Colorado Scientific Society

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

2011 CSS President's Address and Annual Business Meeting

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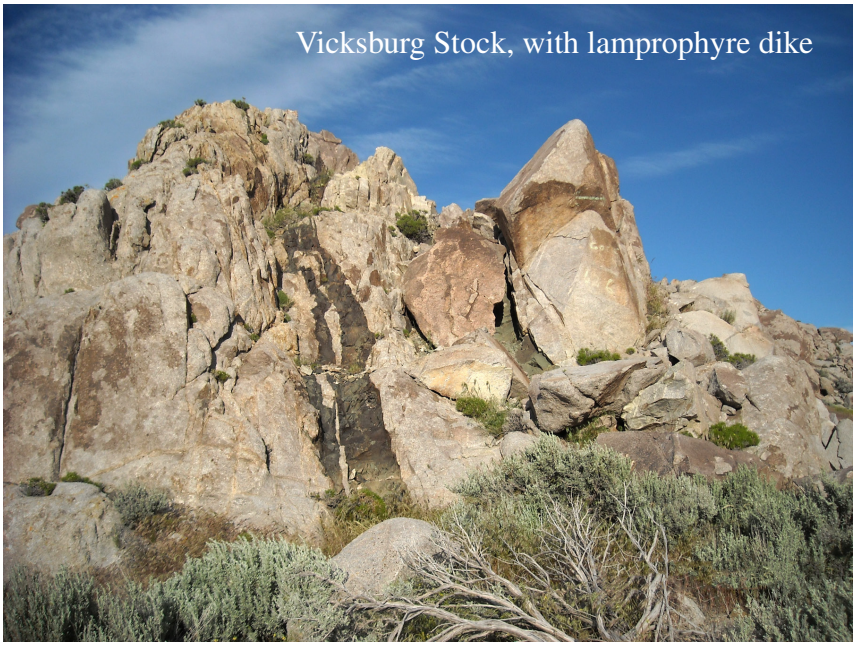
Tertiary Magmatism and Mineralization in a Complex Tectonic Environment, Southwest Utah— Initial Investigations



Vicksburg Stock, with lamprophyre dike

by Lisa R. Fisher, CSS 2011 President

Wednesday, December 14, 2011

Golden Hotel (Clear Creek Room)

800 Eleventh Street, Golden, Colorado

NEW location

Social half-hour – 6:30 p.m. Meeting time – 7:00 p.m.

PRESIDENT'S ADDRESS ABSTRACT

Tertiary Magmatism and Mineralization in a Complex Tectonic Environment, Southwest Utah—Initial Investigations

Lisa R. Fisher, CSS President 2011

The Star Range of southwestern Utah is situated at the intersection of the western edge of the Colorado Plateau, the southern extension of the Sevier Thrust Belt, and the eastern margin of the Basin and Range Province. The range lies within the east-northeast trending Pioche Mineral Belt. This complex junction of features provided opportunity and pathways for Tertiary magmatism and related mineral bearing fluids to produce a series of gold, silver, and base metal bearing porphyry-epithermal deposits hosted by Paleozoic and Mesozoic strata.

Rounded cobble of Moenkopi in andesitic agglomerate.

The North and South Star Mining Districts and adjacent districts were opened ca. 1856–1870 and include some of the oldest mines in Utah. All of these districts historically reported high-grade gold, silver, copper, lead, and zinc deposits. More recently, tungsten, molybdenum, and possible tellurium have been identified. Early works (ca. 1913–1920) by B.S. Butler form a basis for modern geological studies in this area, along with more recent geologic mapping by Best, et al. (1989), Baetck (1969), and Baer (1966). However, much work remains to be done to fully understand the Star Range and its mineral deposits.

The Star Range contains two primary porphyry stocks: the Star Stock on the north side of the range, and the Vicksburg Stock on the east side. A third, more poorly investigated stock, near the ghost town of Shauntie in the southwestern area of the range, is the Moscow Stock. Both the Star and Vicksburg are complex stocks, with greater variation and a rough zoning occurring within the Star Stock. The main phases of the Vicksburg Stock were historically mapped on the basis of color and weathering, as either granodiorite or quartz monzonite phases. New detailed investigations reveal that there is much more quartz and potassium feldspar present than these classifications might suggest, and much less mineralogical difference between phases. Xenoliths are abundant and more mafic. The stocks are accompanied by three different compositions of dikes, identified as quartz porphyry, aplite, and late phase lamprophyres. Some of the "lamprophyres" of previous workers we have re-identified as contact metamorphosed calc-silicate intervals within sedimentary units.

New investigations on the Star Range have also revealed past interpretative errors. An igneous unit previously identified as intrusive granodiorite is now known to be composed of porphyritic andesite flows with definitive volcanic textures and structures such as flow banding, agglomeratic layers, and possible vents or fissures. The lowest flow contains abundant disseminated sulfides, and much of the unit has undergone propylitic alteration. A small outcrop of opal-bearing sinter indicative of surface or near surface hydrothermal activity occurs nearby. The attitude of the flows suggests either flow down a relatively steep slope, or tectonic tilting after deposition. Stream worn cobbles and pebbles of Permian Kaibab Limestone, Triassic Moenkopi shales, siltstones and limestones and possible Jurassic Navajo Sandstones are caught up in the agglomerate flows. Cross-cutting veins in one area contain copper mineralization.

Peak igneous activity in this region occurred ca. 31 Ma to 20 Ma, with rhyolites in the area as young as ~7.4 Ma. Following compressional stresses of the Late Cretaceous Sevier thrusting, extensional tectonics were dominant starting ~56 Ma. The region

underwent at least four episodes of rotation as noted by changes of stress fields from NE-SW (169 to 31 Ma), to ENE-WSW at 30 to 25 Ma, to E-W at 22 Ma, and finally NW-SE at 14 Ma. These regional rotations are reflected on a local scale and influence the emplacement and faulting of mineral deposits, and thus are important to understanding deposits in context of exploration and development.

Mineral deposits result from multiple phases of emplacement. The most common ore types are vein/fissure-fills, chimney-mantos, silica breccias, and skarns. Deposits are controlled by igneous-sedimentary contacts, complex fault systems, and are also developed in porous and permeable zones within the Permian Kaibab Limestone and older Paleozoic zones. Tectonic influences, including basin and range style extensional faulting, subsequent regional rotation of the fault blocks, and association with thrust features of Sevier age, played an important role in developing the geometry of ore bodies in this region.

As our work continues, definite relationships between magmatic units, mineralization, structural/tectonic features, and their timing are becoming apparent. Both the Star and Vicksburg Stocks are polymetallic and carry gold, silver, copper, lead, and zinc, along with other minor minerals. The Vicksburg Stock carries the higher gold content, while the Star Stock appears to have higher associated copper. Epithermal vein deposits carry high lead-silver throughout the range. Silica breccia deposits marginal to the stocks test carry silver-antimony-gold. Numerous skarn deposits at the contacts between the intrusive stocks and Paleozoic limestones are silver-copper-gold-bearing. The aplite dikes, and especially the quartz porphyry dikes, are associated with higher gold areas. Much work remains to be done in this region towards more fully understanding the timing of mineralization with respect to phases of magmatism, and to determine structural/tectonic controls on magmatism and ore emplacement.

President's Message from Lisa R. Fisher

It is with some sadness that I write my last column as CSS President. I have enjoyed this past year, and am honored to have been given this opportunity and privilege. As I look back over the year, we did accomplish several tasks and goals, but some are still awaiting a less busy moment to be addressed. I intend to stay active in CSS, and to attack these other tasks as time permits.

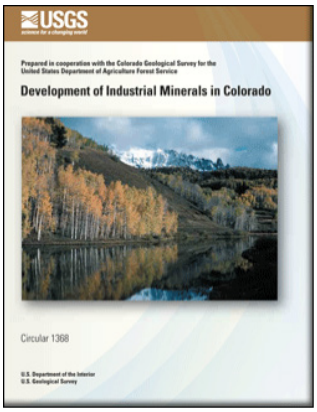
I would like to take this opportunity to call for volunteers. Our Society serves the needs of the scientific community on several levels—professional scientists, people interested in science, students (of all levels), and outreach. We do this through our program talks, field trips, newsletters, outreach projects, university grants, student paper competitions, science fair awards, family activities, and website. In any given year, there are a handful of people active on the CSS Council (officers, councilors, and committee chairs) that plan and coordinate these activities and services. These individuals work very hard, and fit their CSS work into a busy schedule of job & family. We could accomplish much more with a larger volunteer pool. Please give some of your time to work on one of our projects! Whichever holiday you celebrate, I wish you a Merry Christmas, Happy Hanukkah, Happy New Year, or a general, *"Happy Holidays!"*

(Don't forget... before this month's talk, you can purchase a meal at the Golden Hotel, and enjoy drinks & such purchased from the Lounge to bring into our meeting.)

FREE at the USGS Map Store...

As in past years, bundles of "government surplus" maps are being given away for use as gift wrapping (alternatively, "Suitable for Framing," if you happen to get a map that you really like!). Copies of a World Seismicity map are being included, as well as topographic maps. Available now through Christmas, in-person only at the USGS Map Sales room, Denver Fed. Ctr., Bldg. 810, Lakewood. (enter through the Main Gate, Gate #1, off Kipling St. between 6th Ave. and Alameda). The store is open from 8 a.m. to 4 p.m. weekdays only. Call 303-202-4675 for more information or directions. ***For teachers***, free copies of the 2011 Earth Science Week Teachers Packet (posters, maps, brochures, CDs, notebooks) are also available if you ask at the sales counter.

The USGS Bailey 30' x 60' geologic map is now available!! It covers the southern Front Range and South Park. Authors: Cal Ruleman, Bob Bohannon, Bruce Bryant, Ralph Shroba, and Wayne Premo. The downloadable map PDF is 140 MB, so click the download button and go grab a beer! Go to: *http://pubs.usgs.gov/sim/3156/*



Prepared in cooperation with the Colorado Geological Survey for the United States Department of Agriculture Forest Service

Development of Industrial Minerals in Colorado

By Belinda F. Arbogast,[1] Daniel H. Knepper,[1] William H. Langer,[1] Jr., James A. Cappa,[2] John W. Keller,[2] Beth L. Widmann,[2] Karl J. Ellefsen,[1] Terry L. Klein,[1] Jeffrey E. Lucius,[1] and John S. Dersch[3]

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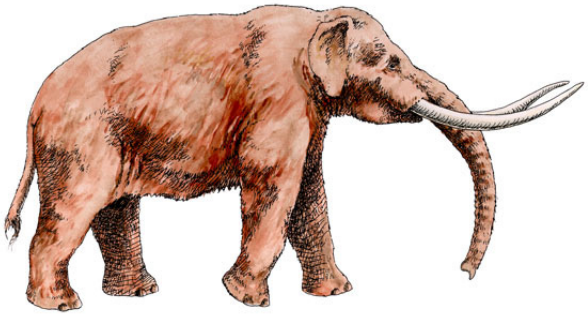
[3]USDA Forest Service, POB 25127, Lakewood, CO 80225

Available at: http://pubs.usgs.gov/circ/1368/



CONGRATULATIONS to the 2011 CSS Best Paper awardees, joint recipients Jeff Pigati (USGS-Denver) and Kirk Johnson (DMNS) for their February 2011 talks entitled: *"The Snowmastodon Site: Discovery, Science, and Initial Results."*

It's Science Fair time again! We are looking for judges for five Science Fair events. There are four middle school science fairs that will be held at Skinner Middle School, Martin Luther King, Jr. Early College Middle School, Morey Middle School, Kepner Middle School, and the DPS District Science Fair for elementary through high school students that will be held at the Denver Zoo.

We could use your help for all or some of the events. The students are anxious to share their experiments with volunteers from the DPS and the Denver metro area community. It is their opportunity to show you how hard they've been working and how much they've learned. It could be an opportunity for you to show the students your interest in their education.

Science Fair Dates for 2011–2012:

December 14 Skinner Middle School 3435 W. 40th Ave. 7:30 a.m.–12:00 p.m.
Jan. 6 Martin Luther King Jr. Early College Middle School 19535 E. 46th Ave. 8–11 a.m.
January 12 Morey Middle School 840 E. 14th Ave. 9:00–11:00 a.m.
January 20 Kepner Middle School 911 South Hazel Ct. 9:00–11:00 a.m.
January 28 DPS District Science Fair Denver Zoo 2300 Steele Street 9:00 a.m.–2:00 p.m.

If you are available to help with all or any of these dates, please let me know. Please pass the schedule along to anyone you know who might be interested in volunteering.
Thank you,
Debbie Turner, Project Director, Debbie_Turner@dpsk12.org, 720-424-2300
Jill Peterson, Admin. Asst., Community Resources, Inc.
3245 E. Exposition Avenue, 720-424-2300, jill_peterson@dpsk12.org

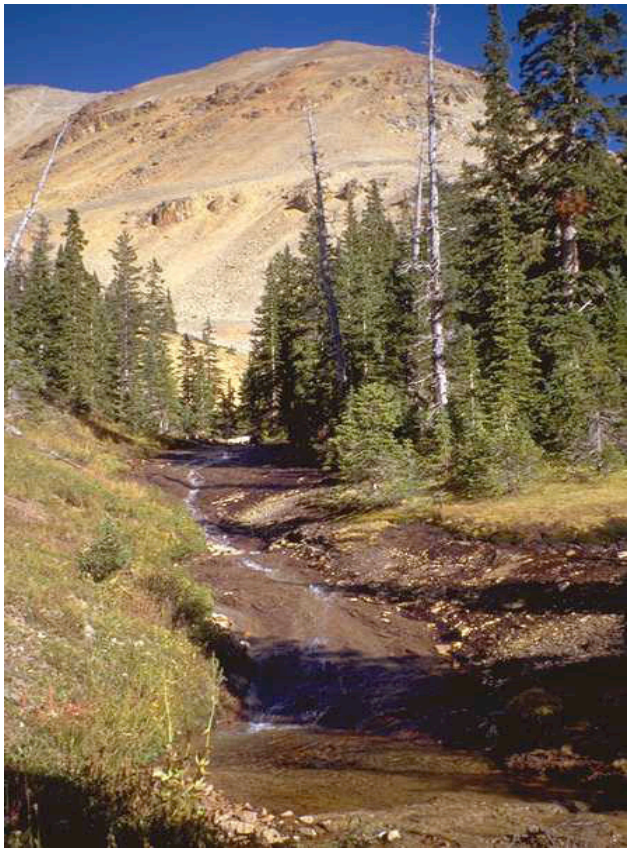
CGS study identifies geology as culprit for poor water quality in parts of Colorado

Is high, pristine mountain water always clean and pure? Can streams unaffected by human activities and livestock influences be unfit for human consumption, or fish? A new study by the Colorado Geological Survey (CGS) has some surprising answers. The study examines specific areas in Colorado that have naturally poor, surface-water quality due to the area's geology.

The report, titled "Natural Acid Rock Drainage Associated with Hydrothermally Altered Terrane in Colorado," identifies a number of streams in eleven different headwater areas of Colorado where surface water is acidic and has high concentrations of metals upstream of any significant human impacts.

Rocks in these areas were altered by intensely hot water circulating in the earth's crust, often associated with volcanic activity during Colorado's geologic past. The "hydrothermal alteration" of the rocks changed their composition by dissolving some minerals and depositing others. In the affected areas, the hydrothermal-alteration process deposited metal-sulfide minerals, commonly pyrite (fool's gold), in the rocks.

When these rocks are exposed at the surface, they interact with oxygen and the iron sulfide "rusts" to form iron oxide minerals, creating striking yellow, orange, and red colors—similar to the oxidation of metal in an old rusty car. "Acid rock drainage" occurs when the sulfur that is displaced by the oxygen combines with water to form weak sulfuric acid. The acidic water then dissolves minerals from the bedrock, often adding significant amounts of dissolved metals to these headwater streams. Natural acid rock drainage has been active in Colorado for thousands, possibly millions of years.



This stream, in the East Mancos River headwaters in the La Plata Mountains of southwest Colorado, is naturally acidic with high concentrations of metals simply because of the surrounding geology.

The CGS collected 101 water samples from headwater areas and identified specific streams in the following areas as being affected by natural acid rock drainage: Silverton area, Lake City area, Platoro-Summitville area, Kite Lake area and East Trout Creek in the San Juan Mountains, the La Plata Mountains, Rico Mountains, headwaters of Lake Creek south of Independence Pass, the Ruby Range near Crested Butte, Red Amphitheatre near Alma, headwaters of the Snake River in eastern Summit County, and the Rabbit Ears Range.

Through detailed geologic mapping, the study characterized the type and intensity of hydrothermal alteration and correlated the geology with surface-water chemistry. Many of the areas exhibiting intense hydrothermal alteration also contain historic mine sites. Frequently, acid-rock drainage from natural sources and mine sites combine to cause severe downstream water quality problems. In these situations it is important to distinguish the natural, or background water quality so that realistic clean-up goals for water quality can be set.

Funding for this study came from the Colorado Geological Survey portion of the Department of Natural Resources Severance Tax Operational Account. Colorado severance taxes are derived from the production of gas, oil, coal, and metallic minerals.

To order the report, please call 303–866–2611, Option 0, or visit our online book store at: http://geosurveystore.state.co.us and search for NARD. Price is $30.00 plus shipping.

Joint AGI/GSA Societies Meeting---by Pete Modreski, CSS President-Elect; pmodreski@usgs.gov

During the October 2011 GSA annual meeting in Minneapolis, I attended the AGI/GSA breakfast meeting, representing the Colorado Scientific Society as one of GSA's associated societies. Holding the two societies' meetings combined as one was a new idea that seemed to work very well. In the past, GSA and AGI have held separate meetings, but many people and organizations are represented in both so it made sense to combine them. GSA has some 59 Associated Societies of which CSS is one, and AGI is a federation of some 50 professional societies and organization. There were about 65 people at the meeting. A recent name change that I hadn't been aware of until this meeting; AGI, formerly the American Geological Institute, became the American Geosciences Institute as of Oct. 1 of this year.

The main topic for the meeting was how AGI, GSA, and member societies can work to support and improve K–12 earth science education. Gary Lewis and Ann Benbow (Directors for Outreach and Education for GSA and AGI, respectively) reported on a survey of "What our member societies are doing in K–12 education," and on "Earth Science literacy standards and new national science education standards," and Gary gave a presentation on "Areas of need in K–12 earth science education." There followed a roundtable discussion in which we all participated, on "How can societies collaborate to effect change?"

I expect to be receiving written reports summarizing some of the key points that we discussed, and if anyone from CSS is interested in what has been done/can be done relating to K–12 earth science education, please write to me and I'll be sure to forward you any information I receive on the topic. So far, I have received a draft of: Core Message to Policymakers on Earth Science Education. "Because it is vital to America's economy, environment, and national security, Earth science must be taught and valued in all U.S. school and college systems. …"

Please write to me if you'd like me to forward to you a copy of this two-page document.

I'll just also note that there was some discussion about the coming 2012 International Geological Congress, Brisbane, Australia, Aug. 5–12, 2012.

The next GSA Associated Societies meeting will be in the spring, 2012, in Boulder, date TBD; and an AGI joint societies meeting will be on April 23, 2012 at the AAPG meeting in Long Beach, California.

It's Time to Pay Dues for 2012...

Membership dues for the coming year (2012) are now due. You will find a dues payment form in this issue of the newsletter, or you can download the form from the CSS website:

www.coloscisoc.org/membership/dues.html

Dues payments are $20 for regular members; $10 for corresponding members (outside the Colorado Front Range area), and $5 for students. You may pay your dues by mailing a check to the CSS, or pay with a credit card using PayPal on the CSS website. If you are uncertain if you owe dues or of your member status, contact CSS Treasurer Don Sweetkind by phone at 303–236–1828 or by e-mail at dsweetkind@usgs.gov.

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. Any contributions made in calendar year 2011 (checks dated before 1 January 2012), will be credited toward the 2011 tax year.

Please remember that your entire contribution goes towards generating interest for the grants and that your contribution is 100% tax deductible because the Society is a non-profit Section 501 (c)(3) organization. Through interest income generated by our Memorial Funds, we have awarded over $125,000 in research grant funding to more than 165 students. This year we also supported the participation of about a dozen students on our field trips through the Pillmore Fund.

PLEASE support our future scientists by generously supporting the *Colorado Scientific Society.*

Thank you!!

Earth Science Meetings and Talks

Newsletter items must be received by the 25th of each month.

Colorado Scientific Society's regular meetings are held the 3rd Thursday of the month at the Colorado School of Mines 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 Lisa Fisher, at 303-215-0480, lisa.fisher@escalantemines.com

Café Scientifique Dec. 13 *Baylor Fox-Kemper, Department of Atmospheric and Oceanic Sciences, UC Boulder,* "The future of El Niño." Meets at: The Wynkoop, 1634 18th St., Denver, evening science talks 6:30–8 p.m. Arrive early to get a seat. Free, except for beer. http://www.cafescicolorado.org

Colorado State University, Dept of Geosciences, Rm 320 Warner College of Natural Resources Bldg., Mondays, 4:00 pm. 970-491-5661. **Jan. 23** *Vera Schulte-Pelkum, Univ. of Colorado,* "TBA." **Jan. 30** *Dr. Svetoslav Georgiev, Geological Survey of Norway, AIRIE Program-CSU, "TBA."* http://warnercnr.colostate.edu/geo-training/

Denver Mining Club Dec. 12 Auction of Mining Memorabilia. Check your attic, closet, & garage for items to donate, or come and look for that special gift. Books, rocks & minerals, jewelry, prospecting & mining supplies & equipment, and much more: Come help us celebrate our 120th anniversary! **Dec. 19 Holiday Story Time.** Share an interesting anecdote from your career with the audience, in 5 minutes or so. The DMC meets every Monday at the Littleton Country Buffet near Bowles and Wadsworth (8100 W. Crestline Ave., in the shopping center) 11:30–1:00. Purchase of buffet lunch required. For more info., contact Dick Beach. Tel: 303–986–6535; E-mail: dickbeach@alumni.mines.edu ; www.denverminingclub.org .

Denver Museum of Nature and Science Jan. 19 6:30 p.m., "Know Your Snow." $8 member, $10 nonmember. Ages 21+ only. http://www.dmns.org/learn/adults/the-science-lounge/know-your-snow

Friends of Dinosaur Ridge January 21–January 29, 2012: National Nuclear Science Week. Small exhibits in Trek Through Time will include dating the ash layer, uranium in the dinosaur bones, and radon as a geologic hazard. Contact Clare Marshall at 303-697-3466 x105 or dinodiscovery@dinoridge.org for tickets or more information.

USGS Rocky Mountain Area Seminar Series Dec. 13 *Craig Jones, Univ. of Colorado*, "Exploring an alternative explanation for the Laramide Orogeny." **Jan. 17, 2012** *Craig Manning, UCLA*, "In Deep Water: New insights into geologic fluids of the deep crust and upper mantle." Tuesdays at 10:30 a.m., Building 25 Lecture Hall, Denver Federal Center (Kipling St. & 6th Ave., Lakewood, CO; use the lg. parking lot east of Bldg. 25, and enter near center of building via main entrance on east side). Contact: Peter J. Modreski, USGS, 303-202-4766, pmodreski@usgs.gov

Western Interior Paleontological Society WIPS meets the first Monday of every month, Sept. to May, except for the December holiday auction that is held on a Saturday. Doors open at 6:30 p.m., talk at 7 p.m., Ricketson Auditorium, Denver Museum of Nature & Science (all welcome, no admission charge). **WIPS Fossil Club for Kids**—A youth program for family members of the Western Interior Paleontological Society. Suitable for children elementary school age and older. If your child or grandchild is interested in joining the Fossil Club, please contact Dennis Gertenbach or 303-709-8218. Meets monthly, every third Sunday. http://www.westernpaleo.org/events.php

Happy Holidays!!!

from the Colorado Scientific Society

Colorado Scientific Society

Application and Membership Update Date_____
Dues and Funds Contributions

New Member _____ Renewing Member _____

_____

(email address) (Telephone)

_____

(Last Name) (First Name) (Initial)

_____

(Address)

The success of most Society activities depends on volunteer help. Please circle any activities for which you can provide assistance. We will pass your name on to the appropriate Committee Chairperson.		
Field Trips	History	Outreach
Fund Raising	Newsletter	Program/Talks

Annual Dues (January – December)

Regular Members $20 _____
Corresponding Members $10 _____
Student Members $5 _____

Memorial Funds: These funds support research grants to graduate students in the Earth Sciences throughout the nation. *Please note if contribution is made in the memory of an individual.*

Ogden Tweto Memorial Fund _____
Steven Oriel Memorial Fund _____
Edwin Eckel Memorial Fund _____
Bill Pierce-Heart Mountain Fund _____
George Snyder Memorial Fund _____
Chuck Pillmore Memorial Fund _____

Endowment Fund:

This fund is used to support the Society's monthly meetings and newsletter, field trips, family night, annual Emmons Lecture, invited speaker honorarium, and special activities. _____

TOTAL CONTRIBUTIONS (DUES AND FUNDS): _____

Please make your checks payable to the: *Colorado Scientific Society* Send this form & your check to: **Colorado Scientific Society** **P.O. Box 150495** **Lakewood, CO 80215-0495**	Or register and pay on-line using PayPal at: http://www.coloscisoc.org/membership/duespaypal.htm

Colorado Scientific Society
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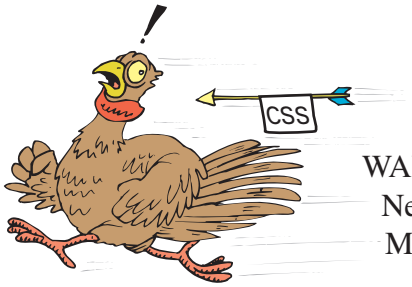

WANTED:
New CSS
Members

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President-Elect:	Pete Modreski, USGS, 303-202-4766, pmodreski@usgs.gov
Treasurer:	Don Sweetkind, USGS, 303-236-1828, dsweetkind@usgs.gov
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Past President:	Scott Minor, USGS, 303-236-0303, sminor@usgs.gov

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2011–2013: Matt Sares, CDWR, 303–866–3581, matt.sares@state.co.us
2011–2013: Jeremy McCreary 303–744–0907 jeremy@cliffshade.com

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Program:	VOLUNTEERS NEEDED! CONTACT LISA FISHER FOR MORE INFO.!
Publicity:	
Science Fair:	Chuck Weisenberg, 303–238–8806, cweisnbrg@msn.com
Webmaster:	Table Mountain Web Design, 303-278-2701, bwarden@tablemtn.com

** STOP! Do NOT recycle this until after the talk! Please help us with publicity by posting at least the front page of this Newsletter on a bulletin board. Thank you!