

COLORADO GEOLOGICAL SURVEY

ROCK TALK

VOLUME TWO, NUMBER ONE

JANUARY, 1999

FOREWORD

BY VICKI COWART

THE COLORADO GEOLOGICAL SURVEY ANNUAL REPORT is presented in this fifth edition of *RockTalk*. The report focuses on the mission of the CGS and asks: What is the CGS mission and how was it carried out in 1998? Did the CGS fulfill its mission in 1998? As you review the report, you will find that it takes stock of many recent changes at the CGS.

The course of the CGS is set through several methods. At the base is the statutory charge of the survey, from the Colorado Revised Statutes 34-1-101. The law states that the purpose of the CGS is to:

coordinate and encourage by use of appropriate means the full development of the state's natural resources, as the same are related to the geological processes that affect realistic development of human and mineral utilization and conservation practices and needs in the state of Colorado, all of which are designed to result in the ultimate benefit to the citizens of the state.

Additional Colorado statutes define the ways and means that the CGS is to accomplish this broad goal. Some statutes direct the CGS into the activities related to counties and development. In short, the law and statutes guide the CGS activities.

In addition, the CGS works closely with a large group of

advisors. Through various advisory committees and steering groups, which focus on topics including geological mapping, water quality data, and minerals inventories, the CGS works with the stakeholders who ultimately use our data and products. The interests of stakeholders, represented by over 60 advisors, include oil and gas, mining (hardrock, coal, sand, gravel and aggregate), local government, homeowners, the water community, educators (both K-12 and college), environmental groups and citizens.

The primary guidance to the CGS comes from the Colorado Geological Survey Advisory Committee (CGSAC), a twelve-member Governor-appointed group of citizens, most of whom have degrees in geology and meet the Colorado

statutory definition of a professional geologist. This group meets four or five times a year, paying close attention to the activities and the budget of the CGS. Each year at the CGSAC fourth quarter meeting, advisors bring to the CGS and each other a detailed report from the various constituencies that they represent. This direct feedback on the effectiveness, success or problems of CGS programs is an extremely useful mechanism for guiding the CGS course.

The reason the CGS has so many advisors is to allow us to be responsive to the geological needs of the citizens of Colorado. As you review our recent activities, I invite you to contact us directly, or work through the CGSAC advisors, to let us know how we are doing and what new or different directions you would have us go in the future. A list of the 1998 CGSAC members and their phone numbers is included in the report on page 2. I know they are interested in your reactions and responses about CGS activities.

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Some of the CGS staff and CGSAC members at the Trapper Mine in Craig, Colo. (1997)

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Ed Church, 303-463-9317
John B. Curtis, 303-273-3887
John M. Kaufman, 303-458-5550
Susan M. Landon, 303-436-1930
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Jan Rousselot, 303-933-3575
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Marian Smith, 970-945-5004
Darrell Speer, 970-416-7184
Susan Steele Weir, 303-628-6616

CGS Staff

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James A. Cappa, **Minerals, Mineral Fuels, and Geologic Mapping**

David C. Noe, **Engineering Geology**
Randal C. Phillips, **GIS and Technical Services**

Vickie B. Pierce, **Administration and Outreach**

Matt Sares, **Environmental Geology**
Knox Williams, **Colorado Avalanche Information Center**

Administration and Outreach

Katie KellerLynn, Anissa Olguin,
Melissa Oros, Greg Richards

Avalanche Information Center

Dale Atkins, Nick Logan, Scott Toepfer

Engineering Geology and Land Use

Celia Greenman, Monica Pavlik,
Roger Pihl, Jim Soule, Jon White

Environmental Geology

Jeff Hynes, John Neubert, Ty Ortiz

Geologic Mapping

Chris Carroll, Bob Kirkham,
Randy Streufert

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COLORADO GEOLOGICAL SURVEY ANNUAL REPORT

BY KATIE KELLERLYNN

MISSION

The Colorado Geological Survey serves and informs the people of Colorado by providing sound geologic information and evaluation as well as educating the public about the important role of earth sciences in everyday life in Colorado. The three aspects of the CGS mission are **service**, **information**, and **education**. Each of these aspects will be highlighted in this report.

During the 1998 fiscal year, the CGS fulfilled its mission through the Engineering and Environmental Geology Section; the Minerals, Mineral Fuels, and Geologic Mapping Section; the Colorado Avalanche Information Center; and the Administration and Outreach Section.

SERVICE

Serving the people of Colorado by providing sound geologic information and evaluation is a CGS priority. The products and services provided by the Colorado Geological Survey have met both public service standards and scientific standards. Meeting standards of service are revealed in the awards recently granted to CGS geologists.

David C. Noe, Candace L. Jochim, and William P. ("Pat") Rogers received the John C. Frye Environmental Geology Award at the Geological Society of America's Annual Meeting in October 1998.

Their work is summarized in Special Publication 43, *A Guide to Swelling Soils for Colorado Homebuyers and Homeowners*. Special Publication 43 is a model for Environmental Geology and is, therefore, worthy of the John C. Frye Environmental Geology Award. This work on swelling soils



William "Pat" Rogers (left) and David Noe receive the John C. Frye Environmental Geology Award from AASG representative James Robertson at a GSA ceremony in Toronto, Ontario, as State Geologist Vicki Cowart looks on.

establishes an environmental problem and provides appropriate land-use recommendations and solutions. Moreover, the information is presented in a manner that is understandable and directly usable by geologists and the public.

The direct applicability of Noe, Jochim, and Rogers' work is reflected in the fact that Special Publication 43 is the top-selling CGS publication. SP 43 assists homeowners in reducing damage caused by swelling soils and provides guidelines for assisting homebuyers in making informed decisions. Nearly 25,000 copies of SP 43 were sold during Fiscal Year 1998.

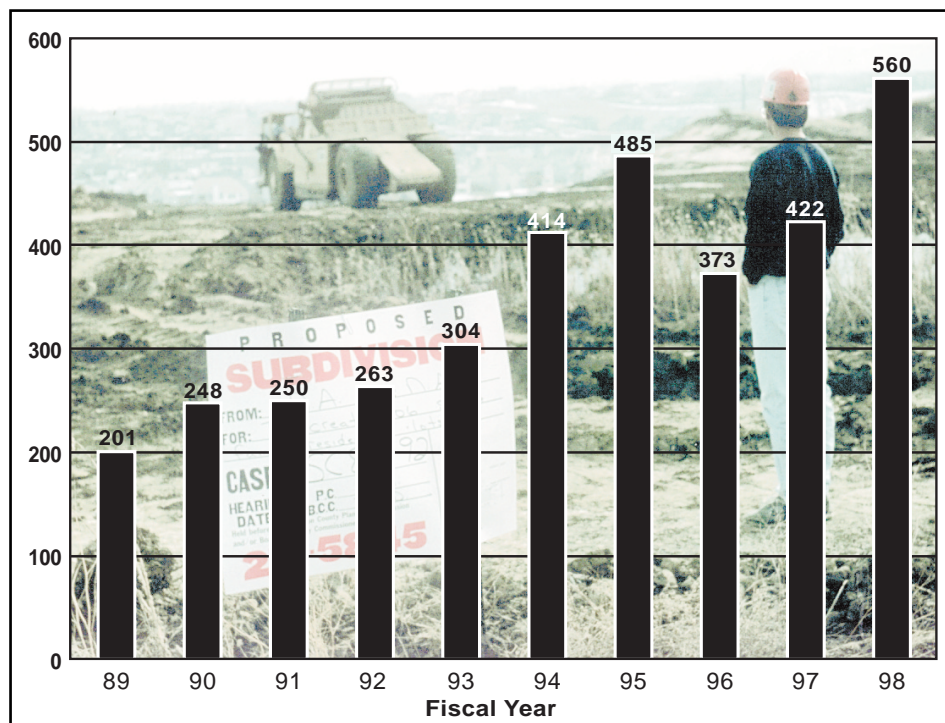
David Noe also published an award-winning technical article, "Heaving Bedrock Hazards Mitigation, and Land-Use Policy: Front Range Piedmont, Colorado" in *Environmental Geosciences*, June 1997, v. 4, no. 2. (published as SP 45). Noe received the American



Association of Professional Geologists 1998 Research Award for his work. In addition to meeting high scientific standards, Noe's work

shows the dedication of the Colorado Geological Survey to provide sound geologic information to the people of Colorado.

The publications that have been acknowledged by these awards are the current culmination of years of swelling soils and heaving bedrock studies. By working with local governments and citizens, CGS studies led to a better understanding and characterization of the geological origin of the problem. CGS facilitated field trips and technology transfer meetings to bring together planners, engineers, builders, local government regulators and geologists to work towards



CGS land-use reviews by fiscal year

a community-wide solution. Local building regulations and standards of professional practice have been changed as a result.

In fiscal year 1998, a new study was initiated to provide the same level of service to soils engineering challenges in western Colorado as in the Front Range. Due to the concerns regarding the occurrence of hydrocompactive and evaporitic soil and rock, a study was conducted to increase awareness of areas subject to hydrocompaction—where soils collapse rather than swell. Early results of the new CGS study were released during the fourth geological hazards conference "Geologic Hazards and Engineering Practices in Western Colorado," held in Glenwood Springs in October 1998 (FY 1999).

CGS serves counties, municipalities, and school districts by assisting them with planning, development, and construction problems caused by adverse geologic conditions. The Land Use Review Program helps citizens and local governments become

aware of geologic hazards such as swelling soils, heaving bedrock, rockfall, and landslides before building begins.

Population increases and urban growth in Colorado have resulted in the Colorado Geological Survey's receipt of land-use review requests to reach all-time highs this fiscal year. Submittal to CGS for land-use reviews totaled 560. This is an increase of 85 percent over Fiscal Year 1993.

In addition to providing land-use reviews to the people of Colorado, CGS serves its constituents



Pat Rogers, Geologic Hazards Conference Coordinator, gives directions to field trip leader Jon White.

How to Order CGS Publications

HOW TO ORDER PUBLICATIONS

Mail:

Colorado Geological Survey,
1313 Sherman Street,
Room 715, Denver, CO 80203
Phone: (303) 866-2611
Fax: (303) 866-2461,

E-mail:

katie.kellerlynn@state.co.us

Website:

www.dnr.state.co.us/geosurvey

.....
VISA® and MasterCard®
accepted.

Prepayment required.

.....
SHIPPING AND HANDLING
Please contact the CGS for
shipping and handling costs.

.....
DISCOUNTS

Available on bulk orders.

.....
Call for a complete
publication list

PUBLICATIONS MENTIONED IN THIS ISSUE

Information Series 44

*Colorado Mineral and Mineral
Fuel Activity, 1997* \$4.00

Information Series 45

*Active Permitted Mine Operations
in Colorado, 1996-97* \$10.00

Information Series 46

*Snow and Avalanche Annual
Report 1997-1998, CAIC* \$5.00

Map Series 31

*Geologic Map of Glenwood
Springs Quadrangle, Garfield
County, Colorado* \$12.00

Open File Report 98-1

*Geologic Map of the Basalt Quad-
rangle, Eagle, Garfield, and Pitkin
Counties, Colorado* \$6.00

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through geologic mapping. CGS works in areas most in need of geologic mapping and determines its mapping priorities using these criteria:

- The area must be one of rapid growth, where new development is expanding well beyond traditional city boundaries.
- The area must contain potential geologic hazards and/or mineral resources that will affect new development.
- The area must lack detailed geologic mapping at a scale large enough to be useful, typically a 1:24,000 scale.



Randy Streufert (CGS geologist) samples the Mt. Sopris quartz monzonite intrusive as part of the geologic mapping program.

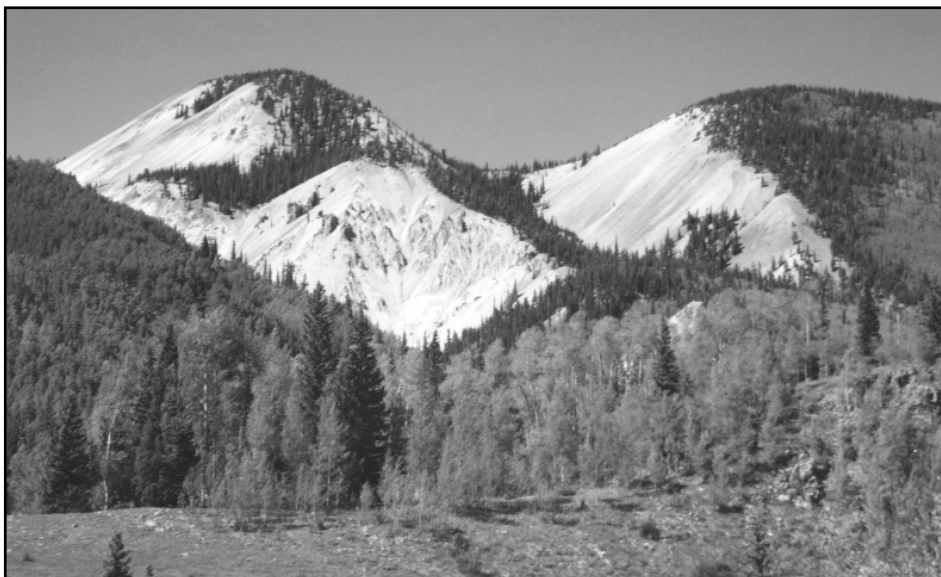
In Fiscal Year 1998 CGS completed a number of mapping projects the Glenwood Springs, Durango, and Salida areas. The new 1:24,000 quadrangle maps that are now available to private individuals, businesses, organizations, and federal, state, and local governments are:

- Basalt Quadrangle (OF 98-1)
- Ludwig Mountain Quadrangle (OF 98-2)
- Leon Quadrangle (OF 98-3)
- Cameron Mountain Quadrangle (OF 98-4)
- Glenwood Springs Quadrangle (color) (MS 31)

CGS also sponsored a one-day conference for small mine operators. The sessions at the conference assisted this select audience with problems that small mine operators face in today's regulatory, financial, and technical world. Over sixty people participated in the conference.

Another service area of the Colorado Geological Survey is exemplified in the programs of the Colorado Avalanche Information Center (CAIC). In a state globally known for its winter outdoor recreation, the CAIC serves not only the residents of Colorado but travelers and the recreation and transportation industries. The CAIC promotes safety by reducing the impact of avalanches through a program of forecasting and education. 2,958 avalanches were reported during 1997-1998. This is a 40 percent increase above the normal 2,110. A total of 73 avalanche incidents resulted in 101 people being caught, five seriously injured, and six killed. Property damage was approximately \$175,000 resulting from one destroyed house and 13 vehicles hit by avalanches.

CAIC provides services to backcountry travelers, students, and snow workers with its Web Site (www.caic.state.co.us). The Web Site consists of 12 different pages with text information, pictures, and links. People may also call "public hotlines" for up-to-date mountain weather forecasts, current snow condition reports, and avalanche hazard evaluations. Data from over 35 field-observation sites are used to prepare forecasts for seven hotlines



The geology of its watershed causes Alum Creek in the Upper Alamosa River Basin to be a natural source of acidic, metal-rich water.

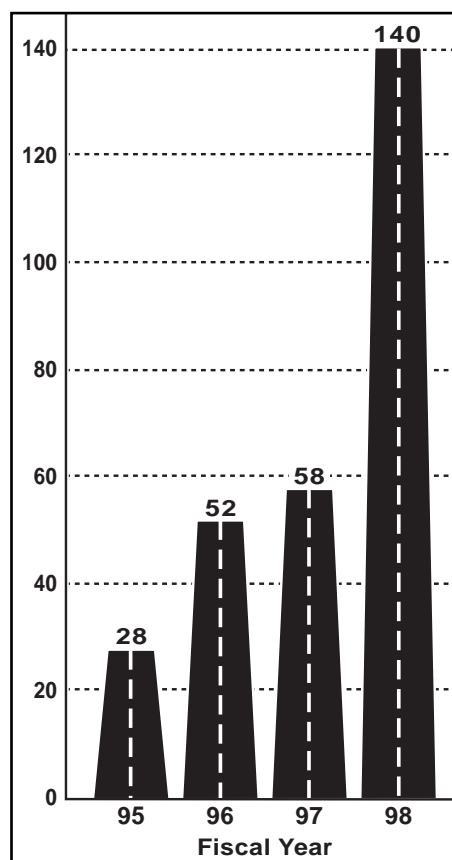
in Colorado. CAIC also serves a large listening audience through dedicated radio stations in mountain communities.

Further service is provided by the Water Quality Data Program. This program focuses on cooperation and interaction with other organizations including the U.S. Geological Survey, the Water Quality Control Division of Colorado Department of Public Health, Jefferson County Ground Water Study, and the Upper Animas River and Alamosa River Stakeholders. The outcome is service to citizens by providing data important in decision-making.

Recently, the Water Quality Control Commission held hearings on the water quality and potential reclassification of the Alamosa River. Data from a CGS-prepared inventory of mining and natural sources of water quality degradation in the Upper Alamosa River Basin was used in this process. These data are summarized in Kirkham et al (1995) in *Proceedings: Summitville Forum '95* (SP 38).

CGS work was instrumental in two major changes in the existing stream classifications. The identification, calculation, and compari-

son of abandoned mine-related contaminant sources versus natural contaminant sources in the Upper Alamosa River Basin, as documented in SP 38, was instru-



Number of CGS outreach events by fiscal year

Upcoming Events Involving CGS

January 27

American Institute of Professional Geologists Reception for Legislators,
University Club, Denver,
Larry Anna, (303) 236-5050, ext. 260

March 1-3

Society of Mining Engineers Annual Meeting,
Colorado Convention Center, Denver, Angie Giles, (303) 973-9550

mental in appropriately downgrading one segment of the Alamosa River to the "Aquatic Life 2" classification. A more stringent "Aquatic Life 1" classification was given to an upstream segment of Iron Creek, partially based on CGS identification of good water quality and a trout population in this tributary to the Alamosa River. Based on water quality measurements, this was an appropriate upgrade from the previous rating.

The same data is currently being used by a task force of citizens, appointed by the governor, to identify abandoned mine sites for potential remediation in the Upper Alamosa River Basin.

The service of CGS to the people of Colorado is shown in the numerous outreach events that the CGS sponsors and in which its employees participate. In FY 1998, CGS staff informed the public about the important role of earth sciences in everyday life in Colorado through 140 outreach events. Events included participation at meetings and hearings, classroom presentations, newspaper and television interviews, news releases, speaking engagements, geologic

field trips, providing information at exhibits, and poster sessions.

Service by the Colorado Geological Survey is further epitomized in the Distinguished Public Service to Earth Science Award that was presented to State

Publications continued from page 4

Open File Report 98-2

Geologic Map of the Ludwig Mountain Quadrangle, La Plata County, Colorado \$6.00

Open File Report 98-3

Geologic Map of Leon Quadrangle, Eagle and Garfield Counties, Colorado \$6.00

Open File Report 98-4

Geologic Map of Cameron Mountain Quadrangle, Chaffee, Park, and Fremont Counties, Colorado \$6.00

Special Publication 38

Proceedings: Summitville Forum '95 \$95.00

Special Publication 40

Dinosaur Lake-The Story of the Purgatoire Valley Dinosaur Tracksite Area \$12.00

Special Publication 43

A Guide to Swelling Soils for Colorado Homebuyers and Homeowners \$7.00

Special Publication 45

Heaving Bedrock Hazards Mitigation and Land Use Policy: Front Range Piedmont, Colorado \$4.00

Special Publication 47

An Introduction to Mining and Minerals in Colorado (CD-ROM) \$10.00

Resource Series 32

Directory and Statistics of Colorado Coal Mines with Distribution and Electric Generation Map, 1995-96 \$10.00

Resource Series 33

Spanish Peaks Field, Las Animas County, Colorado: Geologic Setting and Early Development of a Coalbed Methane Reservoir in the Central Raton Basin \$8.00

Resource Series 34

Penetration Charts of Selected Colorado Oil and Gas Fields \$15.00

Geologist and Director of CGS, Vicki J. Cowart, by the Rocky Mountain Association of Geologists (RMAG) in December 1997. Cowart believes that the award belongs to all of the staff at CGS because, "they continuously improve our abilities to understand and communicate the implications of the geology in Colorado. Their good work backs me up every time I speak to a group of students or citizens."

INFORMATION

The CGS mission mandates that sound geologic information be available to the people of Colorado. The CGS Web Site (www.dnr.state.co.us/geosurvey) allows visitors to search by "key words" to find geologic information via CGS publications. To further facilitate information transfer, the public may order with MasterCard® and Visa® by phone. CGS distributed over 35,000 publications in FY 1998.

CGS made nearly a dozen new publications available to the public in FY 1998. Examples of new publications are:

- *Active Permitted Mine Operations in Colorado, 1996-97 (IS 45)*
- *Snow and Avalanche Annual Report 1997-98, CAIC (IS 46)*
- *Directory and Statistics of Colorado Coal Mines with Distribution and Electric Generation Map, 1995-96 (RS-32)*
- *Spanish Peaks Field, Las Animas County, Colorado: Geologic Setting and Early Development of a Coalbed Methane Reservoir in the Central Raton Basin (RS 33)*
- *Penetration Charts of Selected Colorado Oil and Gas Fields (RS 34)*

CGS also provides books from outside publishers that satisfy the

needs and interests of its Colorado constituents.

CGS distributes information to engineers, consultants, builders, and local government officials at its geologic hazards conferences. Nearly 600 people have attended these CGS-sponsored events, which began in FY 1996. The four conferences have covered Colorado law as it pertains to geologic hazards, flood plain management, soils and foundation-engineering practices on the western slope, snow avalanche hazards, landslides, and techniques for mitigating geologic hazards.

To satisfy the needs of constituents (and anyone interested in the economic impact of mineral and mineral fuel resources in Colorado) CGS geologists investigate and prepare annual reports about the values of mineral and mineral fuel industries in the state. The report includes oil and gas, base and precious metals, industrial and construction materials, coal, and carbon dioxide.

Other geologic/economic issues that impact the state are investigated and reported by CGS. Significant issues in FY 1998 were the dissolution and geologic collapse of ancient layers of sea salt in the Glenwood Springs area, as well as the salinity of water in western Colorado related to this active geologic collapse.

In addition to "traditional information," CGS is keeping up with the demand for digital information. Projects include a digital map of Colorado earthquakes, preliminary statewide map for hydrocompaction and evaporitic soil and rock, statewide rockfall hazard sites and descriptive data on Colorado highways.

New this fiscal year is the *RockTalk* newsletter. Over 40,000 newsletters were distributed in 1998. *RockTalk* allows CGS geologists to inform the public about the important role that earth sciences play in everyday life in

Colorado. Subjects highlighted in the first four issues are mapping, geologic hazards, coal, and avalanches.

EDUCATION

RockTalk also serves as an educational tool. The issues are written to be understandable to a diverse audience. The issues are topical and have provided teachers with information to be used in their classrooms.

Since 1997 the Colorado Geological Survey has been developing educational materials under CMEP—the Colorado Minerals Education Program. The objective of CMEP is to provide mineral and mineral fuel information to middle and high school students in Colorado. During FY 1998 CGS completed Phase 2 of



CMEP. An interactive CD-ROM, *An Introduction to Mining and Minerals in Colorado* (SP 47), was

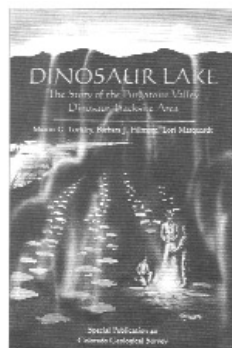
produced through funds from Colorado severance tax allocated from the production of oil, gas, coal, and minerals. Students view a geological map of the state and find out information on minerals and mines. Topics presented on the CD-ROM include exploration, development, production, uses of mineral commodities, impacts on the economy, and reclamation and environmental restoration.

Copies of the CD-ROM are distributed free of charge to Colorado junior and high school teachers who request a copy in writing; the general public may purchase a copy for \$10 by contacting CGS.

CGS publications are written to be informational and educational.

Both technical and non-technical resources are provided by CGS and educate readers about geologic resources. An example of a non-technical yet very informative publication is *Dinosaur Lake—The Story of Purgatoire Valley Dinosaur Track-site Area* (SP 40), by Martin Lockley.

Dinosaur Lake discusses the latest research and summarizes the natural and social history of the region. Readers are also educated about the loss of millions of years of "history" through the forces of erosion and human-caused damage. Readers are given suggestions on how to help guard against the destruction of paleontological resources. To further satisfy public interest, CGS sponsored a book-signing and presentation by Martin Lockley in November 1997.

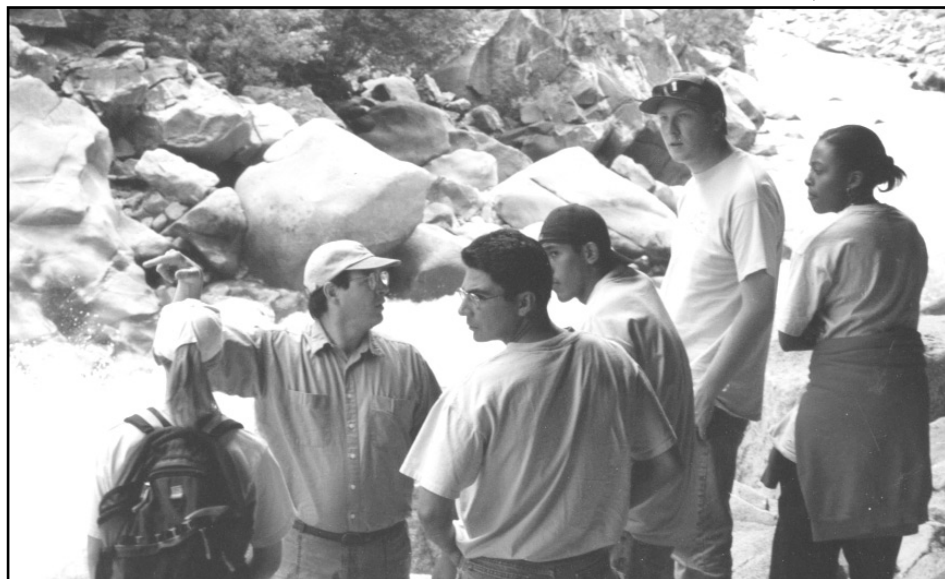


The Colorado Geological Survey is also a sponsor of the Youth in Natural Resources Program (YNR). This educational program introduces students to natural

resources and natural resource careers. CGS cooperates with the Division of Minerals and Geology in this endeavor. The students worked on the following activities during their three and a half weeks at the CGS:

- A field trip to Green Mountain where students studied the recent landslide and its cause and effect on the environment. Students theorized about possible solutions for homeowners. Students also participated in a field trip to the Roaring Fork Valley.
- Techniques in well purging and ground water sampling performed at a petroleum-contaminated site in Loveland.
- Mapping at a project site in southwest Denver. Students learned about the effects of and how to identify swelling soils and heaving bedrock, as well as mapping techniques.
- Data entry of field forms from abandoned mine surveys. The students learned that work in a science field is not just field work. Data gathered in the field needs to be put into a usable form, which usually means a digitized form.

BERNIE GRAUER, GLENWOOD POST



YNR field trip led by CGS geologist Jon White visited a site of rockfall that occurred 10,000 years ago. That rockslide dammed the Colorado River in Glenwood Canyon and created Cottonwood Falls, a class VI rapids.

A MISSION FULFILLED...

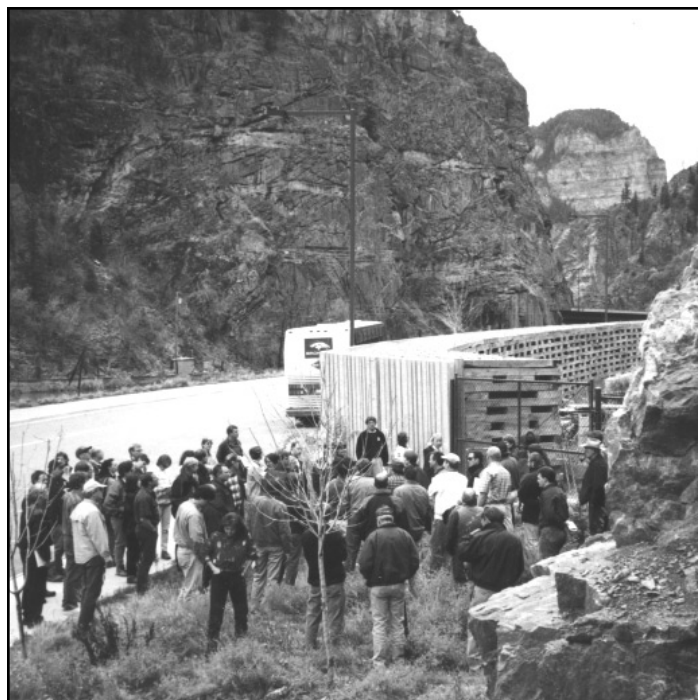
CGS serves the people of Colorado by providing land-use reviews, avalanche programs, water quality data, geologic mapping in areas of rapid population growth coupled with geologic hazards, and numerous outreach events.

The Survey provides the people of Colorado with sound geologic information that is easily accessible through its publication sales. Information and technology transfer is facilitated through CGS-sponsored conferences and workshops. CGS geologists investigate and report on mineral and mineral fuel activity in the state. Both technical and non-technical information is available for use in traditional and digital formats.

CGS has initiated studies which increase education and awareness of geologic hazards and resources. A CD-ROM has been completed and disseminated to Colorado school teachers. Publications that capture a multiplicity of interests and reach a diverse audience have been produced by the Colorado Geological Survey.

CGS fulfilled its mission in Fiscal Year 1998 by serving, informing, and educating the people of Colorado. Moreover, CGS continues to interpret and look for new ways to accomplish its mission in a

state experiencing unprecedented populations growth and development.



1998 Geologic Hazards Conference field trip participants view rockfall wall protecting I-70 Hanging Lake Rest Area parking lot.

CGS MISSION STATEMENT

The CGS mission is to serve and inform the people of Colorado by providing sound geologic information and evaluation and to educate the public about the important role of earth sciences in everyday life in Colorado.



ROCKTALK

Colorado Geological Survey
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