

COLORADO GEOLOGICAL SURVEY

ROCKTALK

VOLUME FOUR, NUMBER ONE

JANUARY, 2001

WHO IS THE COLORADO GEOLOGICAL SURVEY (CGS)?

The Colorado Geological Survey (CGS) is thirty-seven dedicated people whose mission is to serve, inform, and educate the citizens of Colorado about the important role of earth sciences in everyday life. The science, field studies, and research we perform are reflected in the decisions that we make, as well as the products and services we provide. Each of us is encouraged to participate in events that transfer the information we have studied to a wide range of audiences. The State Geologist and seven section chiefs coordinate and lead our efforts.

CGS Takes Pride in Excellence

The year 2000 was a challenging and satisfying year. CGS responded to several emergency situations while carrying out our regular duties and obligations to the people of Colorado. Our people thrive on serving the citizens of our state

and take pride in the results of our efforts. The scientific quality of our work is attested to by awards recently bestowed on our scientists by professional organizations such as the Colorado Scientific Society, the American Association of Petroleum Geologists, the Rocky Mountain Association of Geologists, the Colorado School of Mines, the U.S. Forest Service, the International Erosion Control Association, the Federal Highways Agency, and the Geological Society of America.

WHAT WE DID IN THE YEAR 2000

Land-Use Reviews

Colorado is the third fastest growing state in the nation. Colorado's building boom kept our Engineering section hustling to keep up with Land Use Reviews (LURs). January was a foretaste of the year to come with the highest number of LURs for any January on record. By September and October we were processing more LURs than any month in our history. This year CGS performed about 500 LURs as mandated by state law.

The LUR Program provides technical assistance to local-government officials and planners to evaluate the geologic suitability of proposed subdivisions, schools, and infrastructure projects. The CGS provides these services under the mandate of Senate Bill 35 (1972), House Bill 1041 (1984), and House Bill 1045 (1984). The CGS is authorized, under House Bill 1572 (1983), to establish and collect fees to recover direct costs of providing these review services.



From left: CGS Director, Vicki Cowart welcomes new employees Leslie Baca, Program Assistant; Patricia Platter, Chief of Administration and Outreach; Allison Apeland, Engineering Geologist; Ralf Topper, Hydrogeologist; and Vince Matthews, Senior Science Advisor, who is responsible for Geologic Mapping and Earthquake Hazard Research. Not shown: Jason Wilson, GIS Analyst.

INSIDE THIS ISSUE

Annual Report

Publications5

Colorado Avalanche Information Center

Last winter produced fewer avalanches than normal; 1,660 versus 2,166. As a result only 43 people were caught in avalanches versus the normal 64. However, this winter is off to an early start that looks foreboding for avalanche activity.

Open for the Season

The Colorado Avalanche Information Center (CAIC) opened for the 2000–01 season on November 1 for highway forecasting and November 10 for backcountry forecasting. A staff of 10 forecasters is on the job once more to provide forecast services for CDOT, Colorado ski industry, and backcountry recreationists. CAIC daily forecasts reach industry clients and the public via email, fax, CAIC Web site (<http://caic.state.co.us>), radio stations, and seven hotlines around the state.

New Computer Tools

Eighteen years of weather and avalanche data were converted into a digital database over the past two years. The database will be a valuable resource for improved understanding of the Colorado snowpack, its relation to avalanche release, development of a forecast model, and other research studies. The CAIC converted its atlas of all avalanche paths that affect Colorado highways into a GIS map to improve avalanche forecasting along Colorado highways and to be a tool for quick retrieval of avalanche frequency and severity.

New Forecasting Model

These new tools will enable CAIC to use a nearest-neighbors forecast model this winter as an objective aid to forecasting. This model searches an historical database to find the 10 past days with weather most similar to today's weather, and then the model displays the avalanche events that occurred on those 10 days. This will help forecasters anticipate today's avalanche potential. The model will be tested on Red Mountain Pass and Berthoud Pass this winter.

Mapping

During 2000 CGS published four 7.5-minute geologic quadrangle maps and carried out the fieldwork for five maps to be published in 2001. These maps were

funded by a combination of severance tax, Colorado General Fund, and a federal grant under the National Cooperative Geologic Mapping Program (NCGMP). The NCGMP received a significant increase in funding for next year from the U.S. Congress. The increase enables CGS to map seven quadrangles next year.

List of Completed Maps Grows

In 2000 CGS completed the twenty-eighth 7.5-minute geologic quadrangle map in its program begun in 1992. These maps are located where one or more of the following characteristics are present: significant mineral potential, significant construction in areas with consequential geologic hazards, and/or significant unresolved scientific questions. Mapping in 2000 was carried out near Georgetown, Colorado Springs, Durango, Glenwood Springs, and Buena Vista. Status of the mapping program is available at www.dnr.state.co.us/geosurvey.

New Technology

Last year CGS took a leap forward in map publishing by making color maps entirely with digital



Bob Kirkham, Mapping Supervisor, points out the challenges of urban mapping in Colorado Springs to Jon Thorson, Senior Author for the Pikeview quadrangle geologic map.

technology. This year the GTS section took another leap forward by producing geological maps that are draped over shaded-relief topography. This technique makes the geology and its relationship to topography much more apparent to the user. These maps will be more useful to non-geologists and geologists alike.

Hazards

Fire Support

Two major fires broke out in the Front Range during the summer. Most people don't automatically think "geologist" when a fire occurs. However, fires increase the likelihood of floods and debris flows in the burned areas. CGS geologists quickly identified those areas most prone to these hazards and mapped the buildings likely to be threatened. Maps of these danger zones were posted on the Web (www.dnr.state.co.us/geosurvey/pubs/fires/maps/debris_flow.haz.gif) within a week of the fires being extinguished.

Because of this response, CGS Chief Engineering Geologist Dave Noe was an invited speaker at a USGS workshop on post-fire geologic hazards. About 20 geologists from a variety of state geological surveys and federal agencies attended.

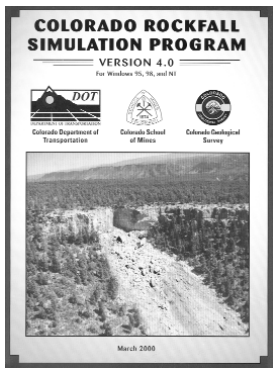
Earthquakes

2000 was a busy year for earthquake research. The Bureau of Reclamation's project in southwestern Colorado has produced more than 3000 earthquakes. In June the largest quake yet, of magnitude 4.3, coincided closely with the release of CGS' two new publications on historical earthquakes in Colorado and Quaternary faulting in Colorado.

In September the Federal Emergency Management Agency released a report wherein they projected that Colorado would suffer financial losses of \$5.8 million per year on an annualized basis from earthquakes. CGS is conducting research to better define the potential for damaging earthquakes in the Front Range area.

DeBeque Canyon Landslide

CGS, along with its partners at the USGS, Colorado School of Mines, and a private consulting firm, continued investigating a major landslide in DeBeque Canyon near Palisade. This landslide, which has undergone periods of activity since 1924, caused damage and traffic delays on I-70 in 1998. During January-February 2000, the project team monitored the landslide for movement, finalized the landslide map and cross-sections, and wrote a report about the geologic-investigation findings.



Colorado Rockfall Simulation Program (CRSP)

CGS and Colorado School of Mines completed preparation of the updated Colorado Rockfall Simulation Program diskettes and manual, under a CDOT-funded task order. This popular rockfall-modeling program is used worldwide, and has been unavailable for over a year. The newest version has

an improved, user-friendly interface and can be run on a number of newer operating systems, including Windows 98 and Windows NT.

Groundwater Atlas of Colorado

CGS embarked on an important new project to compile a map-based atlas of groundwater information in a generic, statewide scale. The atlas is intended to provide general groundwater information in a form that laypersons can understand, but will also be valuable to anyone interested in Colorado's groundwater. The

atlas will include maps that show general surface geology, precipitation, evaporation/plant transpiration, aquifers, water levels, water level change over time, and water quality.

Matt Sares presented the project at November meetings with local irrigators in Yuma and Burlington in hopes of obtaining proprietary current and historical data on water levels in the Northern High Plains (Ogallala) Aquifer. The project is being done in cooperation with the Colorado Water Conservation Board. Atlas publication is expected by July 2002.

Mineral Resources

Mineral Inventory of State Lands

The State of Colorado owns the mineral rights on four million acres that are administered by the State Land Board. In 1998 CGS began evaluating the mineral and mineral fuel resource potential of these tracts of land. During 2001 the team of CGS employees, interns, and contractors will reach the halfway mark of two million acres completed.

Evaluations are complete for the following counties: Boulder, Jefferson, Clear Creek, Gilpin, Kit Carson, Saguache, Grand, Summit, and Cheyenne. Mineral resource evaluation of SLB tracts is in progress for Rio Grande, Alamosa, Conejos, Montezuma, Dolores, Prowers, and Bent Counties (www.dnr.state.co.us/geosurvey/pubs/slb/mineralmap.gif).

Coal Studies

CGS is conducting several coal projects in the state. The National Coal Quality Inventory is building a database of chemical information on coals that will be mined or consumed at power plants during the next decade. Samples were collected and entered into a digital database from five mines in Colorado.

As part of the USGS Coal Availability study CGS conducted research to determine the amount of coal that is available to be mined in the western part of the Yampa Coal Field. The report was submitted to the USGS in September.

The National Coal Resource Data System is a series of computer databases connecting coal quality and coal resource information within a national framework. CGS is completing a CD-ROM of all the coal quality databases. The STRAT portion of the Colorado database links coal samples to the various stratigraphic coal-bearing formations in the state.

Oil and Gas

As part of the Colorado Oil and Gas Conservation Commission's 3M project (Mapping, Modeling, and Monitoring), the Colorado Geological Survey completed and published a final report containing maps and cross sections pertaining to the Fruitland Formation coals in the San Juan Basin of southwestern Colorado.

Open-File Report 00-18, published as a CD-ROM in July 2000, includes the following information: 1) a 1:12,000 scale geologic map of the Fruitland Formation coals along the northwestern and northern outcrop of the San Juan Basin between Ridges Basin just north of the Southern Ute Indian Tribe boundary to the Archuleta County line (total distance of approximately 25 miles); 2) a stratigraphic cross section along the outcrop composed of 25 measured sections; 3) a grid of 16 stratigraphic cross sections, oriented NW-SE and NE-SW, which present interval correlations of the Fruitland Formation coals from the outcrop to the New Mexico border; 4) accompanying stratigraphic columns, correlation charts, basemaps, and schematic diagrams explaining the interval correlation scheme; and 5) a summary text with bibliography.

A report on the Piceance Basin was published that examined how technological advances increased natural gas production significantly. The report includes structure contour maps, stratigraphic columns, production analyses, seismic, and log analysis data.

In the fall of 2000, the Colorado Geological Survey (CGS) and the Utah Geological Survey (UGS) were awarded a three-year grant to study the reservoir characteristics of the Pennsylvanian Ismay and Desert Creek carbonate reservoirs in the Paradox Basin. CGS will focus its research on the carbonate fields in Colorado, supplying data, interpretations, and pertinent displays to the UGS, the principal investigating

agency. CGS is expected to fulfill a major role as a technology transfer vehicle for disseminating the reservoir characterization analyses done in both states.

With interest in Colorado coalbed methane reaching an all-time high in the year 2000, the Colorado Geological Survey (CGS) is studying the coalbed methane potential of the Laramie and Denver Formation coals in the DJ Basin of eastern Colorado. CGS has compiled much of its old coal studies data into digital files and will issue a preliminary assessment of coalbed methane plays next year. The report, in CD-ROM format, will contain some of the following information: 1) historical data that is merged with recent information to highlight areas of higher gas content and vitrinite reflectance values; 2) subtle structural features that could enhance the gas content of the coals; 3) revised stratigraphic cross sections of both coal-prone formations; and 4) and reservoir engineering calculations for prospective areas. The final report will be completed in June, 2001.

Limestone

CGS is building a database of carbonate rock geochemical analyses from published and unpublished literature. CGS will be taking samples in areas where no analyses are available. The database will supply useful data on the geochemistry of carbonate rock formations and their suitability for cement, chemical grade limestone, and construction and industrial material.

SPREADING THE WORD

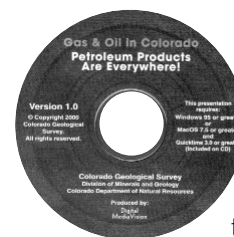
Research by CGS is not justified unless it is useful to people. People can't use the information developed by CGS scientists unless they know about it. CGS gets the word out through numerous vehicles during the year. These efforts include publishing articles in CGS reports and in professional journals; making oral presentations to the public, government officials, and professional societies; leading field trips for the public and professionals; working with the news media on geological articles; responding to questions and requests from the public and professionals; providing data and information on the Web and staffing information booths at various scientific and public meetings.

Publications Lead the Way

One indicator of the importance of CGS' efforts is the continuing strong sales of its publications. Sales in 2000 outpaced the previous year. CGS' award-winning publication *A Guide to Swelling Soils for Colorado Homebuyers and Homeowners* (see *RockTalk*, v. 2, no., 1) is by far our best seller. Since it was published three years ago, 94,127 copies have been sold, a national record for state survey publications.

Innovative CD-ROM Designed for Students

This year CGS released a new CD-ROM publication on the oil and gas industry. The CD was



designed for use by junior high school students and is therefore full of fun, attention-keeping interactive activities.

The graphics and activities are excellent. Just as many adults are enjoying the Harry Potter books designed for young people, so are many adults also enjoying and learning from this CD-ROM.

CGS Geohazards Conference Well Attended

Reducing Colorado's vulnerability to geological hazards by fostering cooperative, "Smart Growth"

interactions between local governments and the development community was the theme of Dipping Bedrock Revisited, a conference sponsored by the Colorado Geological Survey and Jefferson County on April 27–28 at the Arvada Center. This conference focused on geological hazards associated with dipping layers of bedrock, which have caused extensive damage to buildings and roads along Colorado's Front Range. The session highlighted political and technical issues that are involved in mitigating the hazard. This was followed by three optional half-day field trips. The conference was attended by nearly 300 people who represent a variety of stakeholders including developers, homebuilders, contractors, engineers, geologists, home inspectors, real estate professionals, insurers, school facility planners and officials, and city and county planners and officials. The conference and field trips featured presentations from members of all of these stakeholder groups.

Earth Science Week Field Trips Are Big Success

In 1998 the American Geological Institute initiated the first "Earth Science Week" across the country. This June, Governor Owens declared October 9–14 "Earth Science Week in Colorado." CGS geologists led four field trips for the public during Earth Science Week. Two of the trips were re-runs of last year, the Front Range Geologic Hazards trip and the Geology of the Glenwood Springs area. Both trips were well attended again this year. Attendees ranged from professional geologists to elementary school children. Both trips were also run for various groups at other times during the year.

Two new trips were added this year. The first toured the Ouray-Silverton area and examined areas of mine reclamation, natural contamination of surface waters, and techniques of avalanche prediction and control. The second was a fun mountain-bike trip to the dinosaur trackway along the Purgatoire



Geologist, John Keller, shows off dinosaur tracks on the Purgatoire River bike trip for Earth Sciences Week.

How to Order CGS Publications

HOW TO ORDER PUBLICATIONS

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MI 69

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OF 00-1

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Colorado* \$10.00

OF 00-3

*Geologic Map of the Colorado Springs
Quadrangle, El Paso County, Colorado* \$10.00

continued on p. 7



Engineering Geologist, Karen Berry, points out landslides on the Front Range trip for Earth Science Week.



Trip leaders Matt Sares and Andy Gleason showed a hardy group of participants about avalanche control, mine reclamation, and natural acid waters in the San Juan Mountains.

River in southeastern Colorado. Spectacular and abundant tracks awaited the hardy souls who pedaled in the five miles (and five miles out).

CGS Bookmark Quickly Becomes a Popular Item



A colorful geologic time-scale bookmark highlights geologic events in Colorado and "scenic" geologic areas in the state. Bookmarks are included with every publication order and distributed at outreach events and in educational packets. For your free bookmark simply call, write, or e-mail your request.

CGS Gives Award at Science and Engineering Fair

For the first time CGS sponsored a special award at the State Science and Engineering Fair. Five judges from CGS participated and select-

ed "The Best Earth Science Award" for Junior and Senior High. A student from Fairview High School (Boulder) won the Senior Award, and a student from Liberty Common School (Loveland) won the Junior Award.

Sares and Neubert Make Presentation at International Conference on Acid Rock Drainage

Matt Sares and John Neubert of CGS, and Daryl Gusey of the U.S. Forest Service collaborated on a poster presentation for this international conference meeting in Denver. The poster highlighted the Forest Service Abandoned Mine Land Inventory conducted by CGS and areas found to exhibit natural acid-rock drainage.

CGS Geologist Wins Best Paper Award

Congratulations to CGS Senior Engineering Geologist Jonathan White for receiving national recog-

nition for his work on the DeBeque Canyon Landslide project. Jon, along with our partners Jerry Higgins (Colorado School of Mines) and Frank Harrison and Nancy Dessenberger (Golder Associates), received the "Best Technical Paper" award at the 26th Annual Northwest Geotechnical Workshop in Seattle, WA, on August 28, 2000.

New Bibliography Nears Completion

The new Bibliography of Colorado Geology CD-ROM which includes a user-friendly interface, a tutorial, and several index maps will be available in February 2001.

CGS Launches GeoCalendar on the Web

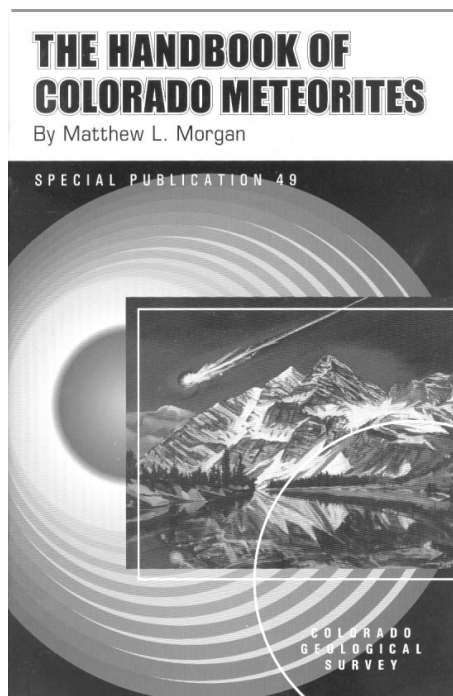
This year CGS initiated the GeoCalendar on its Web site. The calendar lists upcoming events involving CGS personnel, as well as all geological talks in the state. Updates are done monthly.

Earthquake Database Is First Interactive Professional Publication

The newly updated edition of Colorado Earthquake Data and Interpretations by Robert M. Kirkham, and William Pat Rogers was released on CD-ROM in early May as CGS Bulletin 52. The CD contains an updated earthquake listing of recent seismic events through 1994 with hyper-linked text, figures, maps, and references. The publication was the first, interactive bulletin published by the Colorado Geological Survey.

Popular Meteorite Book Debuts

In early July the *Handbook of Colorado Meteorites* by Matthew L. Morgan was introduced as CGS Special Publication 49. The handbook is the first detailed catalogue specifically covering Colorado meteorites. Filled with a full range of information, ranging from meteorite classification to eyewitness accounts of recent falls, the handbook will be of use to expert and novice alike. The colorful maps, tables, and anecdotes are informa-



tive and should be of interest to anyone wanting to know more about these rare and intriguing artifacts of cosmic geology.

Cowart is President-Elect of AASG

Vicki Cowart, State Geologist, is president-elect of the Association of American State Geologists (AASG). The Association of American State Geologists (AASG) is an organization of the chief executives

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Publications continued from page 5

OF 00-4

Geologic Map of the Hesperus Quadrangle, La Plata and Montezuma Counties, Colorado \$10.00

OF 00-7

Evaluation of Mineral and Mineral Fuel Potential of Kit Carson County State Mineral Lands Administered by the Colorado State Land Board \$25.00

OF 00-10

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OF 99-18

History, Geology, and Environmental Setting of Selected Mines near Creede, Rio Grande National Forest, Mineral County, Colorado \$5.00

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Geology of the 1994 South Canyon Fire Area, and a Geomorphic Analysis of the September 1, 1994 Debris Flows, South Flank of Storm King Mountain, Glenwood Springs, Colorado \$16.00

SP 49

The Handbook of Colorado Meteorites \$7.00

SP 50

Gas and Oil in Colorado \$10.00

of the state geological surveys in 50 states and Puerto Rico. The first state survey was established in 1823. The State Geologists began formal meetings with the U.S. Geological Survey in 1879, the year that organization was established. Since 1908, the AASG has met regularly to discuss issues of common interest and to initiate united actions when warranted.

Neubert and Sares Active in Abandoned Mine Lands 2000 Conference

John Neubert presented the findings of his work on natural water quality degradation in hydrothermally altered areas of Colorado (OFR 00-16). Matt Sares moderated a session on innovative water-quality improvement research and projects.

Naturally Occurring Degradation of Water Quality Study

Open-File Report 00-16, *Naturally Degraded Surface Waters Associated with Hydrothermally Altered Terrane in Colorado*, has been released. The report describes sixteen areas in the state affected by

natural "acid rock drainage" processes. This report will be upgraded to an Environmental Geology Series publication, with the addition of hydrothermal alteration maps of selected areas currently underway. During the 2000 field season, alteration data has been gathered in the Grizzly Peak Caldera area south of Independence Pass, Red Amphitheatre near Alma, and the La Plata Mountains. Cooperative work with the USGS will help define alteration types in these areas and others cited in the report using remote sensing data and laboratory analysis of rock samples.

New Popular Geology Book in Preparation

CGS began preparation of a new book entitled *Colorful Colorado: A Geological Wonderland*. Although it is scheduled for publication in 2001, it will also serve as the basis of a Web site devoted to Colorado Geology. The book will cover geologic history, glacial geology, economic geology, geologic hazards, structural geology, gems and minerals, meteorites, rocks, fossils, streams-canyons-caves, and water.



Geologist Bob Kirkham and a participant on the Glenwood Springs Field Trip examine data on salinity in the Colorado River.

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THIS ISSUE

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