GLOSSARY

Arete: A sharp and rugged mountain ridge left between the paths of glaciers moving down a mountain slope.

Cirque: A steep-walled, bowl-shaped area high on a mountain summit scoured out by glacial erosion near the head of the glacier.

Glacial Deposits: Debris scoured from a mountain slope by glaciers and deposited once the glaciers melted. The Ice Age (actually four major ice advances during an interval from around 2 million years ago to 10,000 years ago) carved the landscape into over-steepened U-shaped valleys and moved tremendous amounts of debris across both igneous and sedimentary rock.

Igneous Rock: Rock that was formed by the cooling of molten magma. Rock formed from magma ejected from volcanos that cooled at the ground surface is called igneous extrusive rock. Rock injected into bedrock that cooled beneath the ground surface is called igneous intrusive rock. An episode of igneous activity in Colorado during the Oligocene (around 25 million years ago) reshaped the landscape of western Colorado. Molten igneous rock was injected up through the sedimentary Wasatch and Mesaverde Formations, fracturing and thermally altering the rock, forming the mountain peaks seen along Gunnison County Road 12 .

Laccolith: A form of ingeous intrusive rock that has domed up the overlying strata but is flat on the base. The shape is similar to a mushroom.

Larimide Orogeny: An episode of mountain building in the western United States dating between 40 to 80 million years ago.

Moraine: Rock debris scoured out by glacial action and transported downslope within the glacial ice. Lateral moraines are located along the glacial valleys while terminal moraines are located at the end of a glacier.

Sedimentary Rock: Rock that was formed by the deposition of sediments in streams, lakes, swamps, and oceans.

REFERENCES

Want to learn more about the geology of the Kebler Pass region? The following references were used in the preparation of this road log and will provide insight into the natural resouces of the area.

Ellis et al, (1987), Geologic Map of the Paonia and Gunnison Area, Delta and Gunnison Counties, Colorado; United States Geological Survey Coal Investigations Map C-109.

Rogers et al, (1974), Guidelines and Criteria for Identification and Land-Use Controls of Geologic Hazard and Mineral Resource Areas; Colorado Geological Survey Special Publication 6.

Streufert, Randall K. (1999), Geology and Mineral Resources of Gunnison County, Colorado; Colorado Geological Survey Resource Series 37.

http://parks.state.co.us/cnap is the website for the Colorado Natural Areas Program and provides information on the Mount Emmons Iron Bog and other natural areas in Colorado.

http://geosurvey.state.co.us is the website for the Colorado Geological Survey. Many excellent references on the geology of Colorado are available on-line.

www.usgs.gov is the website for the U. S. Geological Survey. You can order geologic maps and reports as well as topographic maps on-line or by phone at 1-888-ASK-USGS.

Compiled by Nancy B. Lamm

GEOLOGIC ROAD LOG OF KEBLER PASS

GUNNISON COUNTY ROAD 12

ERICKSON SPRINGS RECREATION AREA
TO THE
TOWN OF CRESTED BUTTE

RUBY RANGE, LOOKING WEST FROM GUNNISON COUNTY ROAD 12.

ONLY CHANGE IS CONSTANT

Geology students learn this phrase in their first geology class. Although the world around us appears static, it is not. The forces of nature are constant and unrelenting. As mountains are created, they begin their erosional process. Travel the road over Kebler Pass and learn how the world around us changes. The open road beckons; come and learn!

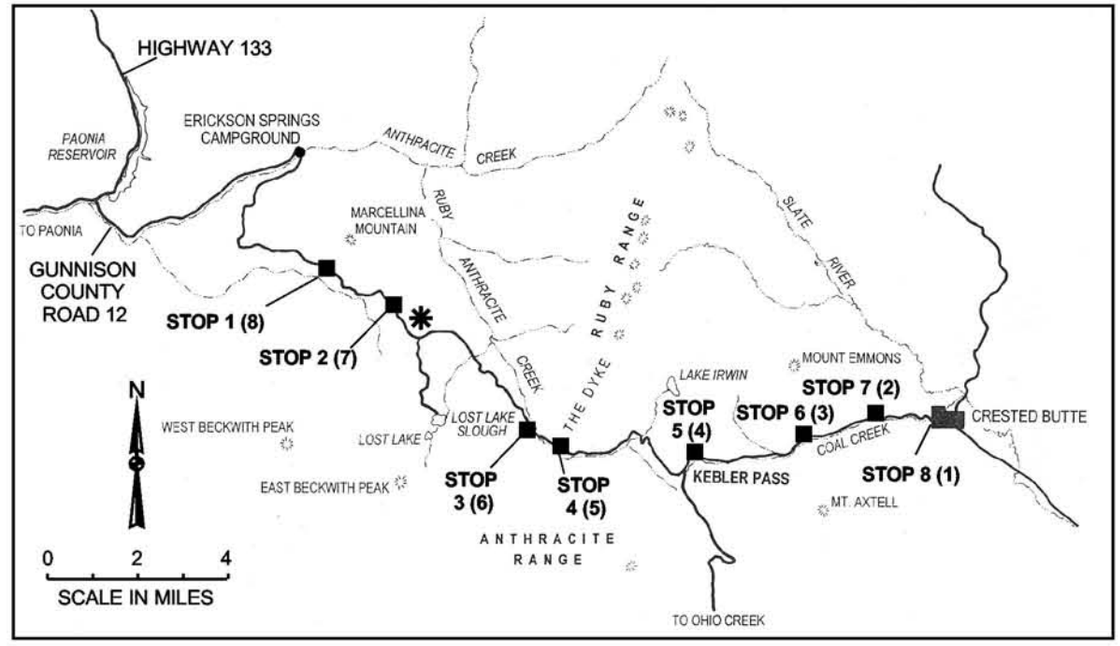
Grand Mesa-Uncompahgre-Gunnison National Forests

HOW TO USE THE ROAD LOG

Follow the general directions to arrive at the starting point of the road log. Zero your odometer and follow the mileage notations to arrive at the geologic points of interest. If you are traveling east to Crested Butte over Kebler Pass, use the mileage notation on the left; if you are traveling west from Crested Butte, use the mileage notation in parenthesis. Pull off the road at the designated stops to look around you and read the descriptions. Some of the descriptions refer to stretches of road, so study the landscape as you travel. Don't hesitate to stop along the way, camp, hike, and enjoy the stunning mountain scenery around you. The road log contains mileage references such as cattle guards, intersections, and bridges to recalibrate your odometer if you take side trips. A glossary at the end of the log describes the geologic terms used.

From Hwy. 133: just west of the Paonia Reservoir dam, turn east on Gunnison County Road 12 and go six miles to the Erickson Springs Rec. Area.

From Crested Butte: take Whiterock Avenue to the bridge at Coal Creek on the west side of town.



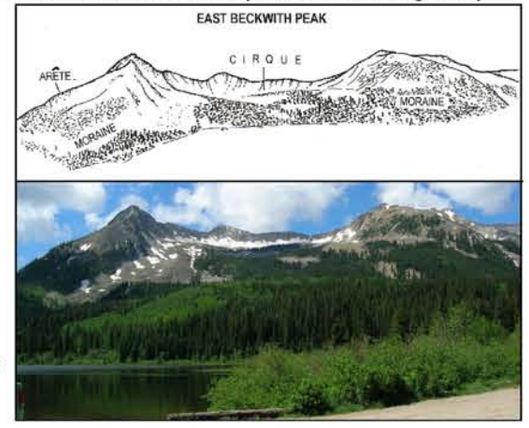
Map of the Geologic Road Log of Kebler Pass

* **Side trip to Lost Lake Slough:** The following road log is provided for the 5.4 mile round trip to Lost Lake from mileage point 9.2 (16.1) at the intersection of Gunnison County Road 12 and the road to Lost Lake Campground (FR 706). This intersection is in an open park with a good view to the northeast of Ruby Range. If you take the side trip to Lost Lake, subtract 5.4 miles from your odometer reading when you continue your drive on Gunnison County Road 12.

0 From the intersection of Gunnison County Road 12 and FR 706, turn south and proceed to Lost Lake Campground.

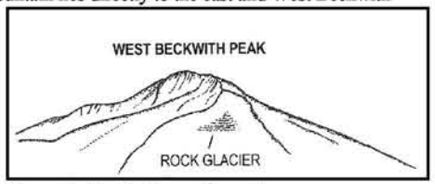
2.3 Fork in the road at the campground. Turn to the left and proceed for another 0.4 miles to the turn-around.

2.7 Turn around at the lake. The lake is actually a reservoir built on a natural landform called Lost Lake Slough that formed in a low spot in glacial deposits. East Beckwith Peak dominates the view from the campground and provides a close up view of a glacial cirque, arete, and moraines. The prominent bowl shape of the mountain above timberline was formed by the head of a glacier which flowed down to the north toward the point where you are standing. Rock debris was scoured from the mountain slope and carried down the mountainside, entrapped within the ice. When the glacier melted at the end of the last Ice Age (around 10,000 years ago) the rock debris was left as long ridges called moraines. The forested slopes around the lake are moraine deposits left as unconsolidated rubble. A hike from the campground winds up and to the south of the reservoir to the natural Lost Lake as well as Dollar Lake. Turn around and return to County Road 12.

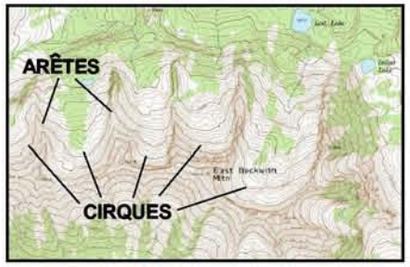


Lost Lake Slough and East Beckwith Peak showing glacial landforms

MILEAGE		DESCRIPTION
0	(25.3)	County Road 12 crosses Anthracite Creek at the Erickson Springs Recreation Area. On the skyline to the northwest is the Raggeds Wilderness where sandstones, shales and coal beds of the 100 million year old Mesaverde Formation are visible. These rock layers formed at the edge of a shallow sea, in an environment similar to today's Gulf Coast of the U.S. As you travel along the side of the canyon, the road crosses outcrops of the Mesaverde Formation and the 50 million year old Wasatch Formation. The clays, shales, sandstones and conglomerates of the Wasatch Formation were deposited by rivers, streams and lakes that eroded mountains built during the Laramide Orogeny.
0.6	(24.7)	Look for a rockslide on the south side of the road. (There is a good pull-out near the rockslide.) This rockslide is a weathered igneous dike that was pushed as a vertical body into the sedimentary bedrock.
3.0	(22.3)	Cattle guard at Gunnison National Forest boundary.
3.4	(21.5)	As you travel the next 0.5 mile, notice the mountains around you. Marcellina Mountain lies directly to the east and West Beckwith Peak is visible to the south. Mount Gunnison is visible to the right of West Beckwith Peak. All three mountains are the result of intrusion of molten magma into the sedimentary bedrock. The cooled and solidified magma was more resistant than the surrounding broken sedimentary bedrock which was eroded away, leaving the solidified magma as prominent landforms. Look carefully at the side of West Beckwith Peak above timberline, using the drawing as a guide. Horizontal ridges are apparent extending across the open face of the upper slopes of the mountain. These are rock glaciers, comprised of rock debris and ice. They are slowly flowing down the side of West Beckwith Peak , pulled by the force of gravity.



6.0	(19.3)	**STOP 1 (STOP 8).** Look for a dirt road leading off to the south and pull off for a view of the spires of Marcellina Mountain. This rough, rugged mountain slope is made of igneous rock intruded up through the sedimentary rock. The igneous rock is resistant to weathering and forms crags and spires. A fan shaped deposit of debris eroded from Marcellina Mountain is visible above the tree line. This cone shaped fan is made up of "talus" or "scree", rough, angular rocks and boulders eroded from the mountain slopes.



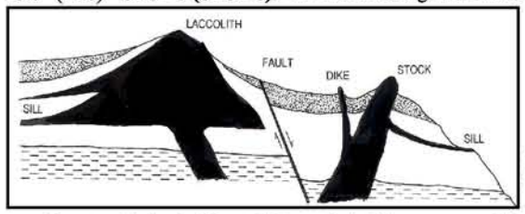
To the south is East Beckwith Peak, which provides an excellent example of glacier shaped landforms. The bowl-shaped areas near the summit of East Beckwith Peak are called "cirques". It was in these cirques that the mass of snow and ice accumulated before spilling down the mountain side. Note the open U-shape of each valley below the cirque. These five valleys represent the paths of five glaciers down the north slope of the mountain. Imagine the amount of rock and debris scoured out by each glacier. The forested slopes between you and and the mountain are made up of glacial debris called moraines.

These glacial landforms are easily identified in the topographic map (at left) of East Beckwith Peak . The contour lines form U-shapes defining the cirques. The moraine deposits spill out in an apron below the mountain, covering the Wasatch Formation underneath.

6.3	(19.0)	Cattle guard.
7.5	(17.8)	Bend in the road at the trailhead for the Ruby Anthracite Trail, #836.
8.1	(17.2)	**STOP 2 (STOP 7).** Wide pull-off on the north side of the road. Walk a short distance to the north for views of the Ruby Range (on the left) and Anthracite Range (on the right).The ragged north slope of Marcellina Mountain is visible to the far left. All three mountain ranges were created when molten magma intruded into the existing sedimentary bedrock. Broken remnants of sedimentary bedrock outcrop on the slopes of the mountains.

ROAD THROUGH ASPEN FOREST. The road is crossing a vast extent of glacial debris (moraines) and landslide deposits that support lush sub-alpine vegetation. Moraine deposits are often steep and slope failure in these deposits is common. Look for pistol-butted trees (see photo on opposite page) and crescent shaped scarps to find areas of unstable slopes.

9.2	(16.1)	Intersection of Gunnison County Road 12 and FR 706. Road log of side trip to Lost Lake Slough on previous page.
13.5	(11.8)	Cattle guard at Ruby Creek and Horse Ranch Park.
13.7	(11.6)	**STOP 3 (STOP 6).** Pull-out at the sign for "Horse Ranch Park". There are good pull-outs on both sides of the road.



Ruby Range, on the north side of the road, was formed by multiple injections of molten magma into the native sedimentary rock, including vertical pillars called stocks, horizontal injections between layers of bedrock called sills, vertical injections into fractures called dikes, and large mushroom shaped masses called laccoliths. The extensive intrusion shattered the existing bedrock with multiple faults and fractures while the heat of the magma baked and changed the native rock.

Extending south from Ruby Range is a prominent landform called "The Dyke". The Dyke is appropriately named as it is what geologists call an intrusive dike, formed when molten magma was injected into a vertical fissure in the surrounding sedimentary bedrock (Wasatch Formation). The magma cooled to solid rock which was harder than the broken sedimentary rock. As erosion wore away the surrounding Wasatch Formation, the dike was left as a wall-like ridge.

14.8	(10.5)	**STOP 4 (STOP 5).** The road crosses The Dyke which is used as a quarry. The rock is a kind of igneous rock called quartz monzonite phorphyry. If you study the rock you can see individual minerals that make up the rock. They are visible because the intrusive molten rock, still buried within the bedrock, cooled slowly, allowing time for crystals to form. The Dyke is easily visible on the north side of the road. Look off to the south to find the southern end of The Dyke where it rises above the trees as jagged pinnacles. This wall-like landform is several miles long.

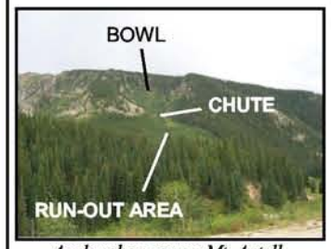
WEST SIDE OF KEBLER PASS. This part of the Kebler Pass road crosses several landslide areas. Look for crescent shaped scarps visible along the edge of the road and "pistol-butted" trees on the hill slopes for signs of areas of unstable slopes. Colorado's mountains are covered with landslides as gravity, helped by water from snowmelt or ground water, constantly pulls on surface deposits and weak bedrock. In fact, the geologic history of Colorado's mountains is a story of both mountain building and mountain destruction. Even as the mountains were pushed up by forces deep in the earth they were being eroded by the constant force of gravity, running water or glacial ice pulling and pushing the rock back down to the sea.

Pistol-butted trees

16.7	(8.6)	Bridge across Anthracite Creek.
18.4	(6.9)	Summit of Kebler Pass and site of the Old Irwin Cemetery.
18.5	(6.8)	Intersection of FS 730, Ohio Pass Road.
19.0	(6.3)	**STOP 5 (STOP 4).** Intersection with the Lake Irwin Road. The Lake Irwin area was once an area of silver mining in the 1890's. Silver, zinc, lead, copper, molybdenum, and gold were associated with intrusive dikes and stocks of the Ruby Range and were mined in the Ruby District.

ROAD ALONG THE COAL CREEK DRAINAGE TOWARD CRESTED BUTTE. You are traveling down the path of an Ice Age glacier. Notice the characteristic U-shape of the valley and the moraines (long ridges of glacial debris along the valley sides). The moraine deposits are easily seen in road cuts as masses of angular rock of different sizes. Look also for large angular boulders called glacial "erratics" in the road cuts and on the hills on either side of the road. These are large rocks carried by glacial ice and left in place when the ice melted.

20.3	(5.0)	Intersection with Splains Gulch Road. The western slope of Mount Axtell is visible to the south.
21.8	(3.5)	**STOP 6 (STOP 3).** There are several pull-out areas along the south side of the road. Mount Axtell is visible to the south. Refer to the photograph to find the path of an avalanche along the north face of Mount Axtell. Geologists call this a "chute". Snow accumulates in the bowl-shaped area high on the ridge. When snow is deep and heavy enough, it sweeps down the mountain side with tremendous energy, ripping through everything in its path. Note the younger, smaller vegetation within the chute flanked by the older conifers. Abrupt changes in vegetation like this are often the best indication of the path of an avalanche.



Avalanche area on Mt. Axtell

The Mount Emmons Iron Bog is located on the north side of the road. You cannot see the Iron Bog from the road but it is located at the point where the powerline enters the trees to the right. The Mount Emmons Iron Bog is not really a bog but a "fen" (spring fed wetland) enriched with iron leached by ground water from the mineral deposits of Mount Emmons. The fen is home to a rare roundleaf sundew, *Drosera rotundifolia.* Water from the seepage of the Iron Bog runs down the road cut below and stains the ground surface a deep rust red. The Iron Bog was declared a Natural Area by the Colorado Department of Natural Resouces in 1999.

Drosera rotundifolia
Source: USDA

22.2	(3.1)	Staining from iron enriched ground water seepage on the hillslopes below the Mount Emmons Iron Bog.
23.4	(1.9)	Pavement begins (ends).
23.5	(1.8)	**STOP 7 (STOP 2).** Pull-out to the south across from road angling up the north side of the valley. View of Mount Emmons and the road to the water treatment plant, which treats drainage from the Keystone Mine, a historic silver mine. Deep in the center of Mount Emmons molybdenum ore (used as a steel-hardener and dry lubricant) is concentrated near the top of an intrusive stock Exploration of this vast ore body was begun in 1977 and the molybdenum ore body is estimated at 155 million tons. To the east is the view down valley to the Town of Crested Butte. Mount Crested Butte is visible to the east on the east side of town.
25.1	(0.2)	**STOP 8 (STOP 1).** Pull-out on south side of road across from the McClure Pass sign on the north side of the road. Coal Creek flows to the east into the Town of Crested Butte.

The low hill on the south side of the drainage is covered with "terminal" moraine deposits, marking the end of the route of the last Ice Age glacier. The rock and debris carried by the glacier moved down valley as far as this point when climatic conditions eventually halted the movement of the glacier. As the ice melted and retreated, the debris entrained in the glacier was left as a prominent ridge. This moraine, visible as vegetation covered slopes, rests directly on the fractured, blocky exposures of the Mesaverde Formation, the same formation exposed at the start of the road log.

25.3	(0)	Bridge across Coal Creek at Whiterock Avenue in Crested Butte; end (or beginning) of road log. The Mesaverde Formation exposed in the slopes above the Town of Crested Butte contain beds of hard anthracite coal which was mined from 1884 to 1992.