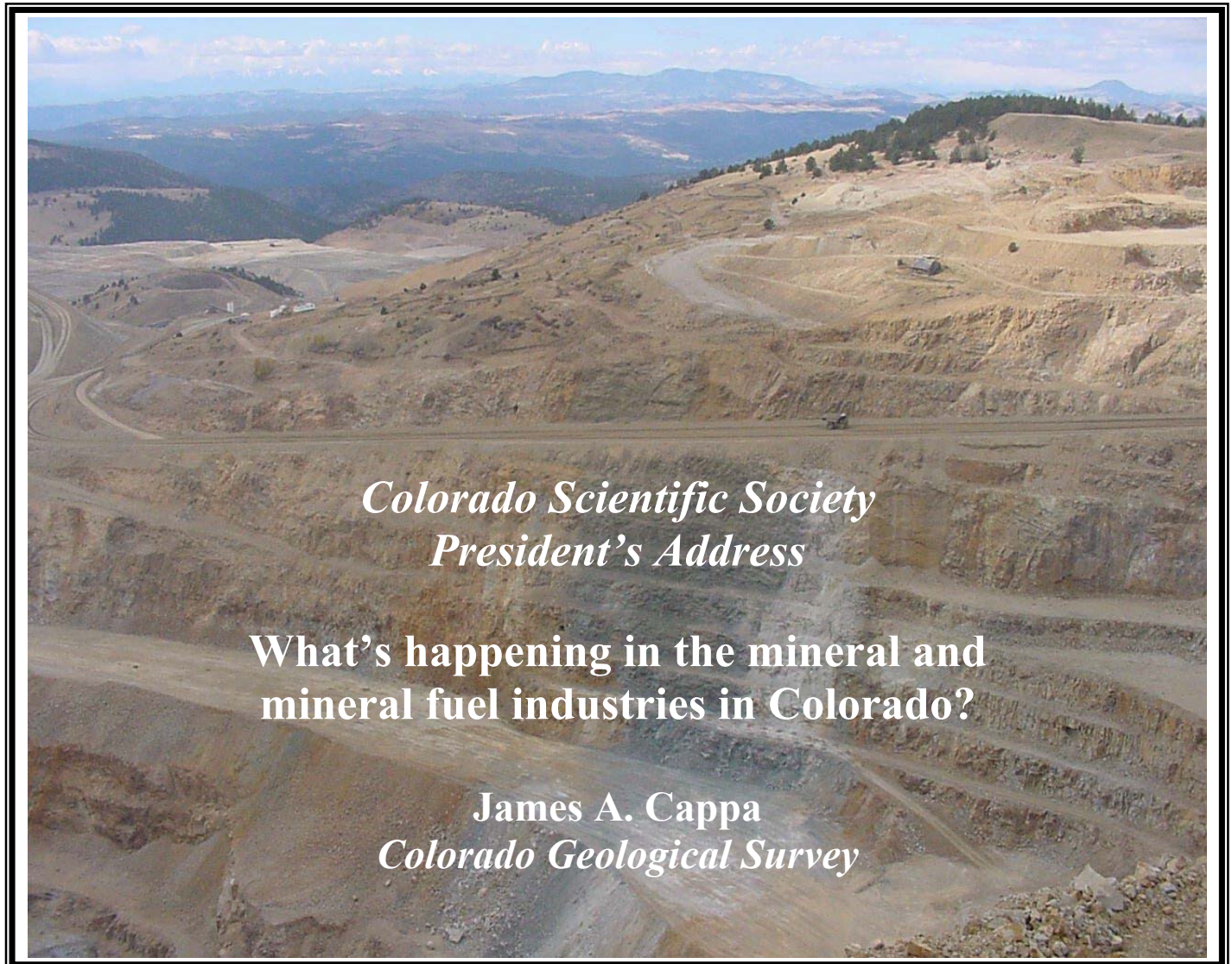




Colorado Scientific Society

*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*

**What's happening in the mineral and
mineral fuel industries in Colorado?**

**James A. Cappa
Colorado Geological Survey**

**Thursday, December 18, 2003
American Mountaineering Center
710 10th St. (NE corner with Washington), Golden
Social half-hour – 7:00 pm. Meeting time – 7:30 pm.**

Abstract

What's happening in the mineral and mineral fuel industries in Colorado?

By **James A. Cappa**, Colorado Geological Survey, Denver

INTRODUCTION

The Colorado Geological Survey (CGS) Mineral Resources Section estimates the total value of 2002 mineral and mineral fuel production in Colorado to be \$3,723 million, a 20 percent decrease from the 2001 total value of \$4,645 million.

Mineral fuel and CO₂ production values for 2002 are estimated at:

- ♦ oil \$417.6 million
- ♦ natural gas \$1,943 million
- ♦ CO₂ \$117.7 million
- ♦ coal \$616 million

The total estimated value of oil, natural gas, and CO₂ production in 2002 was \$2,478 million, which is down 31 percent from the 2001 value of \$3,610 million. Colorado natural gas production increased and oil production declined; however, both prices for gas and oil declined during most of 2002. The value of CO₂ production decreased from \$122 million to \$118 million, primarily owing to decreased production. Estimated production volumes for 2002 total 821 billion cubic feet of gas, 19.2 million barrels of oil, and 294 billion cubic feet of CO₂.

The CGS forecasts total natural gas production to increase to 840 BCF in 2003, a 2.3 percent increase. Oil production is forecast to remain flat at 19.2 million barrels. Total production value is forecast to be \$2.30 billion, a 15 percent increase over 2002 value.

Coal production increased from the 2001 level of 33.4 million tons to a record 35.2 million tons in 2002. Coal prices, which vary from mine to mine, are estimated at an average \$17.50 per ton for 2002. The value of Colorado coal production is estimated at \$616 million, up 23 percent from the 2001 value of \$502 million. The CGS estimates that coal production will set a new record of 36 million tons for 2003.

In 2002 (the most recent annual data available), the U.S. Geological Survey estimated a total value of nonfuel mineral production in Colorado of \$614 million. This value is an increase of 6.4 percent over the 2001 production value. The production value of nonfuel minerals is expected to be substantially higher in 2003 and 2004 owing principally to increases in the prices of gold and molybdenum.

Gold prices increased significantly in 2003 compared to the depressed prices during the previous four years. As of early October 2003, the spot gold price was around \$380 per ounce, whereas the average gold price in 2002 was \$310 per ounce. This is good news for Colorado's only operating gold mine, the Cripple Creek & Victor Mine (CC&V) in Teller County. This world-class mine employs about 300 people and produced 224,000 ounces of gold in 2002. In late 2002, CC&V completed its two-year, \$168.5 million expansion and capital improvement program. With the expanded production capacity, the mine is expected to produce 300,000 to 400,000 ounces of gold per year in 2003 and beyond. The current reserve base is sufficient to support gold production until 2012 at the expanded production rate.

The Henderson Mine in Clear Creek County continues to be North America's largest primary producer of molybdenum. The underground mine is owned by Climax Molybdenum Company, a subsidiary of Phelps Dodge Corp., and employs approximately 300 people. In 2002, the mine produced 20.5 million pounds of molybdenum metal, an increase of 9 percent over the 18.8 million pounds produced in 2001. Molybdenum prices have risen significantly in the past two years. As of October 2003, the price for molybdenic oxide was more than \$6.00 per pound compared to an average price of \$3.75 per pound in 2002 and \$2.36 per pound in 2001. The Henderson Mine hopes to increase production by 5 percent over the next year and an additional 5 percent the following year.

COALBED METHANE

Included in the production numbers for natural gas is the production of naturally occurring methane gas from subsurface coal beds. Known as coalbed methane (CBM), this subset of natural gas is becoming increasingly important in Colorado. Only seven years after CBM production reporting commenced in Colorado, CBM production surpassed that of conventional natural gas. However, 2001 saw a resurgence in the production of conventional natural gas, which once again surpassed CBM production.

CBM is natural gas (methane) that is produced specifically from subsurface coal beds that contain significant quantities of methane gas, chemically identified as CH₄. Long considered an undesirable and dangerous by-product of many Colorado coals, this colorless and odorless gas, often capable of spontaneous combustion, was responsible for many coal fires and mine explosions. The petroleum industry, in conjunction with State and Federal agencies, developed techniques to extract methane from coal beds using drill rigs and subsurface completion technologies similar to those used to produce natural gas from conventional reservoirs, predominantly sandstones and limestones. Coal beds were identified as unconventional gas reservoirs, subject to tax credits in the late 1980s and early 1990s. Though the tax credits provided the initial economic impetus to explore for these unconventional reservoirs, successful drilling and completion technologies allowed the extraction of CBM to become fully profitable even after the tax credits expired in the early 1990s.

Coal-bearing units underlie approximately 28 percent or 29,600 square miles of Colorado. As such, it is no surprise that CBM exploration and development is so prolific in the state. A number of reservoir components related to subsurface coal beds control how methane is trapped in the coal and whether it can be recovered economically. Factors such as the preserved gas content in the coals, the amount of water in the coals, the ability of both water and gas to flow to a well bore, the reservoir pressure exerted on the coal, and the thickness and depth of the coal are all significant. As the number of successful CBM operations continues to increase in Colorado, it becomes apparent that these critical factors exist, in some unique combination, for all coals.

Given the fact that more than 1,700 historic coal mines have been in operation in the state during the past 120 years, ample data can be derived from those operations. The presence in coal mines of methane gas and dust, capable of spontaneous combustion, caused numerous explosions and fires in the mines. Other observable indications have been documented as well.

GOLD

The Cripple Creek district is located within a small (approximately 6 square miles), 32–28 million year old alkalic intrusive-diatreme complex emplaced at the junction of four Precambrian igneous and metamorphic units. Diatremes are neck-like volcanic features composed of breccia formed by the explosive activity that results when molten rock interacts with abundant groundwater near the surface. The complex consists primarily of a large mass of phonolite, an alkalic igneous rock, and phonolite breccia. There are also lake sediments, tree trunks, and coal layers within parts of the complex, which indicate that these igneous rocks formed a small volcanic center at the surface.

Because of their unique composition, ore deposits associated with alkalic igneous rocks have a distinctive set of gangue and ore minerals. The principal ore minerals in the Cripple Creek district are gold telluride minerals: calaverite and rarely sylvanite and petzite. Calaverite from district mines contains 39 percent to 43 percent gold and minor amounts of silver.

The Cripple Creek district is in Teller County, well south of the Colorado Mineral Belt. The district is the most important gold-producing camp in the state; it has produced more than 23 million ounces of gold since its discovery in 1891. In comparison, the entire state of Colorado has produced about 44 million ounces. Four main types of ore deposits are found within the Cripple Creek district: vein deposits, diatreme-hosted deposits, hydrothermal breccia-hosted deposits, and bedded rock-hosted deposits.

MOLYBDENUM

The Henderson ore body was discovered by exploration drilling by Climax geologists beneath the Urad molybdenite deposit, which was exposed on Red Mountain near Berthoud Falls in Clear Creek County. The Urad deposit was so named because early prospectors thought the yellow minerals at the prospect were uranium oxide minerals. AMAX completed mining of the Urad deposit in 1974; that deposit yielded 13.7 million tons of ore grading 0.35 percent MoS₂-about 96 million pounds of molybdenite.

Colorado Scientific Society President's Note—December 2003

By **Jim Cappa**

It's December and time for the changing of the guard at the Colorado Scientific Society. Emmett Evanoff, the current President-elect, will be taking over as president at our next meeting on December 18, 2004. Emmett has done an outstanding job as field trip chairman and President elect this year, and I am sure that he will do a great job as President in 2004.

Part of Emmett's first responsibilities is the arrangement of the annual Emmons lecture for January 2004. The Emmons lecture will be on Thursday, January 15, and will feature Dr. Malcolm McKenna, whose talk title is "Effects of an isolated Arctic Ocean at the end of the Paleocene." Dr. McKenna is retired from the American Museum of Natural History and was the chair of the Vertebrate Paleontology section. His talk will integrate paleontology with geology to answer some major questions of plate reconstructions, land bridges, and paleo-oceanography.

We will also lose two of our retiring councilors, Graham Closs and Parker Calkin. I thank them both for their great advice and counsel during 2003. Emmett will be announcing the two new councilors soon.

The December meeting also includes the Colorado Scientific Society annual business meeting. We will hear reports from Don Sweetkind, treasurer, Eric Nelson, past president and memorial funds chairperson, and from Mark Hudson on the "Best Paper of 2003" award.

It has been an honor serving as President of the Colorado Scientific Society. Thank you — members, councilors, and chairpersons for all your support this year.

Dues and Contributions for 2004

By **Don Sweetkind**, Treasurer

Membership dues for the coming year (2004) are now due. You will find a dues payment form in this issue of the newsletter. Dues payments are \$15 for regular members, \$10 for corresponding members (outside the Colorado Front Range area), and \$5 for students. If you receive this newsletter as a paper copy, your member status is printed on your address label. If you receive the newsletter electronically, your member status is noted in the e-mail to which the newsletter was attached. If you are uncertain of your member status or whether you owe dues, 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 2003 (i.e., checks dated before Jan. 1, 2004) will be credited toward the 2003 tax year. 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.

This year, please consider making a Memorial Fund donation in memory of Charles L. (Chuck) Pillmore. Chuck's family wishes for us to establish a separate Memorial Fund under Chuck's name. To do so, we must accumulate principal of \$10,000 within 3 years in order to create a viable fund. To date we have received \$4,165 in contributions in Chuck's name. Your contributions can be made to the "Colorado Scientific Society Memorial Funds," with a memo that the donation is in memory of Charles L. (Chuck) Pillmore. Mail contributions to Colorado Scientific Society, P.O. Box 150495, Lakewood, CO 80215-0495.

Emmons lecture – January 2004

By **Emmett Evanoff**, President elect

The 2004 Emmons lecture of the Colorado Scientific Society will be given by Malcolm McKenna, emeritus of the Department of Vertebrate Paleontology at the American Museum of Natural History in New York City. The title of Dr. McKenna's talk will be "Effects of an isolated Arctic Ocean at the end of the Paleocene." Dr. McKenna has worked for decades in the Paleocene and Eocene rocks of the Canadian high Arctic, and has used fossil vertebrates to determine the timing of migration corridors between North America, Europe, and Asia. Such information leads to reconstructions of early Cenozoic continent and ocean geometries that are key to understanding ancient global oceanographic and climatic events. The lecture will be at the Colorado School of Mines Green Center on Thursday, January 15, 2004.

Yule Marble—Maybe our new state rock?

By **Vince Matthews**, Colorado Geological Survey

A Girl Scout troop has been mounting a campaign to make Yule Marble our State rock. Representative Betty Boyd says she will introduce legislation to do just that. An informational PowerPoint show on Yule Marble is now on the Colorado Geological Survey's website (<http://geosurvey.state.co.us/>). You might want to review it (and/or link to it) so that you are prepared if anyone asks your opinion on the idea.



A View Through the Brown Cloud

by Lisa Ramirez Rukstales

Hot lava! Where did the year go? I'm finally comfortable with scrawling 2003 on my checks and now I have a new year to remember. Not good considering I'm still afflicted with "new-mommy/dingbat syndrome" induced by, you guessed it, a lack of forty winks. It's been 10 diaper-filled months since I've had REM sleep, so please pardon me if I forget your name! This Christmas will be interesting thanks to the addition of Junior Ruk. He's crawling with a vengeance and pulling himself upright on things so I have visions of sugar plums strewn about the floor, the Xmas tree leaning at a 45-degree angle, and presents covered in goo. I can't think of a better way to spend the holidays. My grinchy inclinations have been replaced by a new world view filled with slobbery kisses, giggles, and squeals of delight. (I'm still allowed to grumble when battling the crowds at Toys-We-B and watch out cell phone yappers!) I wish all of the CSS family happy holidays. See you next year!

2004 DUES & FUNDS CONTRIBUTIONS COLORADO SCIENTIFIC SOCIETY

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Last Name: _____

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

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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:

TOTAL CONTRIBUTIONS (DUES AND FUNDS):

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Earth Science Meetings and Talks

Newsletter items must be received by the 4th 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 7:00 p.m. and talks start at 7:30 p.m. For more information, contact Jim Cappa at (303) 866-3393, jim.cappa@state.co.us

Denver Mining Club meets every Monday (except when noted) at Country Buffet near Bowles and Wadsworth (at 8100 W. Crestline Ave.) 11:30 a.m.-1:00 p.m. **Mercury in Your Environment: You Better Love It, You Can't Leave It**, December 1.--Eugene Michal, President, Toiyabe Exploration, Inc. **Frauds, Scams and Questionable Business Practices in the Front Range Mining Industry**, December 8.--Ed Raines, Vice-President, Clear Creek County Metal Mining Association. **Holiday Story Time**, December 15--Volunteers to tell the group, in 5 minutes or less, an interesting anecdote from their career in the mining industry (advance speaking reservation suggested but not required; phone Dave Jonson, 303-751-5577). **Auction of Mining Memorabilia**, December 22--Check your attic, closet, & garage for items to donate, or come and look for that special gift. Come help us celebrate our 112th anniversary! For additional information contact Dick Beach, (303) 986-6535 .

Denver International Petroleum Society 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 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. **Paradigm Shifts in Exploration Geochemistry**, December 8--Jeffrey A. Jaacks 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. **Utilizing Lab NMR Data to Customize NMR Log Interpretations**, December 15--Freddie Curby, Halliburton Energy Services. Call Elice Wickham at 303-573-2781 for reservations. Web page: <http://dwls.spwla.org>.

Rocky Mountain Association of Geologists (RMAG) Reception at 11:30 a.m., lunch at 12:00 p.m., talk at 12:30 p.m. Reservations are taken by recording at 303-623-5396 until 10:30 a.m., Wed. before the luncheon. Cancellations are taken until 11:00 a.m. on Wed. at 303-573-8621. Luncheon cost is \$20 payable to RMAG at the door. Reservations are not required for talk only—cost is \$3. Meeting location: Denver Petroleum Club, Anaconda Tower, 555-17th St, 37th floor. **Presentation of the first Legends of the Rocky Mountain Oil Industry Award**, December 5—Robert Weimer. Web page: <http://www.rmag.org>.

University of Colorado at Boulder, Geological Sciences Colloquium Wednesdays, 4:00-5:30 p.m., Rm. 180. Refreshments at 3:30 p.m. on the 3rd floor. **Physical Stratigraphy of Clastic Strata: A Hierarchical Approach to the Analysis of Genetically Related Stratigraphic Elements for Improved Reservoir Prediction**, December 3, Anthony Sprague, ExxonMobil Upstream Research Company. For more information, call 303-492-8141. Web page: <http://www.colorado.edu/GeolSci>.

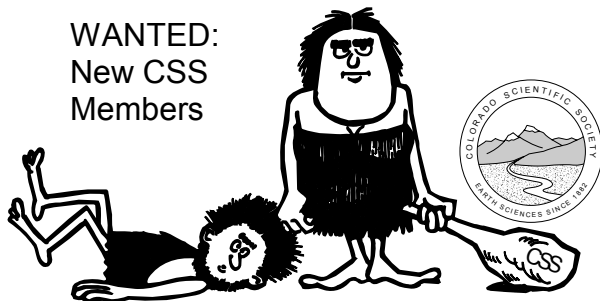
Friends of Dinosaur Ridge; 7:00 pm at Red Rocks Elementary School in Morrison, CO. Join now. Web page: <http://www.dinoridge.org>.

Colorado School of Mines, Van Tuyl Lectures Fridays from 3:00PM to 4:00PM in Berthoud Hall room 108. For further information, check the web page: <http://www.mines.edu/academic/geology/calendar/vantuyl.html>

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

Colorado Scientific Society
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