South Cañon Trails Geology Hike

FREMONT COUNTY
HERITAGE GUIDE

Allow about 2½ hours for this hike. To be safe and comfortable on the hike carry a liter of water per person, more if it is hot, bring a hat, sunscreen and bug spray, wear sturdy shoes, take a snack if you wish, pack out all your trash, keep an eye out for hazards, and watch out for mountain bikers. The hike is on US Bureau of Land Management property, but there is private property nearby; please respect it.

This Guide was prepared by Harold Taylor and edited by Jim Nelson. Illustrations were provided by Millie Wintz. Cindy Smith, Steve Wolf and Linda Skinner provided review comments. This is one of a series of Fremont County Heritage Guides produced by the Fremont County Heritage Commission and the Fremont County Tourism Council with the aid of a grant from the Colorado Tourism Office. The Fremont County Historical Society, a 501(c)3 nonprofit organization is a partner in this effort. Questions, comments and suggestions are welcome and may be conveyed to info@fremontheritage.com or sent to the Fremont County Heritage Commission, 615 Macon Ave, Cañon City, CO 81212. This and other Heritage Guides may be downloaded at www.fremontheritage.com/self-guided-heritage-tours-2 or obtained from Museums, Chambers of Commerce and visitor locations in the county. First published in October 2020.

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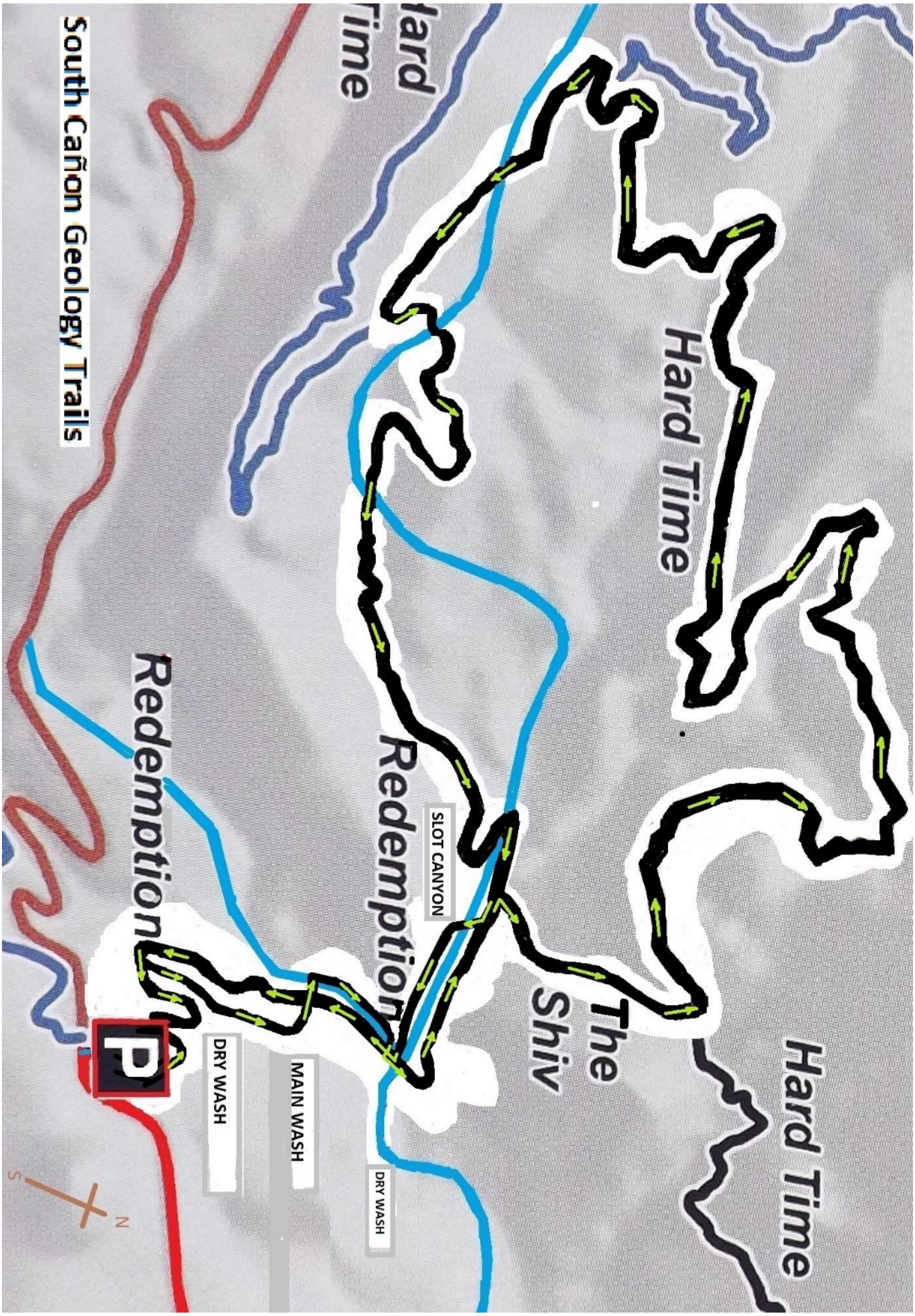
ROYAL GORGE REGION

This has to be one of the best geology hikes in the USA! You will see an ammonite fossil, dinosaur tracks, remnants of the original ancestral Rocky Mountains, rocks from the dawn of vertebrate life, layers from the Western Interior Seaway and the remains of a volcano as well as the *Great Unconformity*, where Ordovician rocks lie directly on top of Precambrian rocks.

Additional information about the geology of the area can be found in the *Rocks and Fossils of Fremont County* Heritage Guide: www.fremontheritage.com/wp-content/uploads/2018/07/Rocks-and-Fossils-Online4.pdf. Maps for this hike can be found at www.joinfar.org/uploads/1/3/1/6/13163562/south_canon_map_2017_03_02.pdf, the Fremont Adventure Recreation website, South Canyon trail map. Cellular phone service is available on most of the trail.

To get to the trailhead, begin at US-50 & 1st Street in Cañon City and go south 1 mile to the intersection with Temple Canyon Road. Turn right on Temple Canyon Road, go past the large parking area for Rockafellow Ecology Park and park in the small lot on the right, 2 miles from the intersection, 3 miles from US-50. The South Cañon Trails Geology Hike starts here.

The hike begins with the Redemption Trail. Note the time, or start a stopwatch to keep track of your progress along the trail. Use the times listed as a rough guide, the actual time you spend will depend on your hiking speed and how much you explore, admire and photograph the geologic sites along the way.


South Cañon Geology Trails
Hard Time
Hard Time
Redemption
Redemption
SLOT CANYON
The Shiv
DRY WASH
MAIN WASH
DRY WASH
P
S
N

From the trailhead, the trail starts out flat. Beneath you is ***Pierre Shale*** covered by material that has washed down from the mountains upstream. Pierre Shale is also exposed along the Riverwalk near Ash Street and along CO-115 just north of the Arkansas River by Florence and is about 70-80 million years old. It is one of the layers from the ***Western Interior Seaway***, which extended from Utah to Kansas and cut the North American continent in half. The limestones, shales and sandstones you will see in the next half-hour or so all were the result of this seaway.

As you start downhill you will notice white rocks adjacent to the trail. This is ***Niobrara Limestone***, 85 million years old. Large, dinner plate sized clams can be found in this layer although none are visible along this section of trail. As you take a turn to the right, the trail goes through the ***Juana Lopez layer***, a darker brown layer which often contains interesting fossils, as we will soon see. The dark gray slopes to the right are the ***Carlile Shale***. Continue down the trail.

(6 Min.) When the trail reaches the bottom of a dry stream bed, leave the trail and follow the stream bed downstream to the right. Keep an eye out on the left side of the creek for a rock with a partial ***ammonite fossil***. (G1) The rock is a chunk of Juana Lopez which rolled down the hill from the outcrop above and conveniently landed so the fossil is exposed.

Continue down the dry creek bed, which soon drops through multiple, tilted layers of limestone. This is (G2) ***Greenhorn Formation*** and is 93.5 million years old. ***Limestone*** is made up of sea creature shell remains deposited in relatively deep water, as opposed to shale, which is primarily sediment which washed off nearby land in a shallower environment. The rocks tell the story of the Western Interior Seaway as it cycled over time between deep and shallow water. Some layers stretch all the way to central Kansas, where they were quarried during the depression for stone fenceposts on the treeless prairie. Check out the Bridge Creek Trail in the Hogbacks Open Space for details about these rocks and their embedded fossils used to correlate this age to other locations. Continue walking in the creek bed past the trail crossing until you see the main drainage in front of you.

(9 Min.) Before you reach the main drainage ahead, observe the shale on the right side of the bed. If you look carefully, you will occasionally see brown streaks in the gray shale (G3). These are layers of ***Bentonite***, the result of volcanic ash falling into the seaway and settling to the bottom. This is significant

because volcanic ash, unlike shale, limestone or sandstone, can be radiometrically dated. The ash, coming out of the volcano, had its radiometric clock reset. The age of these ash layers can be determined to within a few hundred thousand years based on the known rate of decay of Uranium.

When you reach the wide, main creek bed, turn right and follow it along the base of the Dakota Hogback to the mouth of the slot canyon. We will explore this canyon on the way out, so for now, continue past the mouth and take the trail which climbs up and eventually parallel to the canyon. Approaching the top, you will see brown, circular structures in the sandstone. These ***concretions*** (G4) formed because impurities in the original sand caused a difference in the local chemistry, changing the color of the sandstone and its hardness. Here, the concretions produced softer rock, creating cavities. In other locations, the impurities hardened the rock, creating spherical ***Moqui Marbles*** that weather out.

At the top of the ridge you have a great view of the ***Dakota Sandstone*** (G5). This sandstone also forms the crest of Skyline Drive, and the formation can be followed for hundreds of miles. The formation traces the western shoreline of the Western Interior Seaway located here

about 100 million years ago. The sandy shore produced the sandstone we see today. Ahead, to the west, you can see cliffs of much older Ordovician Limestone, more than 450 million years old (G6).

Drop down on the trail, cross the drainage, and look for a trail sign for The Shiv. Turn right on this trail and head up the hill. Note that this trail is currently not shown on the map online.

(32 Min.) The Shiv ends at the Hard Time trail, turn left.

(34 Min.) The surface of the trail turns red because you have encountered the ***Fountain Formation*** (G7). The large, rounded cobbles tell of a time when massive floods deposited these rocks. These floods flowed from the Ancestral Rockies, a mountain range that was just west of here, not far from the location of the current Rockies but much older. Over 300 million years ago, these mountains dominated the landscape. Eventually they were eroded flat and their conglomerate sediment created such landmarks as Red Rocks Park north of Cañon City, The Garden of the Gods, Red Rocks Amphitheater near Denver and the Flatirons outside Boulder.

(36 Min.) The rocks change again (G8). Now we see finer grained sandstone along with shades of yellow Ordovician rocks that are about 450 million years old. The ***Harding Sandstone*** is part of this group, a layer which preserved the fossil fish ***Astraspis,*** discovered just west of Cañon City in 1892 by Dr. Charles Walcott. It held the record as the oldest known vertebrate (having a backbone) fossil until 1977. This layer is famous for containing fossil fish scales, little blue flakes representing the scales from two ancient fish. Scales have not been noted on this trail but can be seen on the Geology Time Trail at Pueblo Community College – Fremont Campus.

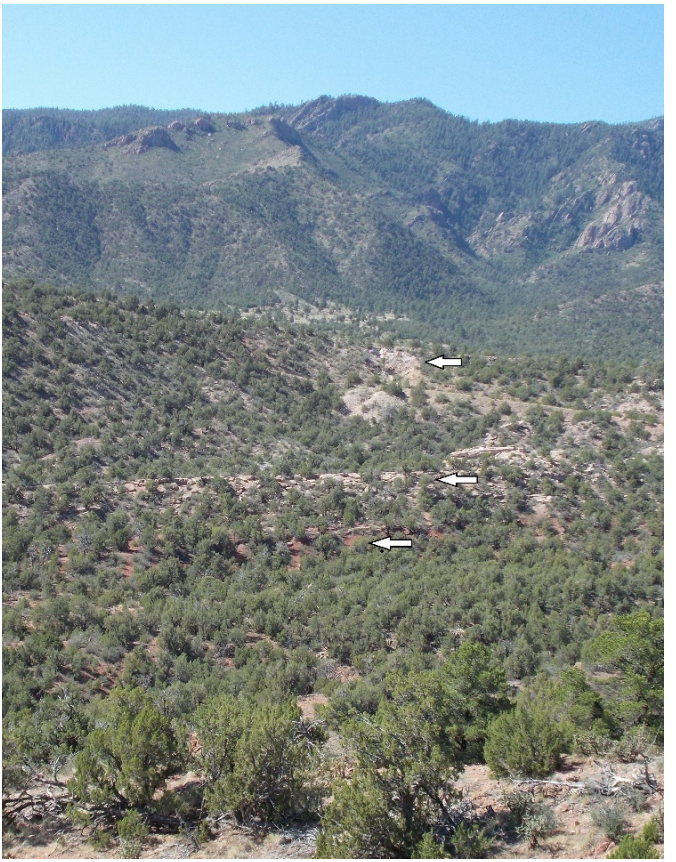
(39 Min.) ***Ordovician limestone*** can be seen along the trail (G9). You may have noticed chunks of this material since leaving The Shiv trail, but those were boulders that had rolled down from above. These are in place.

(46 Min.) We are now seeing ***Precambrian*** rocks. A large chunk covers half the trail (G10). These rocks are old, 1.7 billion years, with slightly younger material, about 1.4 billion years that forced itself into the cracks of the older rock when it was buried deep

within the earth. Actually, we have been seeing chunks of Precambrian rock since we started up The Shiv. These pieces rolled down from the layer you are standing on now. This material is crystalline, so you see bright reflections from the crystals in the sun. The oldest rock is ***metamorphic***, rock that has crystallized as a result of tremendous heat and pressure deep underground, while the slightly younger material is ***igneous intrusive***, so it oozed into the host rock as a molten material and solidified. Usually the older rock is fine grained, the younger rock is coarser, with crystals ¼ inch or larger. Tunnel Drive Trail is another great place to observe these rocks.

(52 Min.) After the trail goes over some flat Ordovician sandstones, you arrive at two places where the 450-million-year-old Ordovician rocks rest directly on 1.7-billion-year-old Precambrian rocks (G11, G12). ***This gap in the rock record is over 1 billion years***. An even better exposure of this ***Great Unconformity*** is ahead.

(1 Hr. 2 Min.) The trail rounds a corner here giving a great view of the Ordovician cliffs you just hiked under (G13) and the valley below (G14). In the distance to the south are the Wet Mountains. Closer is the crest of the Dakota hogback and, below that, tan Morrison Formation and red Fountain Formation. You will be hiking there soon.



(1 Hr. 8 Min.) Along the trail is a good example of the coarse, younger rock and the older, fine grained rock. (G15)

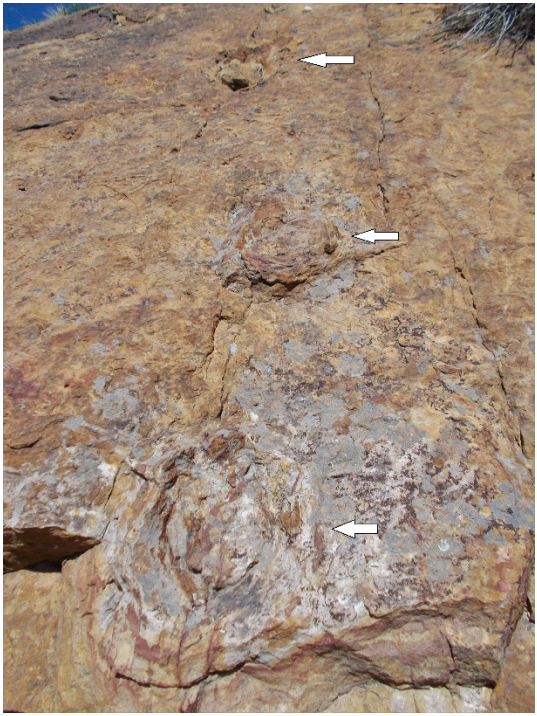
(1 Hr. 10 Min.) The red Fountain Formation shows up again.

(1 Hr. 13 Min.) Here is the best exposure of the ***Great Unconformity*** (G16). The flat slabs of Ordovician sandstone are right on top of Precambrian material. The top of the Precambrian is not a level surface. The ancient surface was irregular before being covered by the sandstone.

(1 Hr. 26 Min.) <u>The Great Escape trail goes off to the right, but continue straight</u>. Soon the trail follows a man-made bench on the ***Morrison Formation***. Perhaps Morrison clay was mined here. The Morrison is characterized by fine grained sediments from flat desert environments and slow-moving rivers with swamps. It is Jurassic in age, about 150 million years old, and the source of many of the dinosaur fossils found in the area. Those discoveries were north of town, in the Garden Park area, and included three Stegosaurus. An exact replica of the most recent find is at the Royal Gorge Regional Museum, 6th St & US-50, while the original is out of public view at the Denver Museum of Nature and Science.

(1 Hr. 34 Min.) <u>At the intersection with the Redemption trail, go left.</u> Initially, the trail goes over typical Morrison material, fine grained rocks as would be expected, but then irregular chunks of orange ***Feldspar*** appear along the trail....

(1 Hr. 42 Min.) Now we see where those chunks are coming from. This outcrop of rock is out of character for the Morrison. (G17,18). The large, irregular chunks of Feldspar in the rocks indicate transport by a fast-moving current, and the lack of erosional rounding of the rocks means that they have not been transferred very far from their source. It is also localized. This layer does not appear in the Morrison below Skyline Drive. Area Geologist Dan Grenard provided the key to this riddle with a paper that describes a location where the Morrison lies directly on the Precambrian, and that location is only 5 miles away! So, during the more recent Jurassic Period, the older Precambrian material was exposed nearby, and that explains the presence of this conglomerate. As you drop down the trail, you will see an overhanging layer to the right, where this conglomerate is directly above rocks more typical of the Morrison's purplish mudstone. (19) This contact shows that the transition from very slow-moving water to the deposition of conglomerate was abrupt. Perhaps the motion of a fault raised the Precambrian rocks, exposing them to erosion. The mind-boggling fact is that about half a mile in-depth of sediments (Fountain and Ordovician) which are present here are absent 5 miles away.



Continue on the trail, following this rock layer down the creek, and then leave the creek along the side of the slope. After a switchback, the trail goes over two more exposed humps of the rock, then drops down to the creek again.

(2 Hrs.) Back at the intersection with The Shiv trail, continue on the trail until you get to the creek bed just above the slot canyon. Leave the trail here and hike into the canyon. The bottom of the canyon starts out level but then starts to drop through layers of the ***Dakota Sandstone***. Soon you come to a particularly steep, narrow drop, which is best bypassed by traversing on the rocks to the left. As you do so, you are crossing the dinosaur trackway! The dinosaur tracks are both above you and below you on a flat plane of sandstone. You can see how the sediment was squished as the dinosaur walked by. This was not a huge beast but, as you can see from the tracks, it was making some long strides. (G20 & G21)

As you continue through the canyon, you can see layers of shale mixed with the sandstone, documenting times when the seaway rose and temporarily put this area under water. (G22) Continue down the narrow canyon. (G23)

(2Hrs. 14 Min.) Back to the main creek bed. Turn right. Going back, it is best to take the trail visible on the other side of the creek.

(2 Hrs. 30 Min) Back to the trailhead. The large hill across the road is actually a ***volcanic remnant***. (G24) 23 million years ago ***Magma*** forced its way to the surface. This is part of the remaining magma column which cooled underground. It is more resistant to weathering than the surrounding shale, creating the hill. The area closest to the road is public land, so feel free to take a closer look.

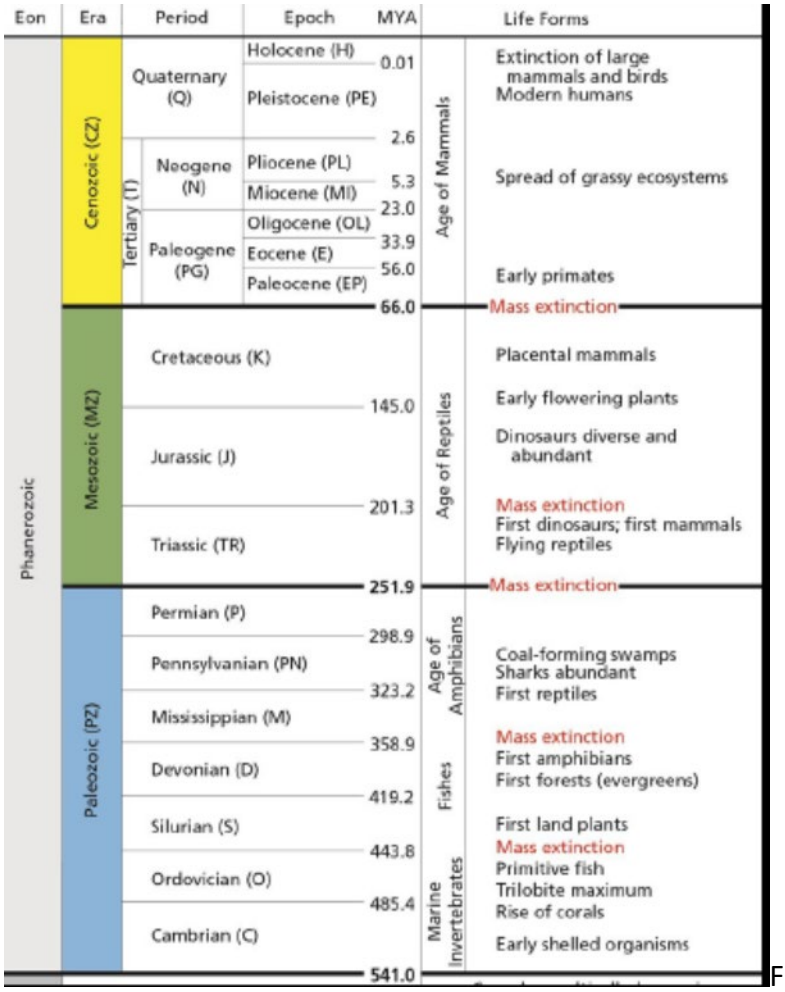
If you want to see the ***Morrison-Precambrian contact***, continue 5.2 miles on Temple Canyon Road, passing the sign for the east Entrance of Temple Canyon Park and later over a bridge across Grape Creek. When you reach the large Temple Canyon Park sign and cattle guard exiting the park, park across from the sign. ***(Note****: This is a winding, graded, mountain road that has some steep grades and is narrow in places. Driving it in wet weather is not advised. A mostly paved 17-mile alternative route is available: Start at 1st St. & US-50, drive west on 50 past the turn-off to the Royal Gorge and turn left at 10.7 miles on County Road 3, just after crossing the Arkansas River. Stay on CR3 toward the Royal Gorge/Temple Canyon by turning left where CR28 goes right to Copper Gulch. Follow CR3 past the turn-off to the Royal Gorge South Rim by keeping right on the dirt road where paved CR3A turns off at 14.4 on your odometer. Continue on the dirt Temple Canyon Road for about 3 miles to the sign at the west Entrance to the park. There is a small parking area to the left.* ***Note****: You can also follow this route back to Cañon City if you have traveled through the park to reach this location.)*

You will see the conglomerate along the road in the park, and if you hike uphill on the road a hundred yards or so, you will see Precambrian Schist with Morrison directly above it (G25). If you continue about 0.2 miles downhill, you will see a very different conglomerate in the Morrison, with Precambrian rocks exposed in the creek bed just below.

The paper that describes this contact is: *Plants, Fish, Turtles, and Insects from the Morrison Formation near Cañon City*, January 2008, GSA Field Guide 10: Roaming the Rocky Mountains and Environs: Geological Field Trips, pp.295-310. Available at https://pubs.geoscienceworld.org/books/book/909/Roaming-the-Rocky-Mountains-and-EnvironsGeological

Now you know why so many universities send their geology field camps to this area, and even to this trail. The geology of Fremont County is truly amazing. Continue to explore it!

Geologic Time Scale



Source: U. S. National Park Service