$500, Fault kinematics, geometry, and timing of the Poncha Pass transfer zone, northern Rio Grande Rift, Colorado

Jason Ruf, M.S. thesis, Colorado State University, \$800, Fracture analysis of the northern San Juan Basin using both shear fractures and joints

Paul Wisniewski, M.S. thesis, University of New Mexico, \$945, Incision rates and knickpoint migration of the Canadian River, northeastern New Mexico

### Steven S. Oriel Memorial Fund

Thomas Kalakay, Ph.D. thesis, University of Wyoming, \$800, Structural and thermochronologic study of the Pioneer batholith, southwest Montana—a test of the critical taper wedge model in the Sevier orogen of southwest Montana (funded for second year)

Michael O'Connell, M.S. thesis, Montana State University, \$700, Relative timing and mechanisms of emplacement of the Phillipsburg batholith, western Montana

Mark Hespenheide, M.S. thesis, Montana State University, \$600, Thrusting and magmatism—a possible modification of the critical-taper wedge model

### Edwin B. Eckel Memorial Fund

David Mitchell, M.S. thesis, University of New Mexico, \$1,000, Modeling long-term rates of incision of four New Mexico streams using a field-calibrated stream power law

Andrew Dunn, M.S. thesis, New Mexico Tech, \$572, Hydrogeologic investigations of groundwater flow in and adjacent to a stabilized, deep-seated landslide near Costilla Reservoir, Taos County, New Mexico

Emily Hunt, M.S. thesis, University of Denver, \$400, Fire-related sedimentation on alluvial fans—Buffalo Creek and Spring Creek, Colorado



# Colorado Scientific Society

## 1998 FALL FIELD TRIP

THE CHEYENNE BELT - A MIDDLE PROTEROZOIC STRUCTURE IN  
SOUTHEASTERN WYOMING  
AND SOME GEOLOGIC HIGHLIGHTS OF NORTH CENTRAL COLORADO

**September 19-20, 1998**

Principal leader: Ted Ball, Tetra Tech EM, Inc.

The focus of the Fall field trip will be the structure and stratigraphy of the Cheyenne Belt, a middle Proterozoic suture zone in southeastern Wyoming. Ted Ball will lead our investigation of this major feature in the Medicine Bow Range. As we drive toward Wyoming on Saturday and as we return to Denver on Sunday, several stops will be made to discuss interesting geological features such as Phanerozoic strata and Laramide structures west of Ft. Collins, isotope geochemistry of Proterozoic rocks, entrenched meanders in Buckhorn Canyon, Poudre Canyon, overturned strata near Cameron Pass, the Lake Agnes rock glacier, North Park, and its north dune field, and the Virginia Dale ring dike.

The trip will begin at 8:00 am Saturday, Sept. 19, at the Cold Spring Park and-Ride in Lakewood. **Please be there at 7:30 am to get organized.** Accommodations that night will be at the Bighorn Lodge in Encampment, Wyoming, where both double (two beds) rooms and a limited number of single (one double bed) rooms are available. The Bighorn Lodge is not really a lodge at all, but is a clean, comfortable, older style motel. Camping is also an option. It is free, although rather spartan in the Encampment city park. Please bring your own lunch for Saturday, and money for dinner that evening. We may go into Saratoga for that meal; if we do, we might have time for a dip in the Saratoga Hot Springs pool. If this appeals to you, bring your swimming suit, just in case. We plan to return to Denver about 6:00 pm on Sunday.

The cost of the trip per person is \$92 double, \$102 single, or \$70 for those who want to camp. This cost also includes transportation by 12-passenger vans equipped with CB radios, Sunday breakfast and lunch, beverages, snacks, field guide, and Gemeutlichkeit!

To register for the Fall field trip, complete the form below and send it **NO LATER THAN SEPT. 11**, along with a check for either \$92, \$102, or \$70 per person (depending on your choice of accommodations), made payable to the Colorado Scientific Society, to Lee Shropshire at the address at the bottom of the form. Enrollment is limited to the first 30 people who send a check. If you do register by the deadline, you can assume you are included as a participant unless notified otherwise. For additional information, contact Lee at 970-351-2285 or 970-352-8778.

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### **COLORADO SCIENTIFIC SOCIETY 1998 FALL FIELD TRIP REGISTRATION FORM**

Please **print** the information requested below.

NAME: \_\_\_\_\_ PHONE \_\_\_\_\_

ADDRESS \_\_\_\_\_

Name(s) of guest(s) you plan to bring \_\_\_\_\_

To register, please send, **BEFORE SEPTEMBER 11, 1998** this completed form and a check for \$92, \$102, or \$70 per person, made payable to the Colorado Scientific Society, to:

K. Lee Shropshire  
Department of Earth Sciences  
University of Northern Colorado  
Greeley, CO 80639



# Invitation to Join the Colorado Scientific Society

The Society is dedicated to the advancement of science through open forums and activities. We sponsor lectures, field trips, student scholarship grants, and discussions of scientific matters of public concern. Please help us enlist new members.

I hereby apply for \_\_\_\_\_ membership in the Colorado Scientific Society.  
 (Regular, Corresponding, Student)

\_\_\_\_\_  
 (Last Name) (First Name) (Middle)

\_\_\_\_\_  
 (Address) (Telephone, with area code) (e-mail)

\_\_\_\_\_  
 (City) (State) (Zip)

\_\_\_\_\_  
 (Company/Agency/University)

\_\_\_\_\_  
 (Mailing address if different than above)

\_\_\_\_\_  
 School Degree Year Major

### Main Scientific Interests

**DUES**—Your dues are for the calendar year and help support the newsletter, monthly meetings, two field trips each year, family night, and the Emmons Lecture.

Regular Member (\$15) \_\_\_\_\_  
 Corresponding (outside Denver metro area) Member (\$10) \_\_\_\_\_  
 Student Member (\$5) \_\_\_\_\_

Please make your dues payable to Colorado Scientific Society. Thank you!!

**T**he success of certain Colorado Scientific activities depend on your volunteer help. Please circle those activities for which you can provide assistance. We will pass your name on to the appropriate Committee Chairperson.

<i>Arrangements</i>	<i>Fund Raising</i>	<i>Newsletter</i>	<i>Publicity</i>
<i>Best Paper Award</i>	<i>History</i>	<i>Outreach</i>	<i>Science Fairs</i>
<i>Field Trips</i>	<i>Membership</i>	<i>Program</i>	<i>Web Site</i>

I certify that all statements in this application are correct and, I agree to promote the objectives of the Society and to abide by its Constitution, Bylaws, and Rules.

\_\_\_\_\_  
 Applicant's signature

\_\_\_\_\_  
 Date

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

Visit CSS at <http://rainbow.rmi.net/~css/>



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