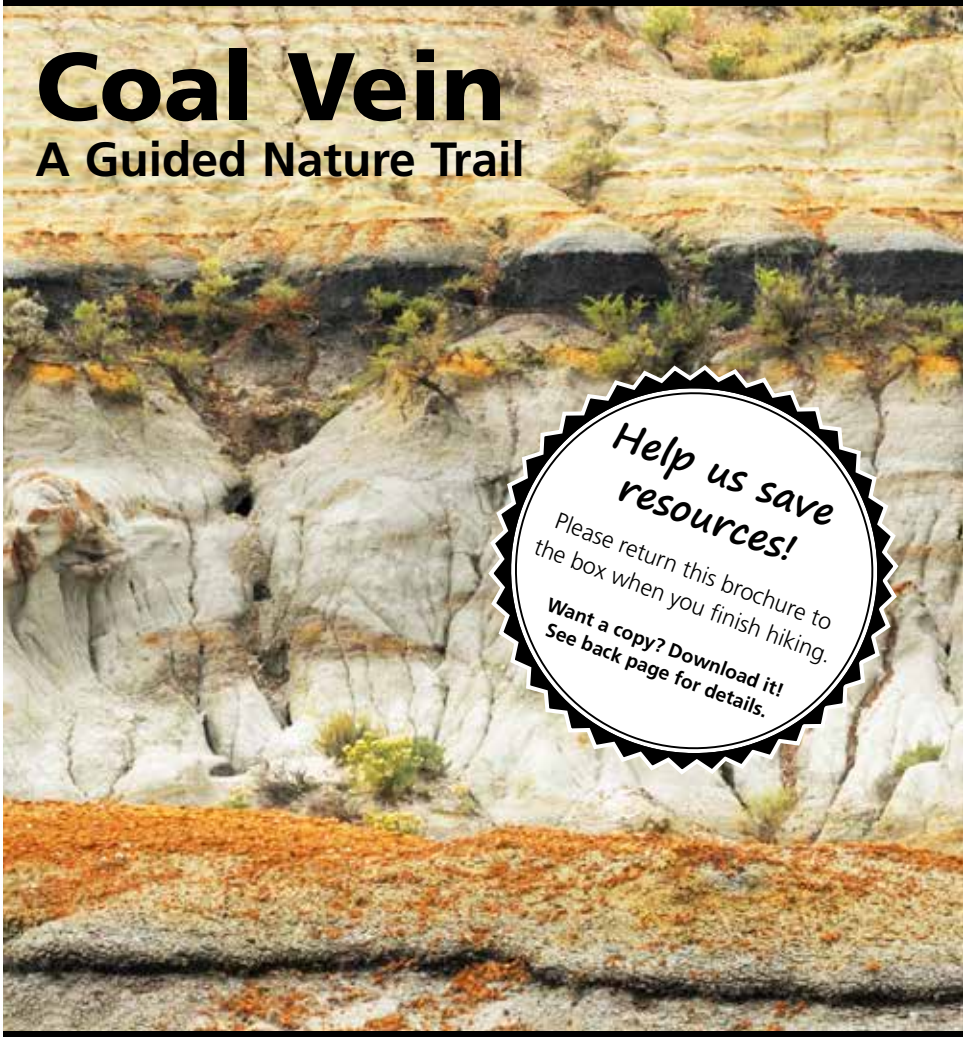
National Park Service
U.S. Department of the Interior

Theodore Roosevelt National Park

Coal Vein
A Guided Nature Trail



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Be aware of the following:


Cliff Edges


Stairs


Rattlesnakes


Wildlife


Poison Ivy

Beautiful layers of rock tell a story of the 60-million-year geologic history of the badlands. From ancient swamps to recent coal fires, this landscape is constantly changing. Learn about badlands geology by following the numbered trail posts.

Stay to the left to follow the posts in numerical order.

1. Layers

Each layer of rock has its own origin story, told by its color.

Brick-red
Clinker forms when coal veins catch fire and bake the rock above, changing it into this much harder, red rock.

Brown and Tan
Sandstone, **siltstone**, and **mudstone** are sediments washed down from the Rocky Mountains.

Black
Coal is the remains of ancient plants and animals that lived in Everglades-like swamps.

Blue-grey
Bentonite clay is made of ash from distant volcanoes.

2. Collapse

In this area there was a 12-foot-thick coal vein deep underground. In 1951 it caught fire and burned for 26 years. As it burned away, the rocks above were left unsupported and the surface collapsed, forming the depression you are about to enter. Before the fire, the land was level with the top of the stairs.

3. Bentonite

Notice the sediment on either side of the trail. Fifty-five million years ago, volcanoes in the Rockies spewed out ash that blew east. At that time, this area was a vast, tropical swamp. The ash settled in wet areas and became bentonite clay.

Bentonite looks like popcorn when dry (*below*), but becomes sticky, slick mud when wet. It can absorb up to five times its weight in water. Known as the mineral of one thousand uses, it is used to seal landfills and ponds, to make cat litter, and much more.

Stay to the left to continue on the guided nature trail.
Take the right on the cutoff trail to avoid a section of trail with very steep stairs. You will rejoin the guided nature trail near post #11.

4. Caprocks

Rocks in the badlands are generally soft and easily eroded by rain and streams. Some are harder than others, and become *caprocks*. A caprock acts like a helmet, shielding softer rock underneath. When the rocks underneath finally erode away, large pieces of caprock break off and fall. The large pieces of sandstone behind you were once caprocks at the top of the hill.

Left: An example of a caprock found elsewhere in the park.

5. Dry Climate

The dry climate of western North Dakota keeps the badlands from eroding away more quickly — if rain were more common, the soft rocks would have washed away long ago. The lack of moisture allows only the hardiest plants to survive.

The trees here are Rocky Mountain juniper. They, and all the other shrubs, grasses, and wildflowers you find here, are adapted to survive in this land of extreme temperatures and little moisture.

6. Seasonal Pool

Low spots like this one formed when the ground collapsed during the coal vein fire. They fill with water in the wet springtime and after summer rains. These seasonal ponds are important habitats for western chorus frogs which must lay their eggs in standing water. Listen for the chirping of the male chorus frogs near seasonal pools from April to June.

7. Burn Out

Just ahead and to the right is where the coal vein fire burned out after 26 years (1951-1977). Visitors could see smoke, glowing coals, and sometimes flames. They even roasted marshmallows over the fire!

Right: This photograph was taken in the 1970s as the burning coal fire crept toward its end.

Caution! Steep cliff edges ahead.

8. Hills Overlook

The trail goes to the right. To your left is an overlook. Be careful; the edge drops off sharply. From the overlook, you can see how the terrain affects plant life. The slopes you see face north. They receive very little direct sunlight which helps retain moisture, allowing juniper to thrive. South-facing slopes receive a lot of direct sunlight. They are very dry and support only hardy grasses and a few drought-tolerant shrubs.

9. Clinker

Feel the red rock next to the post. It is locally called scoria, but its true name is clinker. Clinker is created when a burning coal seam bakes the rock layer above it. Baking rock is like putting clay into a kiln to make pottery — the rock hardens as it bakes. Because clinker is one of the hardest rocks in the badlands, it functions as a caprock atop many buttes.

10. Seasonal Stream

Just ahead, stairs lead to the valley of a seasonal stream. As you descend, notice the cool, moist air against your skin. Because it is protected from the sun, this area stays moist and cool. Note the plants you see here and compare them to the plants you have encountered in open grassland. What are the differences?

Continue straight ahead to follow the guided nature trail.

11. Ignition

This is the spot where the coal vein ignited during a lightning storm in 1951. Even today, these natural fires can be started by lightning, prairie fires, or even spontaneous combustion.

Caution! Steep cliff edges ahead.

12. Clinker Overlook

The small spur trail going up the hill leads to an overlook. Be careful; the edge drops sharply. When you look to the left and right you can see and feel the clinker where it forms a protective caprock. The red color of the clinker comes from iron in the rocks that has oxidized (rusted).

13. Slumping

The hill in front of you has the appearance of sliding slowly into a jumble. That is exactly what it is doing through a process called slumping.

When the coal vein burned under this area, cracks formed in the hillside. Rain flowing into the cracks weakens the hill, especially where it saturates bentonite clay layers which become slippery when wet. As the bentonite slides, the hill slowly slumps away.

Slumping happens on a small scale like you see here, but also on a very large scale when entire hillsides slide. The picture below, taken in the North Unit, shows masses of rock that slid from near the top of the canyon, coming to rest far below.

14. Grassland

When the underground coal fire was burning, this area looked more like a wasteland than a grassland. After the fire burned out, prairie plants reclaimed the land slowly over time.

From a distance, prairie may look plain, but it is actually one of the most diverse ecosystems in the world. An up-close look reveals many different species of grasses and other plants.

15. The Big Picture

Take in the view. The things you have observed on this trail are not unique to this one spot. They can be seen, felt, and identified throughout the badlands. Even today, coal fires shape the dynamic landscape of the badlands.

Geology is not only a study of the past; here it is an ever present process. How do these things fit into the big picture of the park? How long will these processes continue to shape this land?

16. Chimney

What is unusual about the massive piece of clinker in front of you?

Fires need oxygen, even when they are burning underground. As the coal fire burned deep into the hillside, cracks in the rock layers allowed air to be sucked down into the fire. Fire burned up the cracks and baked the rocks nearby forming vertical "chimneys." Chimneys are the hottest part of the coal fire and bake the rock inside into a very hard clinker called porcellanite which is especially resistant to erosion.

This chimney you are looking at was exposed when softer sediments around it eroded away.

There are many signs that large coal vein fires have burned throughout the park in the past. Even today, coal fires can sometimes be found shaping and changing the landscape of the badlands.

Geology is not only a study of the past; it is an ongoing process.

We hope you enjoyed your hiking experience.
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