



Colorado Scientific Society

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

SEAFLOOR HYDROTHERMAL SYSTEMS: 20 YEARS OF REMARKABLE DISCOVERIES

W.C. Pat Shanks III, USGS

CONTINENTAL GROWTH AND OROGENIC LODE GOLD FORMATION

Richard J. Goldfarb, USGS

Tuesday, February 10, 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.

Table of Contents

Speakers' Abstracts.....	3
SEAFLOOR HYDROTHERMAL SYSTEMS: 20 YEARS OF REMARKABLE DISCOVERIES	3
CONTINENTAL GROWTH AND OROGENIC LODE GOLD FORMATION	3
President's Column.....	4
Interesting Websites.....	5
New Members	5
Museums and News.....	5
Snow Avalanche Safety Training.....	6



Earth Science Meetings.....7
Invitation to Join the Colorado Scientific Society.....8
Colorado Scientific Society Officers, Councilors, and Chairpersons9



Speakers' Abstracts

SEAFLOOR HYDROTHERMAL SYSTEMS: 20 YEARS OF REMARKABLE DISCOVERIES

W.C. Pat Shanks III,
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(pshanks@usgs.gov)

Widespread hydrothermal activity related to mid-ocean ridges (MORs) was first indicated by anomalous heat flow patterns and by the discovery of Fe and Mn enriched metalliferous sediments on the ridge flanks. Oxygen isotope analyses of greenstones dredged from the seafloor implicated basalt alteration by hydrothermal seawater circulating at temperatures of 200-300 °C. Discovery of "black smoker" vents using the submersible Alvin at 21°N on the East Pacific Rise proved the role of seawater in MOR hydrothermal systems. NSF-RIDGE supported studies of vent fluids and metal sulfide deposits from a variety of different mid-ocean ridge sites have confirmed the importance of circulating, heated seawater and have revealed remarkable variations in salinity due to phase separation (sub-critical or supercritical boiling) processes. In fact, roughly 25% of the global heat loss is due to hydrothermal circulation at the MORs and basalt-seawater reactions substantially influence global chemical balances of the elements. Recent explorations using the drillship Joides Resolution under the auspices of the Ocean Drilling program have led to the discovery and delineation of major massive sulfide deposits on the Mid-Atlantic Ridge (TAG deposit) and on the northern Juan de Fuca Ridge (Bent Hill Massive Sulfide deposit). These discoveries prove the analogy between some massive sulfide deposits that are mined on the continents for copper, zinc, silver and gold AND modern deposits that are actively forming on the mid-ocean ridges. Some recent studies have suggested the presence of magmatic water in vent fluids immediately following ridge-crest volcanic eruptions. The importance of magmatic volatiles, the role of hyperthermophilic bacteria, and the environmental problems of future seafloor mining activities are fertile topics for additional research.

CONTINENTAL GROWTH AND OROGENIC LODE GOLD FORMATION

Richard J. Goldfarb, USGS, Mineral Resources Program, Denver, CO 80225 (goldfarb@usgs.gov)

Orogenic gold deposits are hosted within deformed metamorphic terranes of all ages. Observations from throughout the world's preserved Archean greenstone belts and more recently active Phanerozoic orogens indicate a strong gold-greenschist association. Ores were formed during deformation near plate margins over 10's-100 million years of collision. Subduction-related thermal events initiate long-distance hydrothermal fluid migration. Resulting gold-bearing quartz veins are emplaced over a unique 15-20 km depth range for hydrothermal ore deposits. The spatial association between gold deposits and subduction-related thermal processes in peripheral orogens is well recognized. Models for the Mesozoic-Cenozoic goldfields of westernmost North America indicate a variety of plate-margin tectonic processes can initiate ore formation. Relationships within Paleozoic internal orogens, such as the gold-rich Variscan belt extending from NE China to southern Europe, indicate continent-continent collisional sutures are also favorable ore sites. A key point in all examples is that hydrated marine rocks were added to craton margins and, during this growth, the accreted rocks experienced high geothermal gradients.



Understanding of gold-forming processes in oldest Paleozoic to Precambrian orogens is typically complicated by hundreds of millions of years of additional geologic time, but ore genesis is still associated with continental growth. Gold veins of the Tasman Orogen in SE Australia make it clear that the ore-forming process need not require a "Cordilleran-style" of deformation; compression-related deformation may be solely intraplate rather than concentrated along terrane sutures. As with the Phanerozoic lodes, many significant Archean deposits are now also viewed as products of deep crustal, continental margin thermotectonic events.

President's Column

Fascinating. That's the only way to describe Hap McSween's Emmons lecture on the evidence for life in Martian meteorites. According to Hap's well-illustrated and even-handed portrayal of the controversy, all the evidence for Martian life can be better attributed to either non-biologic Martian processes or earthly contamination. Yet this whole controversy has revealed how little we know about the fine-scale details in rocks. As the search for extraterrestrial life continues, our knowledge of the earth will undoubtable need expansion to new scales of examination.

As I prepared to introduce Hap to the audience, I sought to find a few defining phrases to describe the Colorado Scientific Society. I was surprised at the vague objectives stated in Edwin B. Eckel's History of the Colorado Scientific Society, which was updated in 1993 by a committee headed by Marjorie E. MacLachlan. The 1977 version of the Colorado Scientific Society's Constitution, as quoted in the history, states "The objective of this society is to promote knowledge, the understanding of science, and its application to industry." This verbiage seems much too broad, with no mention of the geoscience emphasis which pervades the CSS membership. Other statements which indicate that the Society's chief objective is "the advancement of Earth sciences" seemed inappropriate for me to repeat as a prologue for a lecture on Martian meteorites and life! Certainly our Society has great interests outside the earth, as documented by other Emmons lectures on extraterrestrial topics in 1995 (Eugene and Carolyn Shoemaker) and 1990 (Randolph L. Kirk).

How we describe ourselves is critically important to our success in attracting new members. Now is the best time to enlist colleagues into the society, with the start of the fiscal year promising a full return on our minimal dues. But when I attempt to interest others in our Society, I find myself puzzling over the best way to declare our identity. I've heard all sorts of definitions—from the broad, overarching objective described above to ones indicating that our mission is really as a geological social club. Neither seems adequate—there are limits to our scope and interests, but the impact of the Colorado Scientific Society surely extends beyond social self-interest. So I put it to you, the membership, what do you see as the mission(s) of the Colorado Scientific Society?

I look forward to your responses, which I will tabulate in a later column.

Eric Erslev, President



Interesting Websites

Each month we enhance our speakers' abstracts with information concerning websites that offer science over the Internet. This month, we direct your cyber-attention to sites related to deep-sea drilling and research programs of the NSF, NOAA, USGS, and cooperating universities and agencies:

Woods Hole Oceanographic Alvin&Atlantis

<http://dsogserv.whoi.edu/>

<http://dsogserv.whoi.edu/ships/alvin/alvin.htm>

<http://dsogserv.whoi.edu/ships/alvin/photos.htm>

Ocean Drilling Program

<http://www-odp.tamu.edu/>

NSF-RIDGE program

<http://ridge.unh.edu/>

NOAA vents program- has some good videos etc of black smoker

Figure 2. Bathymetry of the Gordon vents Ridge.

<http://www.pmel.noaa.gov/vents/geology/video.html>



Figure 2. Bathymetry of the Gordon vents Ridge.

New Members

The Colorado Scientific Society welcomes the following new member:

William I. Ridley

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.

Morrison Natural History Museum...is open 1-4 p.m., Wednesday through Sunday. The Museum is located on State Highway 8, 1/2 mile south of Morrison. Fireside chats are cosponsored periodically by Friends of Dinosaur Ridge (see above).



Snow Avalanche Safety Training

Colorado Scientific Society—Special Winter Field Trip

The Society is fortunate to have Dr. Bill Hotchkiss, Scientist Emeritus with the USGS Water Resources Division, lead a field seminar on avalanche safety. Don't miss this chance to learn about snow metamorphism and stratigraphy, avalanche dynamics, and safe winter travel in the backcountry. This seminar is specially suited to the recreational skier or snowshoer that is unfamiliar with snow avalanche safety techniques and equipment (probably 75% of us).

We'll dig snow pits, practice searching for buried victims with transceivers (beepers), and learn the basics of identifying "avalanche danger signals." Dr. Hotchkiss is a member of the National Ski Patrol and a co-founder of the National Avalanche School. He has given avalanche seminars all over the Rocky Mountains and is regarded as an expert in the field.

The seminar will be held **Sunday, February 22**. We will leave from the lower parking lot of the Cold Springs Park-and-Ride (northwest corner of the Federal Center; 6th Ave and Union) at 8 a.m. sharp and drive in our own vehicles to Berthoud Pass. We will then ski or snowshoe a short distance to a study site. The seminar should last until about 1 p.m., after which we are free to test our new-found skills on a short ski tour, perhaps up Second Creek or down First Creek (both on the northwest side of Berthoud Pass). Because of logistical problems, the seminar will be limited to only **35 participants**, first-come first-served, and is open to all. Students are especially welcome. The deadline for signing up is February 15th and the seminar is a bargain at only \$20.00 (we are offering Dr. Hotchkiss a modest honorarium for his time and expertise).

If you have any of the following, please bring them: folding snow shovel, hand lens (we suspect some of you might have one!), and transceivers. You will need to supply your own skis or snowshoes and, of course, adequate clothing for unpredictable conditions! Hot drinks will be provided. Bring your lunch.

If you have any questions, call or e-mail Michael Machette (303-273-8612; machette@usgs.gov) or Karl Kellogg (303-236-1305; kkellogg@usgs.gov).

----- tear here -----

Name(s): _____ Phone: _____ E-mail: _____

Send to: Avalanche Safety Training
Colorado Scientific Society
P.O. Box 150495
Lakewood, CO 80215-0495

Cost per person: \$20.00



Earth Science Meetings

Colorado Scientific Society's regular meetings are held the 2nd Tuesday of the month (unless otherwise advertised). Social time begins at 7:00 p.m. and program is at 7:30 p.m. For information, contact Eric Erslev at (970) 491-6375 or erslev@cnr.colorado.edu.

Denver International Petroleum Society (DIPS) meets the 2nd Friday of each month at the Wynkoop Brewing Co., 18th 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 Kristine Peterson (303) 980-6770. 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: \$13 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.

Colorado School of Mines Van Tuyl Lectures, Berthoud Hall, room 108, 4:30 p.m.

For information call the Dept. of Geology at (303) 273-3800.

February 12, – Paul Myrow, Colorado College, "**Integrated Sedimentological, Biostratigraphic and Chemostratigraphic Study of the Cambrian-Ordovician of Colorado**"

February 19 – Robert Kirkham, Colorado Geological Survey, "**Neogene Regional Collapse Due to Salt Flowage and Dissolution near Glenwood Springs, Colorado**"

Colorado State University Geology Lectures

All presentations are at 4:00 p.m. in room NR 316, with the exception of the AAPG Distinguished Lecture, which will be at NOON. For information, contact Linda Hinshaw at (970) 491-6081.

Denver Mining Club meets Thursdays from 11:30 a.m. to 1:00 p.m. at the Country Harvest Buffet at Villa Italia, 7200 W. Alameda Avenue, Lakewood. For more information contact Dick Beach at (303) 986-6535.

February 12 – Jim Miller, Remote Industry Manager, Space Imaging EOSAT, "**The Future of Satellite Imaging in Mining**"

US Geological Survey will host a Geographic Information Systems workshop in May on the Denver Federal Center. Vendors of GIS and image processing software/hardware are invited to participate. Contact L. David Nealey at (303) 236-0249 or dnealey@usgs.gov.



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.

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!!

The 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



Colorado Scientific Society Officers, Councilors, and Chairpersons

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