COLORADO GEOLOGICAL SURVEY

ROCK TALK

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Colorado Geological Survey

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HOW DO WE USE COLORADO'S RESOURCES TO BEST ADVANTAGE?

Growth brings opportunities—and challenges

Colorado's population is growing. Have you noticed? Crowded highways, longer commutes from new subdivisions, longer waits in line. Some people try to escape these big city blues by heading for less-crowded areas that fringe metropolitan areas and for rural communities all over the state. Growing populations can provide more goods and services—but they also need more goods and services.

More people need more things

More people mean a greater demand for housing, highways, heating, water supplies, and consumer goods. All of these have their origins in natural resources ranging from gravel to gold. The demand for sand and gravel, coal, oil, natural gas, minerals such as copper, iron, and lead, and even diamonds and gold increases as populations expand. Water is of particular concern. In areas where residents rely on wells to tap underground water, a growing population may draw out and use water faster than nature can replace it, or the quality of the water may degrade under intense development pressure.

More people mean more confrontations with geologic hazards

More people in formerly sparsely populated areas can bring unexpected confrontations with the underlying rocks. How would you like to find your yard newly landscaped with boulders brought to your doorstep by a debris flow or rockfall? Or to find that the road you take to work suddenly has sinkholes in it, thanks to soils under the roadbed that dissolve or shrink when they get wet?

HOW DOES THE COLORADO GEOLOGICAL SURVEY HELP?

What is the Colorado Geological Survey?

The Survey can trace its history to 1872, when Colorado appointed a Territorial Geologist. The state legislature created a Geological Survey in 1907, but it died sometime in the 1920s from fiscal malnutrition. The present Survey was re-established in 1969 and has been involved in every aspect of the state's geology since then.

Why geologic maps are useful

A basic job of Colorado Geological Survey (CGS) geologists is to make geologic maps. Geologic maps record the distribution of rock types and properties that can pinpoint the location of mineral and aggregate resources, old landslides, stream deposits, faults, and much other information about the land on which we live. Geologic maps record evidence of events that even the longest-term resident may have forgotten—or never known about. Maps are the keys to understanding and working with the land we live on.

Less than a quarter of Colorado is mapped at a geologically useful scale.

Local planners and building departments in Colorado often ask CGS for advice on how local geology will affect new construction projects such as schools, roads, housing subdivisions, and wastewater treatment plants. In rural areas that are growing rapidly, such questions arise frequently. Sometimes geological maps are available to use in formulating answers to these requests; more often, they are not.

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It may come as a surprise to learn that the geology of less than 25 percent of the state has been mapped at a scale large enough to be useful. (A useful scale is 1:24,000, where 1 inch equals 2000 feet.) Thus, geologic maps can be used to plan and regulate new development, or seek mineral resources, in only about a quarter of the state.

Back to the basics

In the early 1990s, CGS decided to get back to the basics: basic geologic quadrangle mapping. (A quadrangle is an area on the surface of the earth, more or less rectangular, that is 7.5 minutes of longitude north to south and 7.5 minutes of latitude east to west. Colorado contains 1824 such quadrangles.) In order to work in the areas most in need of geologic mapping, CGS developed 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 that will affect new development.
- The area must lack detailed geologic mapping at a scale large enough to be useful. That scale usually is 1:24,000, although sometimes 1:62,500 scale is adequate.
- Topographic maps must be available for the area; they are the base on which the geology is plotted.

Colorado Geological Survey geologist measuring the dip and strike of a fault.

ADVISORY BOARDS ENSURE THAT HIGHEST PRIORITY AREAS ARE MAPPED FIRST

In order to respond to the concerns of citizens, Colorado Geological Survey (CGS) solicits advice from two citizen groups. Members of the MEGA Board (the Minerals, Energy, and Geology Policy Advisory Board) are appointed by the Governor; they advise the state on matters related to minerals, energy and geology. A second group, the CGS Advisory Committee, helps to guide CGS programs. It provides vision for the current and future geological needs of the state and its citizens; it oversees programs and makes recommendations for programs and funding; it gives advice and information on geologic matters; and it advocates the role of geology in public policy. This committee contains representatives from local, state, and federal governments and Indian tribes; from the oil and gas and the mining industries; and from academia, engineering geology, and the environmental sciences.

The Glenwood Springs Quadrangle

The Glenwood Springs Quadrangle (in which the city of Glenwood Springs lies) was the first quadrangle picked for basic geologic mapping. Why? Population in the area is growing rapidly, and the area straddles the Interstate-70 corridor. Both of these factors promote expanding development. The region is plagued by geologic hazards such as debris flows and soils that can be corrosive and can shrink (or swell) when wet. Just as important, the Glenwood Springs area has abundant resources such as natural gas, coal, gypsum, limestone, and sand and gravel that can help support its expanding residential and commercial development.

Because of the high priority given to mapping along the Interstate-70 corridor, both the U.S. Geological Survey and CGS are at work in the area. The organizations coordinate their work to make best use of staff and resources, and to accomplish the needed mapping most effectively.

New geologic maps are now available

In 1995, CGS published the geologic map of the Glenwood Springs Quadrangle. This is the very first geologic quadrangle map published by CGS—a milestone accomplishment. By mid-1997, CGS had published (as Open-File Reports) a total of seven geological quadrangle maps in the Glenwood Springs area.

Who will use these maps?

Planning commissions in Garfield, Eagle, and Pitkin counties—the counties containing the mapped quadrangles—recognize the need for thoughtful land-use planning, in view of the widespread geologic hazards in these counties. The new geologic maps are an essential part of their county-wide, GIS-based (geographic information system-based) comprehensive plans. Because the area is a major transportation corridor, the Colorado Department of Transportation will use these maps to help define road alignments or mitigation in hazard areas. Well-constructed geologic maps will aid those who explore for and develop new mineral and water resources needed by the growing populace.

Good geological mapping pays off

In 1996, a developer proposed a new subdivision in eastern Garfield County. The county planning commission used CGS geological maps to determine that parts of the proposed development were underlain by soils that collapse when they get wet (a process called “hydrocompaction”). As a result, the commissioners denied a building permit until the developer devised a plan to avoid building in these areas, or to build in a way that will not trigger hydrocompaction. If a building permit is issued, residents will be able to buy a home that is not only beautiful, but will also be safe in which to live and not need excessive maintenance.

The Durango Area

In 1995 and 1996, geologic mapping expanded to the Durango area on the north rim of the San Juan Basin. This also is an area where population and accompanying development are growing rapidly—in a region of abundant hydrocarbon and construction resources that is beset with engineering and environmental geology problems.

There’s good news. . .

Colorado’s mineral wealth includes coal (about a third of the state is underlain by coal) and methane, a natural gas derived from coal. It is estimated that Colorado contains more than 100 trillion cubic feet of coalbed methane. In deeply buried coals, the gas stays trapped until it is released into a gas production well. In 1997, half of the natural gas produced in Colorado was coalbed methane. Several rock units in the Durango area (and throughout the San Juan Basin) produce large amounts of oil, coal, coalbed methane and natural gas. These economically important rock units need to be mapped in more detail in order to help locate and understand the mineral resources they contain.

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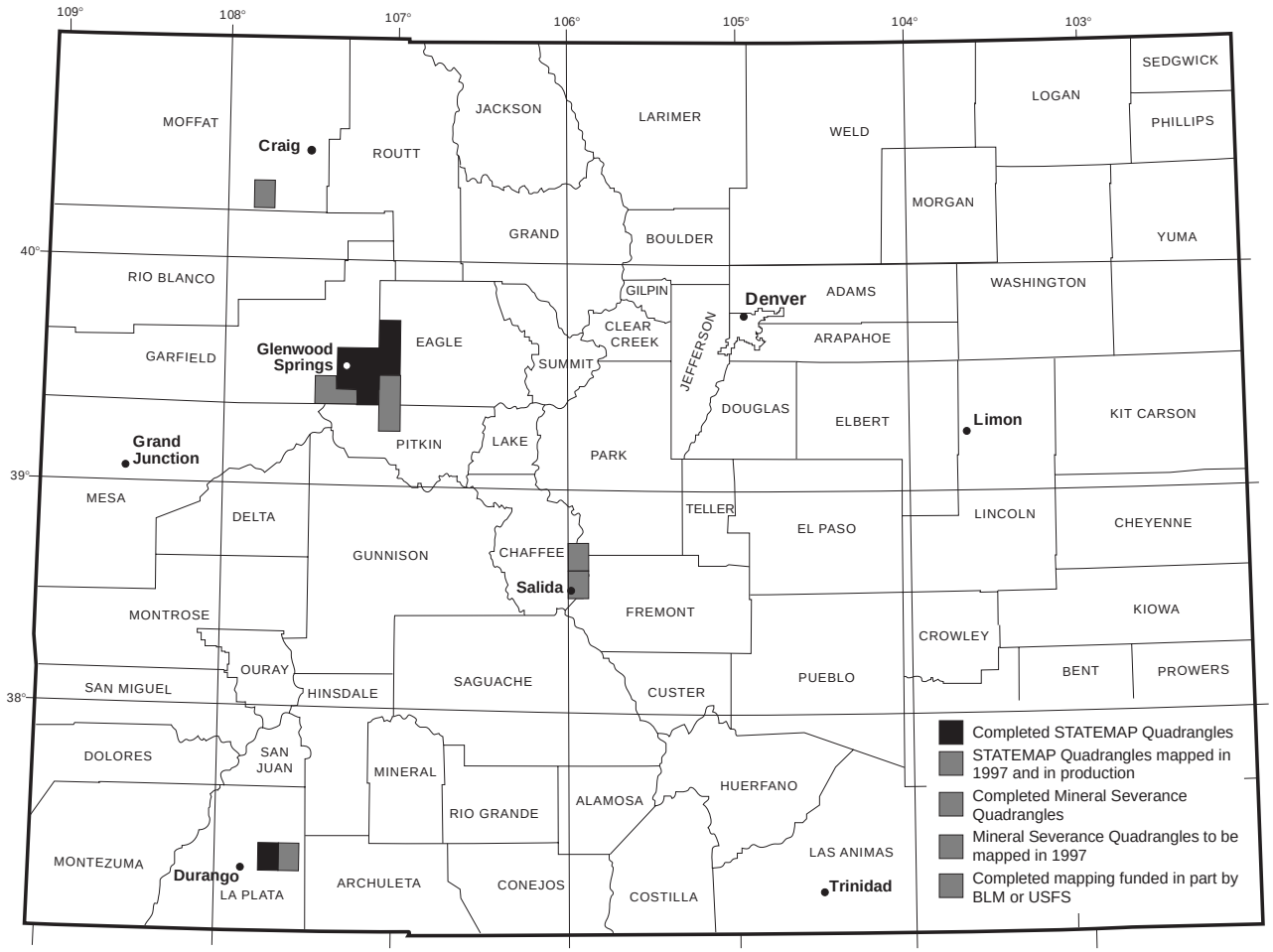

Index map of the Colorado Geological Survey's geological mapping program (scale 1:24,000).

WHERE DOES THE MONEY COME FROM?

Some federal money is available

In 1992, Congress recognized the need for basic geological mapping and the need for federal dollars to pay for it. The Federal National Cooperative Geological Mapping Act was passed in 1992. The portion of the act known as "StateMap" provides federal money to match state funds allocated for field mapping in areas of rapidly growing populations. Under this program, half of the funding comes from federal dollars and the other half is from state money. Six of the published quadrangles mapped in the Glenwood Springs area were funded through StateMap.

Other matching-fund programs have been developed between CGS and the U.S. Bureau of Land Management and the U.S. Forest Service. Two geological maps funded under these programs have been completed.

Some state money is available

The Colorado Legislature also recognized the need for basic geologic mapping to support many kinds of land-use decisions and provided matching dollars for StateMap. In 1996, Colorado Senate Bill 170 also allowed dollars collected by the state in minerals severance taxes to be used by the Colorado Department of Natural Resources, of which the Colorado Geological Survey is a part. Currently, these monies fund geological mapping, geologic hazard studies, oil and gas studies, and studies of mineral resources that increase our knowledge of Colorado's natural wealth.

AND HERE'S WHAT WE HAVE TO SHOW FOR IT

New CGS geological quadrangle maps are available to private individuals, businesses, organizations, and federal, state, and local government agencies.

Glenwood Springs area

Available July 1997
- Carbondale Quadrangle
- Cattle Creek Quadrangle
- Center Mountain Quadrangle
- Cottonwood Pass Quadrangle
- Dotsero Quadrangle
- Glenwood Springs Quadrangle
- Shoshone Quadrangle

Available July 1998
- Basalt Quadrangle
- Leon Quadrangle

Available July 1999
- Hunter Mesa Quadrangle
- Mount Sopris Quadrangle

Durango area

Available July 1997
- Rules Hill Quadrangle

Available July 1998
- Ludwig Mountain Quadrangle

Available July 1999
- Durango East
- Durango West

Salida area (southern Mosquito Range)

Available July 1997
- Salida East Quadrangle

Available July 1998
- Cameron Mountain Quadrangle

Available July 1999
- Gribbles Park Quadrangle

Coal-bearing region of Moffat County

Available July 1997
- Axial Quadrangle

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. . .And there's bad news

However, some of these same rock units are prone to large-scale landslides. Soils that develop on these units are also likely to swell. Additionally, methane from coal-bearing formations can seep into water wells or buildings. At concentrations of 5-15 percent in air, the methane is explosive. One house has been condemned because of potentially explosive concentrations of natural gas underneath it.

New geological maps are available

The first CGS geological quadrangle map in the Durango area (Rules Hill) became available in 1997; an adjacent quadrangle will be available in July 1998, and two more will be published in July 1999.

Who will use these maps?

Careful geological mapping will help to determine whether commercial production of methane gas is contributing to problems with methane in water supplies. Many methane-bearing water wells are in areas actively being drilled to produce methane. Some homeowners believe that their methane problems are a result of commercial drilling. Yet, natural methane seepage has been recorded since the turn of the century. CGS maps will help geologists to understand the source and migration of methane gas.

Rural homeowners are concerned about their well water for other reasons, too: their wells are producing less, as the water table drops, and their water may contain high levels of coliform bacteria and sulfur. Basic geologic maps will provide the information that groundwater hydrologists need to understand these problems.

The Salida Area and Moffat County

To better document Colorado's mineral wealth, in 1996 the CGS began to map in the mountains of Chaffee County just northeast of Salida. This region, the Mosquito Range, contains abundant minerals and mineral fuel resources: copper, gold, iron, and tungsten; dimension stone and other construction-material deposits. An important coal-bearing area in Moffat County is now well documented because of mapping by CGS in 1996.

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